# 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**

ONISOLA AYOMIDE MERCY
**Matric No. ND/23/SGI/FT/0042**

**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.**

**JUNE,2025.**

## CERTIFICATION

This is to certify that ONISOLA AYOMIDE MERCY with **Matric No. ND/23/SGI/FT/0042**

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/0042**

## CERTIFICATION

This is to certify that ONISOLA AYOMIDE MERCY with **Matric No. ND/23/SGI/FT/0042** 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.

| | |
|---|---|
| ................................... | ...................................... |
| 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

My appreciation goes to Almighty God for his guidance and protection over my life up till this moment and for mercies granted unto me in the course and pursuit of this National Diploma programme. May his name be praise.

My profound appreciation goes to my honest dedicated supervisor Surv Kabir who took time to give attention to pursue through my project work and make use of comment, contribution and correction to guide me.

I will like to express my gratitude to my lovely parents MR. AND MRS. ONISHOLA for their support, encouragement throughout my academic career may live long to reap the fruit of your labour (Amen).

Also to my families for their limitless efforts in prayer, encouragement and finance. May Almighty God continue to bless you abundantly. (Amen). I am very grateful to the head of the department of surveying and Geo Informatics for his encouragement and all lectures in my department for your advice In a special way I will like to appreciate colleagues and friends for support towards completion of this project work. Thank you all.

## 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.*

## TABLE OF CONTENTS

**CHAPTER ONE**

## 1.0 INTRODUCTION

Topographical surveys represent a fundamental aspect of land assessment and development, intertwining various disciplines such as engineering, architecture, urban planning, and environmental science. These surveys provide a comprehensive and precise depiction of the Earth's features, encompassing physical elements such as terrain elevations, contours, vegetation, water bodies, existing infrastructure, and human-made structures. The depth and breadth of information collected during these surveys are invaluable for stakeholders who need to analyze, plan, and execute projects within a specific location. From the initial concept of a project to its final implementation, topographical surveys serve as the groundwork that shapes the entire developmental strategy.

As urban areas expand and the demand for infrastructure increases, the need for detailed terrain information becomes increasingly paramount. Topographical surveys facilitate informed decision-making by offering critical insights into site conditions, allowing architects and engineers to devise designs that harmoniously integrate with the natural landscape. For instance, when planning roads or buildings, understanding the elevation changes and natural drainage patterns can help mitigate potential issues. This proactive approach minimizes risks associated with flooding, land erosion, and other environmental concerns that might compromise the longevity and stability of construction projects. Topographical surveys are not merely technical endeavors; they are an integral part of the broader narrative surrounding land development, environmental stewardship, and societal progress. By delivering detailed and precise information about a landscape, these surveys enable stakeholders to engage in comprehensive planning that considers both present needs and future challenges.

As urbanization accelerates and the impacts of climate change intensify, an understanding of the terrain becomes essential for fostering sustainable growth and mitigating potential hazards. The information gleaned from topographical surveys informs a multitude of decisions made by civil engineers during the design and construction phases of projects. For example, when establishing a new roadway or bridge, engineers must assess the land's slope, drainage capabilities, and proximity to surrounding features such as waterways and existing infrastructure. Topographical data helps to elucidate how these elements interconnect, allowing engineers to devise solutions that enhance safety, efficiency, and environmental compatibility. Furthermore, by accurately mapping elevation changes, surveyors can identify areas at risk of flooding, enabling developers to incorporate flood mitigation strategies into their designs proactively. In urban planning, topographical surveys provide critical insights into how new developments might impact existing ecosystems and communities.

Environmental planners use topographical data to evaluate the potential ecological footprint of a proposed project, considering factors such as habitat preservation, green space allocation, and the overall integration of natural features within urban settings. A thorough understanding of the territory facilitates the creation of master plans that balance growth with the sustainability of ecological systems, ultimately leading to more livable and resilient communities. Moreover, the significance of topographical surveys extends to disaster preparedness and response. In regions prone to natural disasters such as floods, landslides, or earthquakes, detailed terrain analysis is crucial.

Planners can use topographical information to develop risk assessment models that identify vulnerable areas and prioritize mitigation measures. In the aftermath of a disaster, rapid topographical surveys using technologies such as LiDAR and aerial drones can assist first responders by providing updated maps that indicate access routes, affected structures, and safe zones for relief efforts. The ongoing integration of technology into topographical surveying is transforming the field in unprecedented ways.

