TOPOGRAPHIC SURVEY

OF

PART OF KWARA STATE POLYTECHNIC MAIN CAMPUS

(FORMER INSTITUTE OF ENVIROMENTAL STUDIES)

ALONG OLD JEBBA ROAD, MORO LOCAL GOVERNMENT AREA,

KWARA STATE.

BY

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BEING FINAL YEAR PROJECT SUBMITTED TO THE
DEPARTMENT OF SURVEYING AND GEOINFORMATICS
INSTITUTE OF ENVIRONMENTAL STUDIES
KWARA STATE POLYTECHNIC, ILORIN.

IN PARTIAL FUFILMENT OF THE REQUIRMENT FOR THE AWARD OF
NATIONAL DIPLOMA (ND) IN SURVEYING AND GEO-INFORMATICS.

JULY,2025.

CERTIFICATION

This is to certify that **ABUBAKAR KUDUS O. Matric No. ND/23/SGI/FT/0051** has satisfactorily carried out his project under my instructions and direct supervision.

I hereby declare that he has conducted himself with diligence, honesty and sobriety on the project.

…………………………..   …………………………..

ABUBAKAR KUDUS O.   **Date   &   Sign**

Matric No. ND/23/SGI/FT/0051

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……………………………   ……………………………………
Surv. Babatunde kabir   Date   and   Sign
(Project Supervisor)

……………………………………   ………………………………………
Surv. R. S. Awoleye   Sign   and   Date
Project Coordinator

………………………………..   ……………………………………
Surv. I. I. Abimbola   Sign   and   Date
Head of the Department

…………………………………..   ……………………………………
External Examiner   Sign   and   Date

DEDICATION

I dedicate this project report to my parents

ACKNOWLEDGEMENT

First and foremost, I am deeply grateful to Almighty Allah for His infinite mercy, protection, and guidance throughout the course of my National Diploma (ND) program.

I sincerely appreciate my supervisor, Surv. Kabir, for his invaluable support, guidance, and encouragement throughout the project. My heartfelt thanks also go to my assistant supervisor, Ambimbola Isau, for her assistance and commitment. I am equally grateful to all my lecturers, including Surv. Banji, Surv. Felix Diran, Surv. Kazeem, and others, for their dedication and contributions to my academic journey.

Special appreciation goes to Mr. and Mrs. Abubakar for their unwavering parental love, support, and encouragement, which played a significant role in the successful completion of this program.

Finally, I extend my profound gratitude to everyone who supported me—both financially and morally—throughout this journey. May Allah reward you all abundantly.

ABSTRACT

Topographical Survey of Part of Kwara State Polytechnic Landed Property (I.E.S.) situated along Old Ilorin Jebba road in Moro Local Government Area of Kwara State, was carried out in other to define the extent of the boundary by carrying out perimeter survey and to produce detailed topographical plan of the land area that will aid in effective planning and design of future development. The procedure involves: Planning, Reconnaissance survey, Monumentation, Traversing, Detailing, spot highten to produce the spot height of the entire area and along the boundary line. The total area covered was 4.768 hectares over six traverse stations. KOLIDA KTS Total station (KTS-400L) and handheld GPS were employed for the execution of the project. After the completion of the field work, all the data obtained from the field operations were downloaded, processed, analyzed and plotted using Auto CAD 2007 Software and Surfer 8.0 Software at a scale of 1: 2,500. All measurements, observations, computations and plotting were done in strict compliance with the survey rules and regulations.

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1.0 INTRODUCTION

A topographic survey is a type of survey usually carried out or made to determine the location of natural and cultural features on Earth's surface and to show the configuration (relief) of that surface. Once located, these features can be represented on maps. Natural features which are normally shown on maps include vegetation, rivers, lakes, ocean and so on. Cultural (man-made) features include roads, railroads, buildings, bridges, canals, settlements, boundary lines and so on, while relief include hills, valleys, plains and other surface formations.

Two major types of maps are prepared as a result of topographic surveys. These are planimetric and topographic maps. Planimetric map depicts natural and cultural features in the plan (x,y) views only. Objects shown are called planimetric features. Topographic maps also include planimetric features, but in addition they show height configuration of the earth's surface.

Topographic maps are used by Engineers, Planners etc. to determine the most desirable and economical locations of highways, railroads, canals, pipelines, transmission lines, reservoirs and other facilities; by Geologist to investigate minerals, oil, water and other resources; by Foresters to locate access or haul roads, fire control routes and observation towers; by Architects in housing and landscape design; by Agriculturist in soil conservation work; by Archaeologists, geographers and Scientists in numerous fields.

Topographic surveys are conducted by one of two basic methods; Aerial, Remote sensing or Ground (field) techniques, but often a combination of both could be employed. Refined equipment and procedures available today have made photogrammetry / remote sensing very accurate and economical. Hence almost all mapping projects covering large

areas now employ this method. However, ground surveys are still commonly used in preparing large scale maps of smaller area. Even when photogrammetry is utilized, ground surveys are necessary to orient and control the map.

Large scale topographic maps are applied where relatively high accuracy is needed over limited area; for example in sub-division design and the design of engineering projects like roads, dams, airports and water and sewage systems. Medium scale are often used for applications such as general preliminary planning where larger areas are covered, but only moderate accuracy is needed. Applications include mapping the general layout of potential construction sites, proposed transportation systems and existing facilities. Small scale topographic maps are commonly used for mapping large areas where a lower order of accuracy will suffice. They are suitable for general topographic coverage, applications in site suitability analysis, preliminary layout of expensive proposed construction projects and for special applications in forestry, geology, environmental impact and management etc.

The choice of a scale depends on the purpose, size and required precision of the finished map. The scale at which a map will be plotted directly affects the choice of instrument and procedures used in performing the mapping survey. This is because the accuracy with which the position of an object is depicted on a map is related to the map's scale which in turn dictates the accuracy with which features must be surveyed.

Topographic survey is a three-dimensional spatial data acquisition which requires various techniques. Whether the mapping is done by ground or aerial methods, the first requirement for any project is good quality control. Control is either horizontal or vertical.

Horizontal control for a topographic survey should consist of three or more permanent survey monuments whose positional accuracy have been tested and also found to be in-situ by observations. It is the basis for locating map. Horizontal control points can be established by traditional ground surveying methods of traversing, triangulation or trilateration, or by using digital method, Global Positioning System (GPS). For large areas, a sparse network of horizontal (and vertical) control can be densified using photogrammetry. For small areas, controls for mapping surveys are generally established by traversing.

Vertical control is provided by benchmarks in or near the site to be surveyed and becomes the foundation for correctly portraying relief on a topographic map. Vertical control is usually established by running lines of differential levels starting from and closing on established benchmarks.

1.2   STATEMENT OF PROBLEM

Currently, there is an absence of an updated and detailed map for the grounds of the former Institute of Environmental Studies. The available site plans are either outdated or incomplete, resulting in a lack of reliable information pertaining to the site's contours and the locations of its features. This deficiency in data complicates effective design and planning processes. Without an accurate, current survey, any proposed layouts risk misalignment with the actual terrain, utility lines, or existing structures on the site. Therefore, executing a comprehensive topographic survey will directly address these issues by delivering essential foundational data required for engineering and construction tasks.

1.3   AIM OF THE PROJECT

The aim of this project is to conduct a comprehensive topographic survey of the former Institute of Environmental Studies part Kwara State Polytechnic Main Campus. In other to produce an up to date map of the area also to provide the essential terrain information needed for future planning, design, or development of the area.

1.4   OBJECTIVES OF THE PROJECT

i.   Measure horizontal positions and elevations of all key points.

ii.   Record the locations of significant features on the ground (e.g. building corners, trees, fences, drainage structures, paved areas, utility poles).

iii.   Compute and draw contour lines at regular intervals to represent terrain slopes and relief.

iv.   Produce final deliverables: a plan (2D) Topographical map, contour plan, and a digital file of the surveyed data.

1.5   SCOPES OF THE PROJECT

The scopes involved in this project work are listed below;

i.   Project planning

ii.   Site selection and recce survey

iii.   Instrumentation

iv.   Field data Acquisition

v.   Data processing

vi.   Plan production and presentation

vii.   Technical report writing

1.6   PROJECT SPECIFICATIONS

The technical specifications adhered to in this project are as follows:-

i.   Survey Scale: 1:2,000-

ii.   Contour Interval: 0.2 meters-

iii.   Projection: Universal Transverse Mercator (UTM), Zone 31

iv.   Equipment: Total Station, GNSS Receiver, Automatic Level-

v.   Data Processing Software: AutoCAD CivilCAD2014

vi.   Horizontal Accuracy: ±10 mm- Vertical Accuracy: ±5 mm

1.7   PROJECT LOCATION

The project is located within the Kwara State Polytechnic main Campus, along old Jebba road, in Moro Local Government Area, Kwara State, Nigeria. The location is characterized by moderate vegetation, gentle slopes, and existing academic and administrative structures. The land is accessible and lies within a growing educational hub, making it suitable for academic and infrastructural development. Its geographical coordinates fall   8°33'39.06"N ; 4°37'56.14"E and   8°33'30.83"N ; 4°37'51.06"Ewithin the WGS84 datum as shown on the figure below.