The emergence of unmanned aerial vehicles (UAVs) has significantly broadened the scope and efficiency of data collection. Drones equipped with high-resolution cameras and LiDAR sensors can cover large areas quickly, capturing data from previously inaccessible locations with minimal environmental disruption. This technological revolution is not only enhancing the speed at which surveys can be conducted but also improving the level of detail and accuracy achieved in the final data outputs. However, as we embrace these technological advancements, it is essential to not overlook the foundational principles that underpin effective topographical surveying. The reliance on advanced tools and methodologies should complement, rather than replace, the expertise and intuition of seasoned land surveyors.

Effective surveying requires a blend of technology and human insight, ensuring that the interpretation of data aligns with the real-world conditions and requirements of the project at hand. As the field of topographical surveying continues to advance, the dialogue surrounding its role in land use planning and environmental preservation becomes increasingly nuanced. There is a growing recognition that these surveys are not just technical exercises but are intricately linked to broader societal issues, including climate change, sustainability, and social equity. The information derived from topographical surveys has the potential to inform policies that promote responsible land use while addressing urgent challenges presented by the changing climate. To realize the full potential of topographical surveys, it is imperative to foster collaboration across various sectors. Engagement between surveyors, engineers, urban planners, environmental scientists, and policymakers will lead to a holistic understanding of land dynamics and ensure that decisions are data-driven and contextually relevant. By adopting an integrated approach to land management that prioritizes the values of sustainability, equity, and resilience, stakeholders can effectively respond to the complexities of modern land use dilemmas.

The evolution of surveying techniques has propelled topographical surveys into the forefront of modern data collection. Traditional methods—such as the use of theodolites and manual leveling—have been significantly enhanced by advancements in technology. Contemporary practices now incorporate Global Navigation Satellite Systems (GNSS), Light Detection and Ranging (LiDAR), and aerial drones. These sophisticated tools have revolutionized how surveyors capture data, enabling them to survey vast and challenging terrains with remarkable efficiency and accuracy. The ability to gather extensive datasets quickly has transformed the landscape of surveying, allowing for comprehensive, high-resolution maps that can be analyzed in detail. In addition to construction and infrastructure development, topographical surveys play a crucial role in environmental management and conservation efforts. Environmental scientists utilize the intricate details provided by these surveys to assess ecosystems, evaluate habitats, and develop strategies to protect natural resources. For example, understanding the slope and elevation of land can identify areas vulnerable to erosion or flooding, informing conservationists on how to prioritize interventions to protect sensitive habitats. Similarly, in agriculture, topographical data aids farmers in optimizing land use and irrigation practices, which can significantly enhance productivity and sustainability while minimizing the environmental impact.

## 1.1 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.

## 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

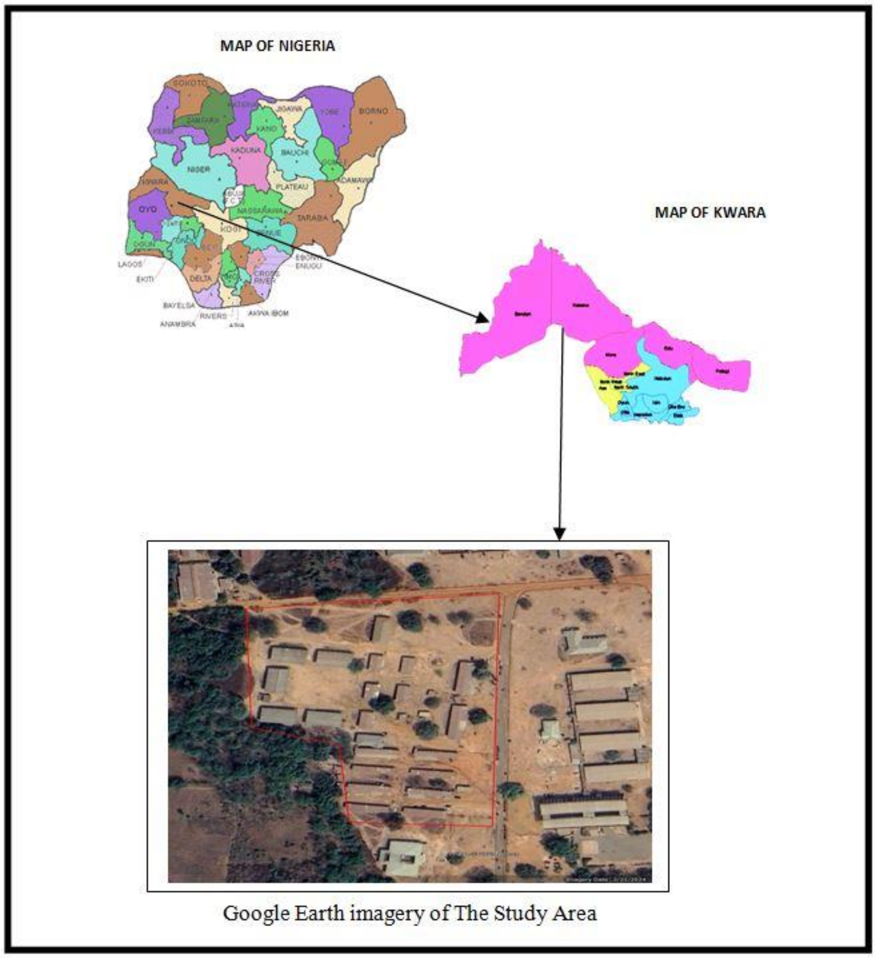
The technical specifications adhered to in this project are as follows:-