Google Earth imagery of The Study Area
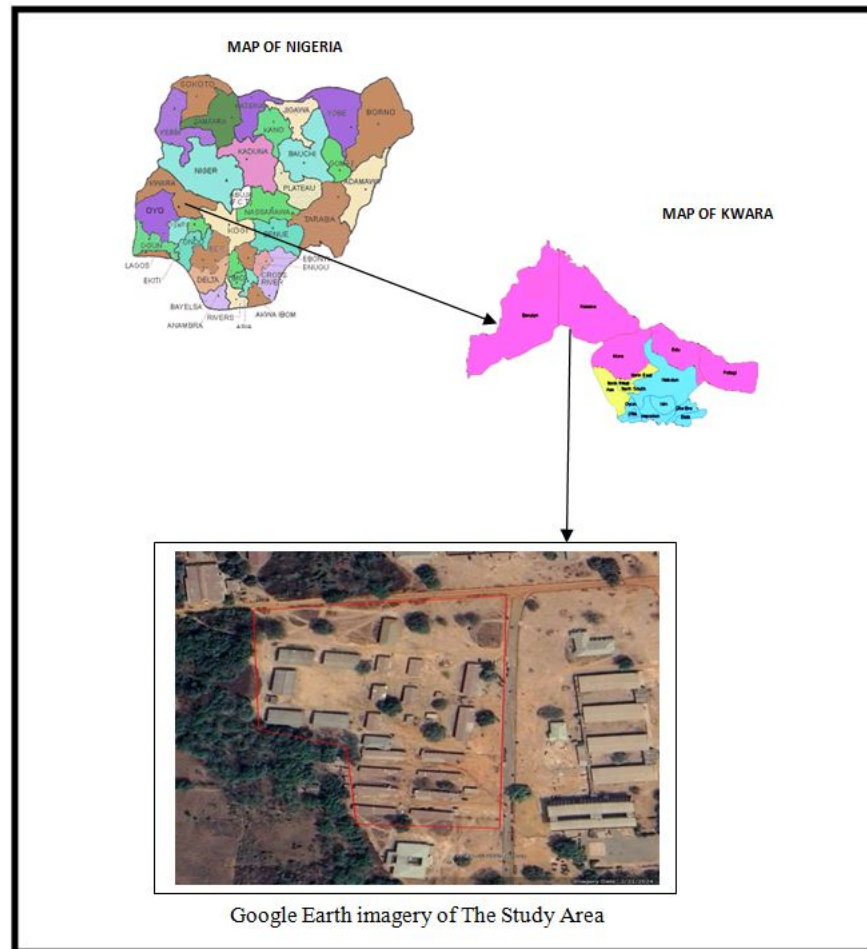
1.8   PROJECT MEMBERS

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CHAPTER TWO

2.0   LITERATURE REVIEW

Topography refers to the natural features, relief and man-made features which exist on the surface of the Earth. All of these are represented in the topographic map by applying cartographic rules. The difference between planimetric map and topographic map is the additional of contour lines on topographic map. The most common techniques used for topographic surveying are using total station, aerial photogrammetry, Global Positioning System (GPS) and remote sensing technique which use satellite imageries. Since mid-2000, TLS is getting popular for topographic surveying [1 3]. This is because this technology is capable of collecting up to a million highly accurate point clouds per second.

Study area the main entrance of Universiti Teknologi Malaysia (UTM) was chosen as the study area for this investigation as shown in figure 1. The traverse loop is highlighted in blue polygon. The main man made features found in this test area are helipad, UTM main gate, two blocks of hostel, one building belonging to the Faculty of Built Environment, open space parking lots, half of the UTM lake, a guard house and two roads. The total size of the area is about 70754 metre squares (m2). This area was chosen because it covers most of the important elements for topographic mapping, such as building, water body, road, slope, bridge, and vegetation. Furthermore, there is a geodetic monument within the area which is used for establishing the mapping coordinate datum.

Techniques used for data collection Data collection was carried out by using the traversing method for both TLS and total station. A total of 18 scan stations were set up to completely cover the study area. The 6" (15.24cm) HDS targets provided by the

developer were used in this data collection for back station and fore station. First of all, the laser scanner Leica ScanStation C10 needs to be set on a tripod and followed by levelling and centering the instrument. This step is important because the instrument must be levelled correctly and plumbed directly over the top of the traverse mark or station on the ground in order to minimize the error in measurement. After setting out the TLS, bearing and coordinates of the back station were set in order to define the fore station. The line of sight for both back station and fore station with the instrument is required. In this study, the 3D point clouds were collected using medium resolution mode (0.1m of point spacing for both horizontal and vertical spacing at the range of 100m). Each scan took around 7 minutes and 10 minutes additional for capturing image (RGB value). At the same time, the Field-of-View (FOV) of scanner set to 360° for horizontal and 270° for the vertical axes. Moreover, the ideal distance between the scanner and surrounding features is not to exceed 200m. All of these steps were repeated for the rest of the stations until the traverse loop is closed. On the other hand, total station Topcon GTS 325 was also used to carry out topographic survey for that area occupying the same traverse stations. The time spent for completing the survey the area was 2 days for TLS and 3 days for the total station because of the batteries power and weather constraint.

Result and analysis the final output of this study is a 2D topographic plan as shown in figure 6. The scale of the generated plan is at 1:1000 which is under the category of large scale. The standard of procedure of using TLS for topographic survey is proposed through this study as shown in figure 7.

Conclusion In conclusion, this study has shown that TLS is capable to provide the same result as traditional topographic survey using total station. At the same time, the

time spent for data collection on site is much shorter by using TLS, thus supporting the concept of rapid mapping [4]. Besides that, the richness of the data also can be used in future for modeling for example 3D City Modelling. For future work, this research will continue with mapping larger area by combining the aerial photos acquired using Unmanned Aerial Vehicle in order to cover the area which hardly scanned by TLS. In addition, a more appropriate filtering algorithm is needed for generating a higher quality DTM.

Topography refers to the characteristics of the land surface. These characteristics include relief, natural features, and artificial (or man-made) features. Relief is the conjuration of the earth surface and includes such features as hills, valleys, plains, summits, depressions, and other natural features, such as trees, streams, and lakes. Man-made features are highways, bridges, dams, wharfs, buildings and so forth. A graphic representation of the topography of an area is called a Topographic map. A topographic map is simply a drawing that shows the natural and artificial features of an area. A topographic survey is a survey conducted to obtain the data needed for the preparation of topographic map. This data consists of the horizontal and vertical locations of the features to be shown on a map. A topographic survey is the means of producing a topographic map. The preparation of topographic map can be done by means of theodolite, aerial photography, Total Station, GNSS etc. High accuracy, efficiency and less time requirement give more predominance and acceptance to Total Station. Theodolite and other conventional surveying techniques are very slow and laborious and practically not feasible for a large area. Total station surveying is advancement to

theodolite surveying. Many field operations such as angle and distance measuring and their field recording have been automated in Total Station surveying.

In recent past, many different works has been done in the area of topographic surveying. A critical view of these researches done on topographic survey using Total Station will be discussed below. Jeyapalan and Bhagawati (2000) conducted a study on Total Station, Differential Global Positioning System (DGPS), Video logging, soft photogrammetric and virtual reality methods of collecting data on road side features of urban, city and rural roads for creating a Geographic Information System (GIS). The first 15 highest priority road side features were: intersections, signs, pavement markings, signals, and curbs, guard rail, number of lanes, rail road crossings, shoulders, side walk, road names, pavement distress, roadway geometric, bridges and Right of way. The video logging system gives the digital image and the X, Y, Z coordinates of the camera locations, using this information and soft photogrammetry it is possible to determine the location of any feature. Virtual reality is the mode in which a user can view in 3D, fly through the virtual model, modify in real time and view or measure its effect. The conclusion of the study was, Total Station can be used to collect data for creating 2D GIS showing roadside features at a scale of 1!=25" or larger and or smaller. DGPS can be used for mapping at scale 1! = 50" or smaller. Both systems are time consuming in the field. Soft Photogrammetry with digital video logging imagery can be used to map roadside features at 1! = 25" or smaller. It saves field data collection time; however, it requires calibration and stereo data collection time in the office. Vachher and Srivastava [2006] defined topographical map as a two dimensional representations of three dimensional land surfaces through a combination of contour lines, symbols and texts,

topographical maps portray the shape and location of mountains, forest, rivers, lakes, cities, villages, roads, rails, bridges and most of other man-made and natural features existing on the surface of the earth. They also contains reference systems like graticule lines, grids, benchmarks, magnetic declination etc. Topographical maps are used by defence forces for planning operations as well as by administrators, civil engineers, natural resources managers, town planners, emergency service agencies, outdoor enthusiasts, historians, geographers etc. Ragab Khalil (2013) studied the accuracy of GIS tools for transforming assumed total station surveys to real world coordinates. In this paper the effect of using Georeferencing tool, Spatial Adjustment tool (Affine and similarity) and CHaMP tool on the precision and relative accuracy of total station survey were studied. The effects of using geodetic GPS, hand-held GPS, Google Earth (GE) and Bing Base maps as sources for control points on the precision and relative accuracy of total station survey was also studied. These effects have been tested by using 111 points from a covered area of 60,000 m2 and the results have shown that the CHaMP tool was the best tool for preserving the relative accuracy of the transformed points. The Georeferencing

CHAPTER THREE

3.0 PROJECT PLANNING

Planning is one of the most important aspects of any surveying operation and must always be undertaken before any observations are made. The essence of planning enables the surveyor to have an overall picture of the whole area to be surveyed in mind so as to work economically to manage time, energy and fund. A poorly executed planning can result in difficulties at later stages, which may lead to waste of time, money, inefficiency on the part of Survey Team and obtain poor result (inaccurate work).