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

| SN | Names | Matric No. | Role |
|---|---|---|---|
| 1. | Onisola Ayomide Mercy | ND/23/SGI/FT/042 | Author |
| 2. | Alabi Leah Olamide | ND/23/SGI/FT/044 | Members |
| 3. | Bello Taiwo Abosede | ND/23/SGI/FT/043 | Members |

| | | | |
|---|---|---|---|
| 4. | Amusa Raimot Ashabi | ND/23/SGI/FT/049 | Members |
| 5. | Abubakar Kudus . O | ND/23/SGI/FT/051 | Members |
| 6. | Mubarak Muhammad | ND/23/SGI/FT/045 | Members |
| 7. | Haroon Abdulmutolib . O | ND/22/SGI/FT/018 | Members |

# CHAPTER TWO

## 2.0 LITERATURE REVIEW

Topographical surveying is a critical process that involves the measurement and recording of the physical features of the Earth's surface. This practice is essential across various domains, including civil engineering, environmental science, urban planning, and agricultural management, facilitating a comprehensive understanding of landscapes and informing design and development decisions. This literature review examines the historical evolution, contemporary methodologies, significance, applications, and challenges associated with topographical surveying, drawing on various scholarly sources to highlight its multifaceted nature. The historical context of topographical surveying reveals its long-standing importance in human civilization. The evolution of surveying techniques can be traced back to ancient times, where the need to quantify land for agriculture and construction motivated early practices.

According to Singh and Chan (2020), ancient Egyptians utilized primitive surveying methods—including the use of ropes and simple tools—to measure land during the construction of monumental structures like the pyramids. As societies advanced, so too did surveying techniques. By the late 16th century, the invention of the theodolite enabled surveyors to measure angles with precision, laying the groundwork for more sophisticated measurements and maps that became the foundation of modern surveying practices (Hernandez & Leese, 2019). In contemporary practice, topographical surveying has seen substantial transformation due to the integration of advanced technologies. Traditional methods relying on optical instruments have largely been supplemented by tools such as Global Navigation Satellite Systems (GNSS), Light Detection and Ranging

(LiDAR), and remote sensing via drones. As noted by Zhang et al. (2021), LiDAR technology provides high-resolution elevation data quickly and accurately, allowing surveyors to create detailed three-dimensional maps of terrains that traditional methods would struggle to achieve. The use of unmanned aerial vehicles (UAVs), commonly referred to as drones, further enhances survey efficiency, especially in inaccessible areas, while ensuring minimal disruption to the environment (Gonzalez et al., 2020).

The significance of topographical surveys cannot be overstated, as they play an essential role in informed decision-making across various sectors. In civil engineering, for instance, accurate topographical data is critical for the design and construction of infrastructure. Engineers utilize topographical maps to assess land slopes, drainage systems, and geological conditions, ensuring safe and sustainable construction practices (Smith & Jacques, 2021). Similarly, in urban planning, topographical surveys inform land use regulations, zoning laws, and sustainable development strategies. Urban planners analyze terrain features to predict the impacts of new construction on existing ecosystems, helping to balance growth with environmental preservation (Johnson, 2022). Additionally, agricultural planners benefit from topographical data in optimizing land use, irrigation techniques, and crop selection based on the physical characteristics of the soil and terrain (Roberts et al., 2021).

The applications of topographical surveys extend beyond engineering and urban planning; they are also instrumental in environmental management and conservation efforts. The detailed information collected during topographical surveys aids environmental scientists in assessing habitat conditions and identifying areas prone to ecological disturbances, such as erosion or flooding. Cheng and Wu (2022) emphasize that effective topographical analysis plays a pivotal role in biodiversity conservation, allowing for targeted interventions that protect vulnerable ecosystems. Moreover, topographical surveys have been increasingly applied in climate change adaptation strategies, enabling stakeholders to evaluate vulnerabilities and design mitigation measures informed by accurate terrain data. Despite the many benefits of topographical surveys, challenges remain that affect their implementation and efficacy. One notable challenge is the high cost associated with advanced surveying technology, which can be prohibitive for smaller firms or community-based projects (Khadka & Koirala, 2021).