In planning, the surveyor needs to think on how to execute the project successfully in terms of selecting the instrument and equipments to be used, locating the suitable and registered controls, selecting suitable positions for traverse station, making use of available records such as existing maps or plans and other relevant information about the project site. For this project to be successfully carried out it underwent two major phases of planning; which were Office Reconnaissance and Field Reconnaissance.

3.1 OFFICE PLANNING

During the office planning both the list of instrument and equipments to be used for the project and the project accuracy and other logistics such as means of transportation, accommodation and welfare of the personnel were considered. The activities involved in executing the task were scheduled and the necessary information needed was itemized, such as the coordinates of the control pillars and the specification for the project were strictly adhered to.

The coordinates of control points very close to project site were obtained from the department of Surveying and Geoinformatic, Kwara State polytechnic, ilorin.

The list of controls and their coordinates are as tabulated in table 3.1 below.

Table 3.1: Control Points Data.

REGISTER VALUE OF EXISTING CONTROLS			
Pillar	Northing (m)	Easting (m)	Height (m)
KWPT.732	946270.767	679688.177	345.400
HND04.111	946468.268	679733.135	352.414
KWPT.733	946561.866	679735.315	358.812

Source: Survey Dept., Kwara State Polytechnic, Ilorin.

3.2   FIELD RECCONNAISSANCE

This involved the physical appearance of the survey party at the site in company of the client's engineer. The entire area of the project site was inspected so as to be familiar with the site and to identify prominent features that are of important to the client. Also essential is the drawing of reconnaissance diagram in order to give good knowledge of the site. The approximate position of the control points was traced with the use of hand held GPS (Garmin 76csx map) receiver.

The positions of those control points were checked to confirm whether they are 'in situ' or not. The intervisibility of the two lines formed by the three control stations were ensured with some bush cutting and observations. The reconnaissance diagram is as shown in figure 3.1 below.

Figure 3.1:   Reconnaissance Diagram.

3.3   SCHEDULE OF FIELD WORK

Having completed the reconnaissance, the schedule of field work was designed as follows:

*   Station selection and clearing of obstruction along the survey lines

*   Moulding of beacons

*   Perimeter Traversing and Detailing

*   Spot Heighting

3.4   INSTRUMENT / EQUIPMENT USED

The instrument and equipments deployed for the execution of this project are:

1.   1 No South Total Station (South NTS – 350R series) serial no. S71071 and its accessories

2.   1 No GARMIN 76CSX hand – held GPS

3.   Field book and writing material (pen)

4.   2 Nos Survey Tripod with plumb – bobs

5.   2 Nos Tribrachs

6.   3 Nos Reflectors / prisms

7.   3 Nos Tracking Rods

8.   1 No Survey Umbrella

9.   1 No Digger

10. 2 Nos Shovels

11. 1 No Hammer

12. 2 Nos Hand Trowels

13. 1 No 5m measuring Tape

14. No 100m steel tape

15. 5 Nos. Cutlasses

16. 2 Nos. Head pans

3.4.1   Hardware: The Hardware Components used were:

i)   1 No pro Book 4530 laptop with its following configuration:

Processor: Intel (R) core (TM) i3 – 2330M

CPU: @ 2.20 GHZ

RAM: 4.00GB

System type: 32- bit Operating System

 ii)   HP (Design jet T1300) plotter

iii)   HP officejet K7100 printer

3.4.2   Software: The Software Components used were:

i)   AutoCAD 2007 –   for graphic plotting

ii)   South Data Transfer – for downloading field Data from Total Station

iii)   Surfer 8.0 – for generating of contour

iv)   Microsoft Office; which includes MS Excel, Note pad and MS word for report writing.

3.5   TEST OF INSTRUMENT

3.5.1   SOUTH (NTS-350R) TOTAL STATION TEST

Various tests were conducted on the South (NTS-350R) Total Station used, to ascertain its working condition prior to the commencement of the project execution. These tests are as follows:

3.5.2   PLATE LEVEL TEST

This test was to verify that the vertical axis of the instrument used was truly vertical when the plate level was at the centre of its run.

PROCEDURE: The Total Station (South NTS-350R) was set up firmly on a point arbitrarily. The plate bubble tube was turned parallel to two foot screws and leveled with two foot screws; the tube was then turned through 90º, now over the third foot – screw and level accordingly using the third foot screw. It was then returned to its former position and accurately leveled with the pair of the two initial foot – screws. To complete the test, the instrument was rotated through 180º and 360º and the bubble was still at the centre of its run, hence the plate bubble was in order.

3.5.3 HORIZONTAL COLLIMATION TEST

The aim of this test was to make sure that the line of sight is truly perpendicular to the trunion axis.

PROCEDURE: The Total Station instrument was set up on a point and all necessary temporary adjustments performed. The instrument was switched on, collimation program was selected from the menu and consequently the horizontal collimation test was chosen. This test was done by bisecting a well defined vertical target about 100m away and taking the horizontal readings on Face Left and Face Right. From the analysis of the results, the Total Station was in good adjustment.

3.5.4 VERTICAL INDEX ERROR TEST

This adjustment ensures that the vertical circle reading is exactly 90º when the line of sight is horizontal. Any deviation from this figure is termed vertical index error.

PROCEDURE: The instrument was set over a station point and all necessary temporary adjustments (centering, levelling and focusing) were performed. The vertical index error test was carried out by sighting a target at a distance of about 120m on Face Left. The Vertical Circle reading was recorded and the target was sighted and bisected again on Face Right and the vertical circle reading was recorded.
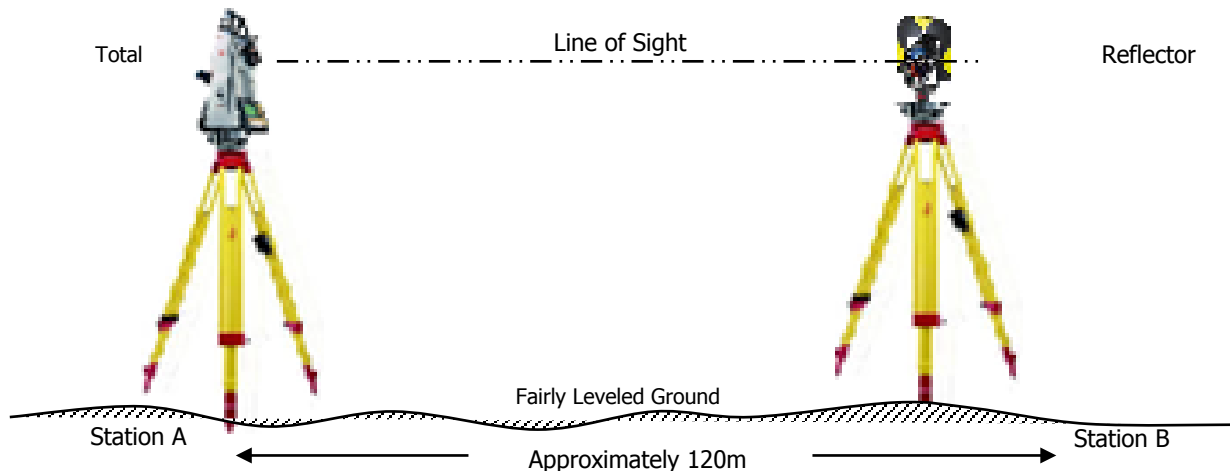
Figure 1.6. : Instrument set-up for horizontal collimation test and vertical index test

3.5.5   ANALYSIS OF COLLIMATION AND VERTICAL INDEX DATA

The readings obtained during the calibration were reduced to obtain the new horizontal collimation and vertical index errors. The results of the calibration data acquired for the total station used for this project are shown in the table below;

Table 1.2: Horizontal and Vertical Collimation Test Reading

Inst Stn.	Sight (Reflector)	Face	Hor.Circle Reading	Ver. Circle Reading
	B	L	87° 35' 10''	88° 26' 15''
A	B	R	267° 35' 12''	271° 33' 46''
			Diff= 180° 00' 02''	Sum= 360° 00' 01'

Horizontal Collimation = [(FR – FL) - 180°]/2

= [(180° 00' 02' - 180° 00' 00'') /2]

= 00° 00' 02''/2

$$= 00° \ 00' \ 01''$$

Vertical Collimation $= [(FR – FL) - 360º]/2$

$$= [(360º \ 00' \ 01'' - 360º \ 00' \ 00'')/2]$$

$$= 00º \ 00' \ 01''/2$$

$$= 00° \ 00' \ 01''$$

Table 1.3: Comparison of Old and New Values.

	OLD	NEW
HORIZONTAL COLLIMATION	+ 00º 00' 02''	+00º 00' 01''
VERTICAL INDEX	+00º 00' 00''	+ 00' 00' 01''

With the result obtained, it is evident that the instrument is in good working condition. Therefore, the new readings were adopted for the instruments Horizontal Collimation Error and Vertical Index Error respectively.

3.6   DATA ACQUISITION / FIELD OPERATIONS

This aspect involved the various methods/procedures adopted in executing the project. The field observation procedures adopted were as follows:

*   In-situ check for the controls

*   Monumentation of the beacons according to required standard

*   Perimeter Traversing

*   Acquisition of Spot Heights and Detailing of the existing features.

3.6.1   IN-SITU CHECK FOR THE CONTROLS

In-situ check was carried out to check the positions and reliability of the control pillars to ascertain that they were still in-situ. The instrument was set up on beacon KWP. 1409, while two reflectors were also set up on beacons HND04.111 and KWPT.733. Then, the temporary adjustment (Centering, Leveling and Elimination of parallax) were performed on the instrument before observations were carried out as thus;

i)   The instrument was oriented by sighting the target (back sight) at station KWPT.733, the coordinates, the height of the instrument and the target were keyed into the Total Station, then the "ALL" button was pressed to take the measurement.

ii)   Thereafter, the instrument was turned to focus, bisect and a Foresight Observation to the target at KWPT.732. were made. The telescope of the instrument was transited to measure on the other Face. See figure 1.8 for the control check diagram.

Figure 3.3: In-situ check Diagram (not drawn to scale).
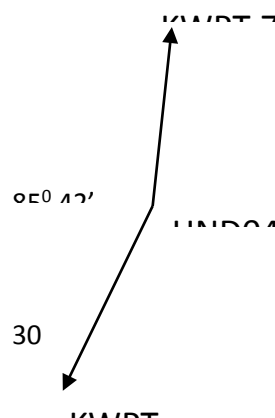
The values observed were compared with the known values, and the result of the comparison depicted shows that the controls were found to be in-situ. The summary is as shown in the table 1.6 below.

3.6.2 CLEARING OF SURVEY LINE

The site visit (field recce) and acquisition of data during data search exercise, however, facilitated the clearing of Survey line. The perimeter boundaries of the land were thoroughly cleared to a width of about 1 meter and stations were selected and intervisibility was ensured. Selection and Marking of stations from the control points to the project site were also carried out. The survey lines were cleared of any obstruction/obstacles which could hinder the line of sight of the deployed instrument.

3.7 MONUMENTATION

Pre-cast property beacons made of 18cm x 18cm x 75cm were used for the demarcation of the project site. In compliance with the specification for cadastral Survey as specified in CAP 194 of law of the Federation of Nigeria, the Beacons were made of concrete mixture of ratio 3:2:1 (3 parts of sand to 2 parts of granite to 1 part of cement) with water, so as to ensure that the pillars were strong. The beacons protruded 15cm above ground level, while the remaining part was inserted and fixed firmly into an undercut hole. An iron rod (80cm in lengths and 10mm in diameter) protruding at the centre of the beacon represents the centre of the station mark.

A total number of Five (5) beacons were emplaced and prefixed with identification mark "KW" where "PT" represent property beacon, KW represent Kwara and PT represent Polytechnic. The beacons were capped and numbered from kwpt733 to kwpt736 as obtained from the department of surveying, Kwara State polytechnic, ilorin and they were numbered in a clockwise direction with stencil.
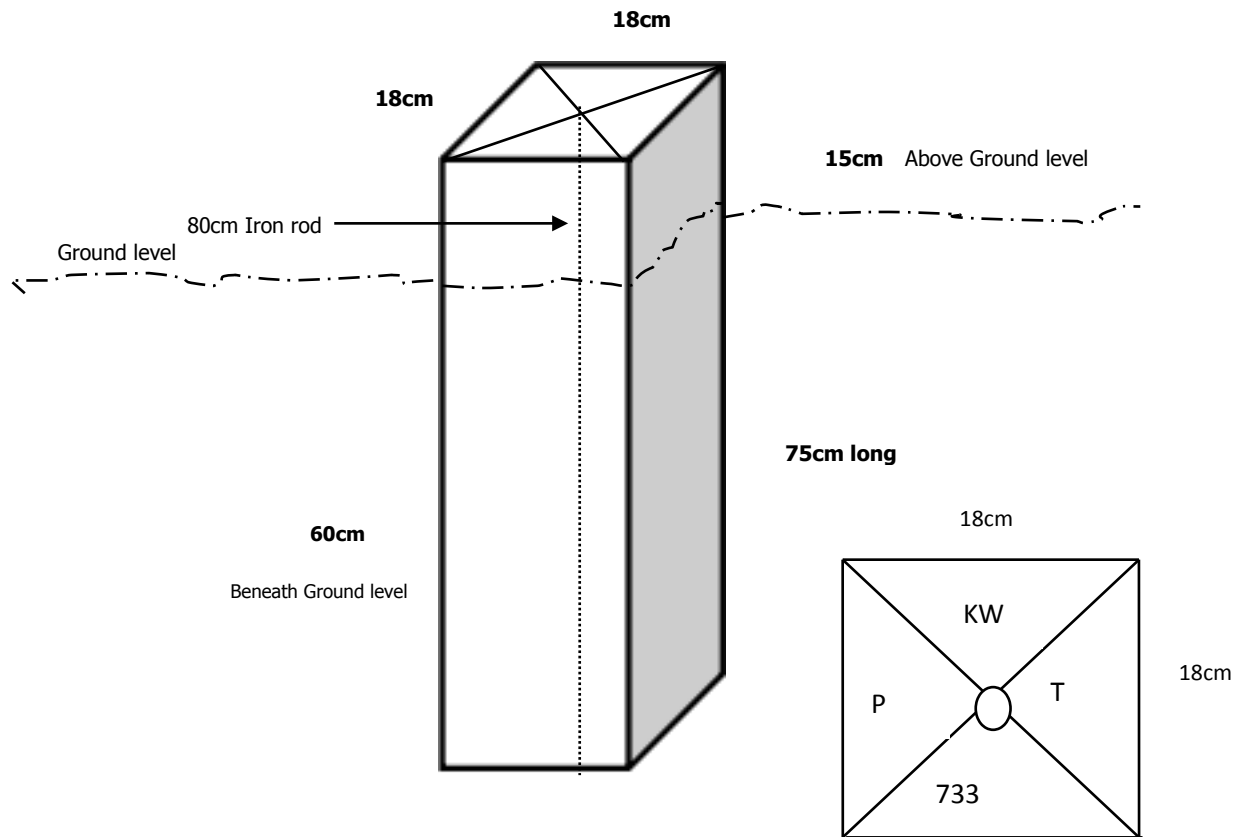
Figure 1.9: Pre- cast property beacon

3.8   TRAVERSING PROCEDURE

At the completion of monumentation, a perimeter traverse was run over the boundary beacons to obtain X, Y and Z coordinates for all the boundary beacons.

The South (NTS -350R) Total Station was set up at HND04.111 and underwent temporary adjustment, the target was also set up at KWPT.733 as back station while the second target was set up at KWPT.732 as forward station. The coordinates of the back station and instrument station already were stored in the internal memory of the instrument during in-situ check. The instrument was used to bisect the target at the back station, and then the telescope was swung clockwisely to bisect the target at the forward station numbered KWPT.734. The instrument automatically calculates the bearing, distance and coordinates of PBL. 38005 and stored it.

Then the instrument position was shifted to KWPT.1234 while KWP.1235 and PBL.38006 became back station and forward station respectively, similar procedure was repeated throughout the course of traversing until all the stations were occupied, coordinated and the traverse was closed back on another control pillar KWPT. 734to form a closed traverse.

South (NTS-350R) Total Station operational procedures were as follows:

1.   The Total Station was set up and temporary adjustment performed

2.   After the instrument was powered ON

3.   MENU button was pressed to open the menu page containing list of programs on the total station.

4.   "DATA COLLECT" sub menu was opened by pressing F1 button

5.   File name was given as KAM and F4 button was pressed to accept the file name

6.   F1 button was pressed to input the parameters for occupy occupies point (Instrument station). The following were set into the instrument under occupy point.

-       Station point e.g. PBL.38005

-       Northing coordinate

-       Easting coordinate

-       Height

7.   F3 button was pressed to recall the input values for proper checking and found okay, F4 button was pressed to accept the input values.

8.   F2 button was pressed to open Back sight sub menu where the Back sight point; Northing coordinate, Easting coordinate and Height parameters will be imputed.

9.   The telescope of the instrument was turned to sight and bisect the target for orientation.

10.   After sighting the target F3 (MEAS) button was pressed to measure the coordinate (Northing, Easting and Height) of back station, and then F4 button was pressed to accept the measured value.

11.   Having completed the orientation, F3 (FS/SS) button was pressed.

12.   Then the instrument was thereafter turned to sight and bisect the reflector on its tracking rod that was held vertically at fore station.

13.   F4 button was pressed to track, measured and store measured value on the internal memory of the total station.

These operational procedures were repeated throughout the course of traversing at every instrument set up.

3.9   DETAIL SURVEY AND SPOT HEIGHTING

This is where the need for a topographical survey is essential. The spot heights and position of all natural and artificial features within the site were determined. Since the entire site was gridded at an internal of 10m as required by client, the details and spot heights were determined from some of the traverse boundary beacons and some of the fixed pegs along the gridded lines. This approach was found to be faster and convenient. In essence, the principle of working from "whole to part" was employed in this topographical survey.

The procedure for observation was as thus:

The Total Station was set up on station kwpt.733, the instrument was switched "ON" and temporary adjustment was performed. The "file" (TOPO) was accessed and orientation was done by referencing to HND04.111 as the back station. However, the "parameters" of station KWPT.733 were recalled from the instrument's internal memory and the height of instrument measured with 5m pocket tape was keyed into the instrument. The "parameters" of HND04.111 which served as reference station was also recalled from the instrument internal memory, then the height of reflector was determined and keyed into the instrument. The reflector held vertically on beacon KWPT.732 was bisected for orientation. The total station automatically compute the bearing and distance

between the two stations after the coordinate of the beacon KWPT.732 that was recalled for orientation was accepted by pressing the enter (F4) key on the instrument keyboard.

After the orientation, the field data acquisition for detailing and spot heightening then commenced by placing the reflector over all the interested points by making sure it was held vertically and the telescope of the total station turned until it bisects the centre of the reflector. Having carefully bisected the reflector, the F4 "ALL" button key was pressed to measure and record the coordinates of entire points. After the spot heights and other details within the instrument's observation range were observed, then the instrument was moved to fore station and the above procedural steps were repeated for other details and spot heights to be observed for their locations and elevations to be determined.

The (N, E, H) of each spot height was obtained by the instrument using the listed below formulae and the accompany diagram as illustration.

Target

Instrument   Zenith Angle

Slope distance, **S**

θ

Horizontal distance, **H**

Reflector
rh   height

Instrument height

hi

Ground Level

Target

Instrument station (N, E, Z)   (N1, E1, Z1)
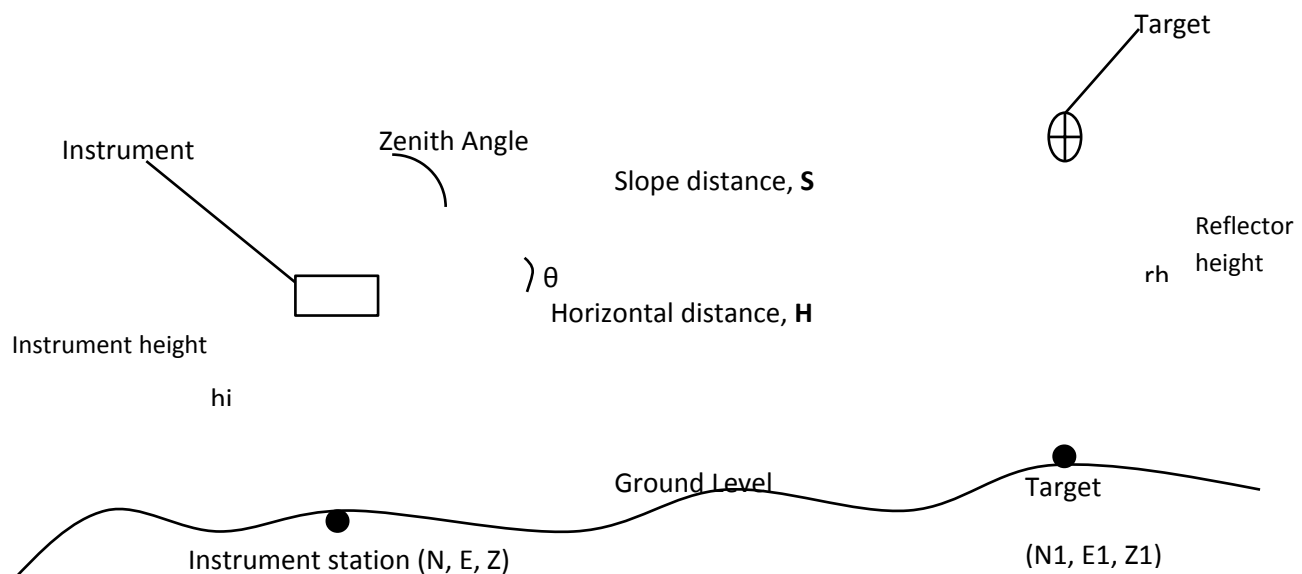
Figure 1.10: Illustrative diagram of spot height determination

N1 = N + (S x Sin Z x Cos AZ)

E1 = E + (S x Sin Z x Sin AZ)

H1 = H + (S x Sin Z + hi – rh)

Where:

N1, E1, Z1 = Northing, Easting and Height respectively of newly determined point.

S = Slope distance

Z = Zenith circle

AZ = Bearing of the instrument station to the reflector or target point

Hi = Height of instrument

rh = Reflector height

The South (NTS – 350R) Total station uses the zenith angle to deduce the true horizontal distance from the measured distance as shown below:

Horizontal distance (D) = S x Cosθ OR S x Sin (90 - θ)

Where:

θ = Angle of inclination

(90 - θ) = Zenith angle (Z)

CHAPTER FOUR

4.0   DATA PROCESSING

The Total Station itself used the data acquired and stored during observation which was stored in the internal memory to compute the final coordinates since it has in-built computation software.

4.1   DATA DOWNLOADING

The acquired data were downloaded from the memory of the instrument via the Data Transfer Port into the computer. The collected data were downloaded using South Data Transfer Software. The explanation below shows the procedures involved during the downloading from the Total Station to the computer:

*   The South (NTS 350R) Total Station was connected to computer before switching "ON" the computer and total station.

*   The computer was switched "ON" and allowed to complete the booting operation.

*   The Total Station was switched "ON"

*   On the Total Station "MENU" key was pressed to open the program page

*   F3 key was pressed to select "Memory Manager".

*   In the memory manager sub-menu, F1 key was pressed on the third page to select "Data Transfer"

* In the data transfer dialogue box, F1 key was pressed to select NTS -300 transfer mode. Then F3 key was pressed to select "COMM. PARAMETERS" where "BAUD RATE, PROTOCOL AND PARITY" was set to have the same setting parameters on the computer and on the Total Station to allow good communication between the Total Station and the Computer.

* Escape (ESC) key was pressed to go back to the previous menu (DATA TRANSFER) and F1 key was pressed to select the "SEND DATA".

* In the appeared dialogue box F1 key was pressed to select the measured data option and the file name "KAM" which is to be downloaded was selected and F4 key was pressed to accept the file to be downloaded.

* On the computer system, in the NTS Total Station software environment, "COMM" menu was clicked on the menu bar and downloads 300 data option was selected on the pull down menu.

* On clicking the download 300 data on the pull down menu, a small dialogue box appear given an instruction to press enter (F4 key) on the Total Station and the (Enter) key on the computer. Once this was done sequentially, the data automatically start to download.

* After downloading the data, Transfer menu was selected on the menu bar and "CASS survey data 300" was selected and clicked to Transfer the data from Chinese Language to English Language for better interpretation and understanding.

4.2   COMPUTATION OF SURVEY DATA

Total Station Instruments, with their microprocessors, can perform a variety of computations, depending on how they are programmed. South (NTS -350R) Total Station is capable of assisting an operator, step by step, through several different types of basic surveying operations.

In addition to providing guidance to the operator, microprocessors of South (NTS -350R) Total Station can perform many different types of computations automatically and some standard computations include:

1)   Averaging of multiple angles and distances observations;

2)   Correcting electronically observed distances for prism constants, atmospheric pressure, and temperature;

3)   Making curvature and refraction corrections to elevations determined by trigonometric leveling;

4)   Reducing slope distances to their horizontal and vertical components;

5)   Calculating point elevations from the vertical distance components (supplemented with keyboard input of instrument and reflector heights);

6)   Making corrections to observed horizontal and vertical angles for various instrumental errors; and

7)   Computing coordinates of surveyed points from horizontal angle and horizontal distance components (supplemented with keyboard input of coordinates for the occupied station,

and a reference azimuth). Furthermore, the microprocessors of total station perform traverse computations and simultaneously calculate and store station coordinates and elevation.

4.3   AREA AND BACK COMPUTATION

The process of determining the total area and both final bearings and distances between the traverse stations were carried out using an in – house (SURVCAD) software, which was designed to carry out the area and back computation, using double latitude departure method for its computation. The area enclosed by the project site was computed

The programme is of the three segments viz:

-      The execution programme: used to execute the task ahead.

-      The input file: used to input all data for the area involved

-      The output file: used to view the result inform of a computation sheet.

4.3.1   RUNNING THE PROGRAMME

DOS EDITOR through the MS DOS PROMPT command was launched through the following this process:

*   Click the start menu

*   Go to programs

*   Search for MS DOS PROMPT and click to go to the C:\WINDOWS>

*   C:\ > type CD\

*   Type C:\\>CD TRAVERSE _ COMP

*   C:\TRAVERSE _ COMP > type EDIT AREA.INP

The operation was carried out by inputting all the involved data into the input file – area.inp in the following order:

-       No of stations (e.g. 10)

-       Input all the point ID, Northing, Easting e.g. (PBL. 38005, 928281.120m, 684441.560m)

-       Save the input file and exit the DOS EDITOR, after which the AREA.EXE file was used to execute the programme.

-       At the DOS PROMPT C:\ type AREA (C:\AREA) to run the programme.

-       At the EDITOR menu the OUTPUT FILE – AREA.OUT was opened to view the result or type EDIT AREA.OUT (C:\TRAVERSE _COMP>EDIT AREA.OUT).

Print out for area and back computation are shown in appendices respectively.

The above program for area and back computation was developed for Office of the Surveyor General, Kwara State by Surv. Felix Iyiola of Department of Geoinformatics, Federal School of Surveying, Oyo, Oyo State.

4.4   PLAN PRODUCTION AND PRESENTATION

The final coordinates obtained from the field observations were used for the perimeter plotting, detailing, spot heights and contours. The boundary, spot heights and details were plotted with AutoCAD 2007 while the contour was generated using Surfer 8

Software which was later exported through data exchange format (.dxf) into AutoCAD 2007.

4.4.1 PLOTTING PROCEDURES

The data was prepared as script file and saved as (.txt format) for plotting of points in AutoCAD 2007.

4.4.2 AUTOCAD PLOTTING PROCEDURE

1. AutoCAD 2007 was launched and '**NEW**' was clicked under the **FILE MENU** and named.

2. **Format Menu** was clicked and then **Units** was selected and clicked.

3. In the appeared dialogue box, the unit settings were carried out for *length precision, Angle type and precision, Direction (clockwise) and direction control (North Azimuth)*.

4. Layers for each feature with their conventional colours were also created e.g. Boundary layer in Red, Details in Black, and Contour in Brown e.t.c.

5. From **Tools Menu, Run scripts** was selected and clicked.

6. From the appeared dialogue box, the coordinate file already prepared in notepad (e.g. boundary.scr) was selected from the source file and the **OK** was clicked.

7. The plotted lines automatically appears in AutoCAD 2007 environment drawing area

8. Each corresponding layer was made active when running the script files (e.g. boundary layer was made active when running the boundary script file e.t.c.).

9. This process was repeated for plotting of all features.

4.4.3 CONTOUR AND DIGITAL TERRAIL MODEL PROCEDURE

The contour line was plotted using Surfer 8.0 software which shows imaginary lines joining points/places of equal elevation together.

The following procedures were followed in plotting the contour;

* Script file was prepared as **Kam.dat**

* Surfer 8.0 was launched from desktop

* **'Data'** from Grid menu was clicked to generate Grid file from the edited spot heights data saved in the computer.

* From the Grid data dialog box opened, column for Easting (X), Northing (Y) and Height (Z), was specified, gridding method (krigging) and output grid file were specified.

* Report generated was saved by clicking **'OK'.**

* From Map menu, Contour map and New Contour Map was selected

* The Grid file was opened from the open dialog box.

* The contour map displayed was double clicked and the contour properties settings dialog box opened.

* The following contour properties were selected;

 - contour interval 0.5m

 - contour line thickness 0.6m

 - contour labeling

 - plotting scale e.t.c.

*   Apply was clicked to effect the new parameters on the newly displayed contour.

*   **'Surface'** was selected from map menu and Digital Terrain Model (DTM) showing the three dimensional representation of the terrain was displayed. This is more comprehensive than the contour lines.

4.4.4 EXPORTING CONTOUR FROM SURFER TO AUTOCAD

*   **'Export'** was selected from file menu and the contour map was exported to AutoCAD 2007 with data exchange format (dxf).

*   From the export dialog box displayed, AutoCAD dxf format was chosen as the save as format and the file name was also supplied and save was clicked.

*   AutoCAD 2007 was launched and the '**file menu'** was clicked and sub-menu '**open'** was selected

*   Edit menu was also clicked, **'Zoom and Extent'** was selected and the contour was displayed and copied.

*   Also AutoCAD 2007 was launched and the plotted boundary of site was opened and '**Paste to Original Coordinates** was selected from view menu. Thereby the imported contour was successfully pasted to its original position.

All the plans presented in this project are attached at the appendix as appendix

CHAPTER FIVE

5.0   SUMMARY, CONCLUSION PROBLEM ENCOUNTERED AND

RECOMMENDATION

5.1   SUMMARY

The project area covered 4.768 hectares. The project cut across reconnaissance, monumentation, perimeter traversing, spot heightening and detailing, South (NTS – 350R) Total Station was used for data acquisition. South data transfer software was used for the downloading of all the acquired data. The final adjusted coordinates were used for the production of perimeter and topographical plan using AutoCAD 2007 and Surfer 8.0 respectively. The plan was drawn at a scale of 1:2,500

5.2   CONCLUSION

The aim and objectives of this project were achieved to its fullest, since the results obtained were all within the limits of permissible accuracies. Meanwhile, it is quite important to mention that, all the observations and measurements were made in total conformity with survey rules and regulations and departmental instructions. The perimeter / topographical plan of the former institute of environmental studies were successfully carried out.

Conclusively, these plans will be useful as source of information for the planning and management of the academic institution purposely for the designing and future construction of the proposed structures in the site.

5.3   PROBLEM ENCOUNTERED

The execution of this project was faced with many problems, some of which are itemize below:

i)   The problem of getting the instrument for the field work.

ii)   The weather condition is another thing due to that it was during raining season.

iii)   The general shortage in power supply also affected the pace of the project at data processing stage. The problem was, however, averted by getting a generator.

5.4   RECOMMENDATION

  i.   The student project should be given early to the students to avoid too rushing.

  ii.   And the school authority to get the department more surveying equipments.

RAW DATA

PT	E	N	H		PT	E	N	H
M27	679768.7	946566.1	355.231		247BLD	679563.2	946433.7	354.413
CV	679758.3	946567	355.38		248SH	679564.8	946439.4	354.751
1CV	679758.2	946567.7	355.385		249SH	679561.8	946441	354.737
2CV	679757.5	946576.2	355.708		250SH	679560.6	946446.5	354.941
3CV	679757.5	946576.7	355.699		251SH	679563.8	946445.5	354.953
4CV	679738.3	946565.9	355.575		252SH	679566.8	946448.1	354.891
5CV	679737.8	946565.7	355.58		253BLD	679567.4	946450.1	354.8
6CV	679744.2	946563.5	355.438		254SH	679564.4	946451.9	354.808
7CV	679732.9	946577.2	355.97		255BLD	679561.1	946451.7	354.852
8CV	679732.9	946577.7	355.993		256SH	679554.4	946457.1	355.082
9SH	679731.3	946566.6	355.457		257SH	679557	946463.2	355.252
10SH	679735.3	946561.9	355.322		258SH	679563.2	946469.2	355.584
11SH	679734.1	946554.9	355.268		259SH	679570.9	946475.6	355.635
12SH	679735	946550.1	355.154		260SH	679579.4	946479.5	355.513
13SH	679729.2	946549.5	355.141		261SH	679585.7	946482.5	355.311
14SH	679726.2	946557.5	355.246		262SH	679585	946474.8	355.259
15SH	679726	946565.7	355.537		263SH	679581.3	946467.8	355.057
16SH	679725.8	946569.2	355.778		264SH	679583.3	946461.5	354.781
17SH	679721.2	946569.3	355.854		265SH	679575.1	946459.8	354.9
18SH	679720.8	946565.2	355.79		266SH	679577.8	946452	354.63
19SH	679720.1	946561	355.772		267SH	679585.7	946448.9	354.304
20SH	679718.7	946555.5	355.498		268SH	679589.5	946455.5	354.304
21SH	679716.5	946552.6	355.489		269SH	679589	946463.8	354.691
22SH	679717.4	946548.4	355.223		270SH	679591.4	946475	355.109
23SH	679721.1	946546.8	355.076		271SH	679596.1	946482.5	355.144
24SH	679727	946546.3	354.981		272SH	679604.1	946483.4	355.098
25SH	679729.2	946543.3	354.897		273SH	679611	946488.5	355.065
26SH	679731.9	946540.9	354.872		274TR	679613.1	946494.8	355.362
27SH	679732.9	946537.6	354.712		275BLD	679621.7	946489.3	354.727
28SH	679728.9	946536.2	354.721		276BLD	679626.8	946508.1	355.612
29SH	679726.4	946534.4	354.752		277SH	679633.5	946519.1	355.851
30SH	679723.8	946538.5	354.814		278BLD	679640.2	946520	355.785
31SH	679721	946542.6	354.977		279SH	679639.8	946513.4	355.627
32SH	679717.6	946539.8	354.892		280EP	679637.4	946507.6	355.433
33SH	679718	946536.4	354.884		281BLD	679636.5	946505.6	355.246
34SH	679714	946538.3	354.977		282SH	679643.8	946502.3	355.063
35SH	679713.3	946542.8	355.154		283BLD	679650.7	946501.9	354.954
36SH	679712.2	946547.9	355.442		284SH	679642.9	946494.6	354.689
37SH	679710.9	946552.7	355.429		285SH	679635.3	946492	354.726
38SH	679708.2	946557.5	355.701		286SH	679641	946488.1	354.571
39SH	679707.7	946563.4	355.883		287SH	679644.8	946486.4	354.7
40SH	679711.1	946566.7	356.004		288BLD	679645.9	946483.4	354.33

41SH	679708.1	946569.9	356.206	289SH	679645.7	946479.5	353.979
42SH	679703.6	946568.2	356.182	290SH	679638.9	946480.2	354.355
43SH	679700.2	946563	356.12	291SH	679633.7	946483	354.408
44EP	679698.2	946563.3	356.114	292BLD	679631.6	946486.8	354.527
45SH	679702.3	946553.9	355.727	293SH	679629.4	946481.2	354.451
46SH	679704.5	946548.4	355.536	294SH	679633.3	946475.9	354.313
47TR	679706.9	946541.3	355.205	295EP	679627.7	946474.3	354.551
48TR	679702.6	946540.8	355.225	296BLD	679628.2	946472.5	354.312
49TR	679699.1	946541.1	355.248	297BLD	679618.2	946475.1	354.697
50SH	679700	946547.5	355.499	298SH	679611.2	946479.6	354.871
51SH	679700.2	946552.8	355.744	299SH	679605.2	946477.6	355.077
52SH	679697.7	946558.7	355.964	300SH	679602	946467.8	354.57
53SH	679694.5	946563.2	356.2	301SH	679597.8	946456.7	354.278
54SH	679693.8	946570.4	356.51	302SH	679594.7	946448	354.104
55SH	679687.9	946568.2	356.447	303BLD	679595.7	946443.4	353.704
56SH	679685.7	946562	356.281	304SH	679599.7	946443.2	353.734
57SH	679685.7	946557.7	355.987	305SH	679606.4	946449.5	353.675
58SH	679687.4	946552.8	355.886	306SH	679612.9	946452.5	353.553
59SH	679689.6	946547.6	355.721	307BLD	679613.5	946456.3	353.862
60SH	679692.1	946541.8	355.525	g308BLD	679619.6	946439.8	352.65
61SH	679687.3	946541.8	355.53	g309SH	679617.2	946446.8	353.497
62SH	679685.1	946548.3	355.926	g310SH	679610.5	946444.8	353.32
63SH	679683.4	946553.8	355.96	g311BLD	679609.6	946442.1	353.459
64SH	679681.3	946561.7	356.184	g312SH	679605.9	946436.5	353.69
65SH	679680.2	946571	356.77	g313SH	679601.2	946433	353.554
66SH	679674.5	946570.5	356.782	g314SH	679595.7	946428.9	353.495
67SH	679673.9	946563.2	356.591	g315BLD	679591.8	946426.5	353.5
68SH	679674.9	946554.6	356.218	g316EP	679598	946422.5	353.204
69SH	679676.6	946546.3	355.755	g317SH	679590.1	946421.1	353.102
70TR	679681.2	946542.1	355.649	g318BLD	679604.9	946423.3	352.95
71TR	679673.8	946542.5	355.789	g319BLD	679615.8	946420.7	352.757
72TR	679665.4	946543.4	355.889	g320SH	679614.2	946417.3	352.596
73SH	679669.4	946542.7	355.803	g321SH	679620.4	946415.7	352.595
74SH	679677.6	946542.3	355.62	g322SH	679622.2	946414.8	352.605
75SH	679669.4	946545.5	355.927	g323BLD	679622.9	946410.2	352.294
76SH	679668.5	946553.8	356.104	g324SH	679625.4	946403.4	351.797
77SH	679668.9	946564.3	356.611	g325BLD	679619.7	946397.5	351.831
78SH	679668.9	946569	356.74	g326BLD	679631.9	946392.1	351.05
79SH	679668.4	946571.6	356.384	g327SH	679635.8	946389.4	350.748
80SH	679658.5	946571.5	357.129	g328BLD	679629.1	946382.7	350.598
81SH	679656.9	946564.6	356.704	g329SH	679621.3	946378.2	350.407
82SH	679659.7	946559.8	356.571	g330SH	679606.6	946383.7	351.339
83SH	679661.4	946553.8	356.428	g331SH	679596.7	946380.8	351.666

84SH	679658.3	946544.9	356.1		g332BLD	679596.7	946388.5	351.902
85SH	679651.8	946547.7	356.306		g333BLD	679599.3	946402.2	352.205
86SH	679653.1	946556.6	356.574		g334BLD	679600	946404.1	352.247
87SH	679652.9	946567.1	356.877		g335BLD	679602.8	946415.1	352.52
88SH	679651.7	946572.1	357.378		g336TR	679591.5	946412.2	352.672
89SH	679643.6	946572.2	357.413		337TR	679576.9	946419.6	353.472
90SH	679644.4	946566.5	357.246		338SH	679580.8	946408.4	352.808
91SH	679645.7	946559.4	357.04		339SH	679565.8	946411.4	353.369
92SH	679647.1	946551.7	356.739		340SH	679558.7	946412.2	353.495
93BLD	679647.6	946549.5	356.635		341SH	679566.7	946408	353.271
94BLD	679636.9	946552.3	357.159		342SH	679567	946388.8	352.506
95SH	679641.8	946557.2	357.072		343BLD	679571.7	946384.7	352.154
96SH	679642.5	946566.2	357.28		344TR	679567.6	946377.1	352.218
97SH	679639.7	946572.6	357.549		345SH	679574.9	946373.7	351.786
98	679638.1	946566.2	357.424		346BLD	679582.1	946383.3	351.964
99SH	679633.8	946560.7	357.238		347SH	679589.9	946379.1	351.617
100SH	679631.7	946554.4	357.111		348BLD	679593.8	946378.6	351.609
101SH	679623.3	946553.8	357.256		349BLD	679592.7	946373.4	351.36
102SH	679624.7	946559.9	357.438		350SH	679591.2	946368.2	351.155
103SH	679624	946568	357.655		351BLD	679585.1	946372.1	351.57
104SH	679624.1	946573.4	357.874		352BLD	679580	946372.4	351.647
105SH	679614.3	946573.9	358.127		353BLD	679579.8	946361.4	351.38
106SH	679613.7	946565.3	357.839		354BLD	679584.7	946361.2	350.9
107SH	679612.1	946556.3	357.508		355SH	679586.2	946359.2	350.709
108SH	679604.2	946553.5	357.549		356BLD	679583.2	946358.5	350.985
109SH	679602	946561.4	357.851		357BLD	679579.2	946359.8	351.415
110SH	679601.3	946569.8	358.163		358BLD	679587.4	946357.5	350.786
111SH	679608.9	946574.4	358.288		359BLD	679582.3	946353.4	350.772
112SH	679609.1	946574.8	358.241		360BLD	679585.3	946351.4	350.581
113CV	679617.6	946581.9	358.345		361SH	679576.9	946338.9	350.162
114CV	679617.7	946582.4	358.349		362BLD	679582.5	946334.2	349.974
115SH	679599.7	946572.7	358.277		363BLD	679581	946328.7	349.615
116SH	679596.4	946572.9	357.998		364SH	679586.8	946320.7	349.368
117SH	679595.5	946567.4	358.085		365SH	679597.4	946313.8	349.046
118SH	679593.4	946557.3	357.738		366SH	679607.1	946318.7	348.963
119TR	679590.3	946549.5	357.64		367BLD	679613.7	946320.1	348.941
120SH	679582.1	946549.4	357.531		368TR	679613.9	946309.8	348.65
121SH	679581.6	946557.2	357.962		369SH	679616.2	946298.2	348.005
122SH	679582.2	946567.9	358.263		370SH	679627.7	946297.1	347.625
123EP	679579.7	946568.6	358.591		371SH	679645.1	946296.7	347.453
124SH	679580.2	946575	358.495		372SH	679658.3	946302.9	347.295
125SH	679571.3	946573.8	358.741		373SH	679666.7	946298.5	347.142
126SH	679572.7	946566.2	358.364		374SH	679680.6	946284.1	346.411

127SH	679574.8	946560	358.059		375SH	679688.2	946270.8	345.395
128SH	679573.5	946553.2	358.022		376CV	679689.3	946261.5	345.332
129SH	679566.7	946550.8	357.993		377CV	679690.3	946261.4	345.328
130SH	679566.9	946557.8	358.18		378CV	679697.8	946261.4	345.408
131SH	679568.5	946567.9	358.512		379CV	679698.5	946261.3	345.478
132SH	679566.3	946575.8	358.74		380SH	679692.3	946305.8	347.227
133RD	679566.1	946577.5	358.327		381SH	679695.6	946312.3	347.226
134RD	679565.7	946582.3	358.571		382CV	679697.4	946313.1	347.122
135SH	679559.5	946575	358.704		383CV	679698	946313	347.138
136SH	679556.4	946568.5	358.758		384CV	679698.3	946319.2	347.244
137SH	679555	946563.4	358.596		385CV	679698.9	946319.2	347.274
138SH	679553	946556	358.304		386SH	679685	946318	347.51
139TR	679552.5	946552.5	358.303		387SH	679672.4	946315.8	347.617
140SH	679545.4	946553.1	358.459		388BLD	679658.2	946309.2	347.637
141SH	679546.7	946561.8	358.652		389BLD	679659.5	946314.7	347.746
142SH	679547.1	946570.4	358.817		390SH	679662.1	946322.1	347.929
143SH	679546.6	946576.8	358.9		391BLD	679664.6	946328.2	347.996
144SH	679537.5	946577.1	358.812		392BLD	679665.6	946337.4	348.704
145RD	679535.2	946578.8	358.651		393SH	679646.2	946324.2	348.235
146RD	679534.5	946583.1	358.823		394BLD	679631.5	946335	348.708
147SH	679539.9	946570.3	358.934		395BLD	679632.6	946345.9	349.393
148SH	679544.4	946558.1	358.671		396BLD	679626.8	946323.1	348.605
149SH	679542.9	946549.1	358.421		397BLD	679625.6	946317.6	348.556
150SH	679539.7	946542	358.296		398EP	679624.5	946325.5	348.953
151SH	679537.1	946534.2	358.041		399BLD	679615.4	946325.9	349.043
152SH	679533.5	946527.2	357.905		400SH	679625.7	946339.6	348.81
153SH	679532.6	946516.9	357.628		401BLD	679619.2	946342.3	349.354
154SH	679532.2	946509.9	357.354		402BLD	679620.5	946349.1	349.802
155SH	679532.5	946506.5	357.25		403SH	679620.4	946355.6	350.257
156SH	679538.4	946504.8	357.316		404SH	679611.7	946360.6	350.523
157SH	679540.9	946511.6	357.488		405SH	679607.6	946365.4	350.685
158SH	679543.3	946519.9	357.603		406BLD	679625.6	946365.5	350.363
159SH	679546.2	946529.7	357.712		407BLD	679627	946370.7	350.097
160SH	679545.8	946534.5	357.933		408SH	679633.7	946366.2	350.067
161SH	679548.3	946541.9	358.09		409EP	679632.1	946354.8	349.928
162SH	679550.7	946548.7	358.235		410TR	679639.5	946352.7	350.048
163SH	679561.1	946547.8	357.996		411SH	679655.1	946353.2	349.219
164SH	679560.3	946537.6	357.688		412SH	679657.8	946344.1	349.121
165SH	679559	946529.5	357.501		413SH	679678.2	946346.6	348.571
166CV	679550.8	946527.8	357.744		414SH	679685.7	946339.6	347.804
167BLD	679550.8	946527.8	357.751		415SH	679693.7	946350	348.212
168EP	679549.2	946532	358.235		416SH	679689.3	946359.3	348.39
169SH	679546.6	946517.5	357.867		417SH	679697.3	946363.6	349.033

170BLD	679546.5	946511.2	357.256		418SH	679702.2	946372.7	348.67
171SH	679546.1	946507.2	357.186		419SH	679688.6	946371.5	348.483
172BLD	679545.3	946503.3	357.135		420SH	679677.2	946367.2	349.121
173SH	679551.7	946505.4	356.976		421SH	679671.4	946359.9	348.729
174SH	679559.9	946503.8	356.64		422BLD	679670.3	946354.5	349.084
175BLD	679561.8	946500.4	356.478		423BLD	679675.9	946377.1	349.092
176SH	679566.9	946498.4	356.428		424BLD	679677.1	946382.8	349.104
177SH	679571.2	946501.3	356.343		425SH	679662.3	946371.3	349.086
178BLD	679573.8	946504.7	357.183		426SH	679647.7	946369.2	349.931
179SH	679578.6	946504.1	356.447		427SH	679642	946376.7	349.812
180BLD	679582.3	946503.1	355.884		428BLD	679638.6	946368.1	350.15
181SH	679580	946509.6	356.121		429BLD	679637.1	946362.6	350.102
182SH	679583.8	946519	357.024		430BLD	679642.7	946384.4	350.7
183BLD	679577.6	946520.7	356.899		431EP	679640.4	946386.1	351.014
184SH	679572.4	946524.5	357.272		432BLD	679644.2	946392	351.105
185SH	679564.7	946525.9	357.481		433SH	679645.6	946401.9	351.266
186SH	679561	946531.9	357.539		434SH	679656.4	946403.3	350.336
187SH	679563.2	946539.3	357.697		435SH	679666.1	946393.7	350.098
188SH	679570.5	946542.3	357.698		436BLD	679671.9	946402.6	350.621
189SH	679574.1	946537.3	357.474		437BLD	679683.3	946399.8	349.785
190SH	679572.8	946530.8	357.268		438SH	679684.8	946392.8	349.542
191SH	679580	946527	357.036		439SH	679694.3	946383.3	349.352
192SH	679586.1	946523.8	356.906		440SH	679700.9	946391.8	349.379
193BLD	679586.6	946518.6	356.888		441SH	679698	946401.6	350.207
194SH	679591.2	946521.4	356.86		442SH	679691.2	946407.8	350.659
195EP	679593.5	946519.8	356.908		443SH	679693.1	946424.1	351.444
196SH	679592.7	946530.2	356.945		444SH	679709.3	946425.3	350.398
197SH	679595.2	946536.9	357.132		445SH	679700.2	946437.2	351.277
198SH	679601.3	946533.4	356.671		446BLD	679692.5	946437.1	351.513
199SH	679607.7	946537.2	356.882		447BLD	679681.3	946440	352.138
200SH	679615.4	946534.5	356.675		448SH	679670.6	946428.4	352.005
201SH	679619.8	946538	356.77		449SH	679663.4	946427.9	351.66
202SH	679628	946537.4	356.481		450TR	679660.6	946414.2	351.409
203SH	679630.9	946533.1	356.72		451SH	679666.4	946437.9	352.43
204SH	679626	946526.8	356.201		452BLD	679682.2	946443.1	352.568
205BLD	679629.2	946522.7	355.981		453BLD	679686.7	946442.1	351.911
206SH	679623.4	946520.5	356.201		454SH	679674.9	946452	352.97
207SH	679617.7	946521.2	356.108		455BLD	679684.5	946451.3	352.486
208SH	679611.6	946523.3	356.384		456BLD	679689	946449.9	351.837
209SH	679604.3	946525.8	356.865		457BLD	679696.3	946451.5	351.911
210SH	679602.2	946520	356.68		458BLD	679685.2	946454.6	352.676
211SH	679606.1	946515.1	356.475		459SH	679675.9	946461.6	353.019
212SH	679613.1	946517	356.194		460SH	679658.2	946458.7	353.337

213BLD	679612.3	946512	356.107		461EP	679658.2	946453	353.214
214SH	679619.1	946510.3	355.873		462BLD	679648.4	946447.2	352.812
215SH	679612.7	946503.6	355.803		463BLD	679637.6	946450.2	353.151
216BLD	679608.1	946496.4	355.398		464BLD	679642.4	946469	353.937
217SH	679603.9	946490.1	355.448		465BLD	679652	946466.3	353.419
218SH	679596.5	946493.7	355.604		466SH	679651.4	946474.9	354.079
219SH	679590.5	946498.9	356.009		467SH	679666.3	946476.5	353.816
220SH	679584.8	946496.3	355.747		468BLD	679656.8	946480.5	353.787
221SH	679578.3	946492.7	355.877		469BLD	679645.9	946483.1	354.285
222SH	679571.3	946490	356.129		470SH	679644.4	946490.2	354.801
223SH	679563.2	946490.9	356.253		471BLD	679661	946499.4	354.491
224SH	679560.6	946484.9	356.036		472EP	679670.2	946496.7	354.513
225SH	679560.8	946478	355.726		473SH	679680.6	946496.1	354.202
226SH	679556.9	946472.5	355.577		474SH	679672.4	946509.5	354.748
227BLD	679553.8	946473.4	355.804		475SH	679672.4	946509.5	354.739
228BLD	679538.5	946476.2	356.302		476SH	679664.9	946523.6	355.222
229BLD	679533.9	946474	356.554		477SH	679676	946530.6	355.519
230SH	679527.8	946468.5	356.181		478SH	679686.2	946531.4	355.08
231SH	679529.4	946463.3	356.074		479SH	679700.7	946534.1	355.174
232SH	679525.5	946458.7	355.888		480SH	679704.5	946528.6	355.07
233BLD	679532.5	946457.9	355.865		481SH	679698.7	946515.4	354.326
234BLD	679534.4	946463.9	355.907		482SH	679698.4	946503.3	354.155
235BLD	679539.2	946462.3	355.783		483SH	679723.7	946504.1	353.476
236BLD	679541.6	946470.6	356.121		484CV	679724.6	946494.3	353.215
237SH	679544.7	946467.5	355.849		485CV	679725.2	946494	353.219
238SH	679528.8	946452.7	355.837		486CV	679724.5	946489.2	353.073
239SH	679527.7	946446.4	355.505		487CV	679724.2	946489.2	353.046
240BLD	679528.7	946441.9	355.166		488EP	679717.4	946488.5	353.257
241SH	679534.2	946439.4	354.862		489BLD	679705.9	946488.2	353.574
242SH	679550	946434.1	354.871		490BLD	679694.3	946490.8	353.581
243SH	679554.8	946428.8	354.268		491TR	679711.1	946483.1	353.198
244EP	679559.1	946432.2	354.382		492SH	679715.2	946466.1	352.765
245BLD	679556.7	946434.9	354.583		493SH	679704.7	946454.2	352.534
246SH	679560.6	946436	354.447		494SH	679717.2	946455.6	351.999
					495HND5	679731.3	946443.9	351.403
					496O4	679732.8	946468.4	352.414