Additionally, the complexity of data integration poses a significant hurdle. Often, topographical survey data must be combined with other geographic and environmental datasets; achieving compatibility requires expertise in geographic information systems (GIS) (Nguyen & Dabo, 2022).

Furthermore, environmental factors such as weather conditions and vegetation can complicate data collection, potentially leading to inaccuracies. As the field of topographical surveying continues to evolve, there is a growing recognition of the need for interdisciplinary collaboration. Engaging professionals from various domains—such as surveyors, engineers, urban planners, and environmental scientists—can enhance the effectiveness of topographical surveys by fostering a more holistic understanding of land dynamics and enabling data-driven decision-making (Mason & Connors, 2021). By emphasizing cooperation between different sectors, stakeholders can leverage topographical data to address complex challenges related to urbanization, climate change, and sustainable resource management. In summary, topographical surveying stands as a fundamental practice with far-reaching implications across various fields. The historical evolution of surveying techniques, coupled with modern advancements, has significantly enhanced the accuracy and efficiency of topographical data collection. The multifaceted applications of this data reflect its critical role in civil engineering, urban planning, environmental management, and agriculture.

However, challenges associated with cost and data integration remain, necessitating ongoing collaboration and innovation. Thus, as the landscape of surveying technology continues to advance, the potential for topographical surveys to inform sustainable development and responsible land management remains robust. Acknowledging these advancements and challenges will be essential for professionals as they navigate the complexities of modern land use and strive toward a future that balances development with environmental integrity. In conclusion, the literature highlights the profound impact of topographical surveying on various sectors, demonstrating its role as a fundamental tool for understanding and managing the complexities of land. The transition from historical practices to modern methodologies showcases the continuous evolution of the field, while the expanding applications underscore the critical need for accurate data in decision-making processes. As society looks to the future, the collaboration and integration of technology in topographical surveying will be imperative in ensuring that land management, environmental stewardship, and urban planning align with the overarching goals of sustainability and resilience in the face of ongoing challenges

# 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 90$^{o}$, 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.

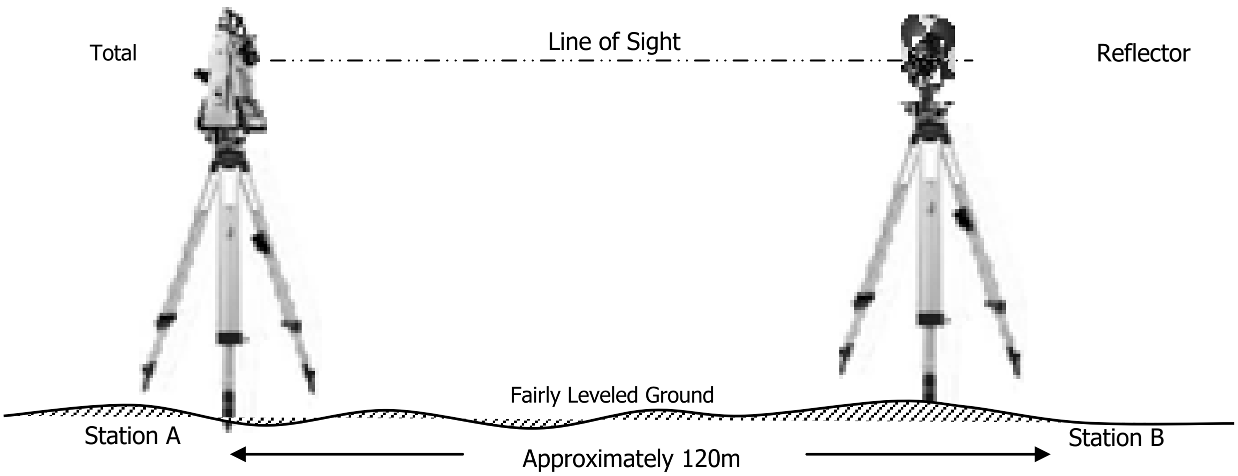



***Figure 1.6. : Instrument set-up for horizontal collimation test and vertical index test***

### 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 | 87º 35’ 10’’ | 88º 26’ 15’’ |
| A | B | R | 267º 35’ 12’’ | 271º 33’ 46’’ |
| | | | Diff= 180º 00’ 02’’ | Sum= 360º 00’ 01’ |

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

= [(180º 00’ 02’ - 180º 00’ 00’’) /2]

= 00º 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.

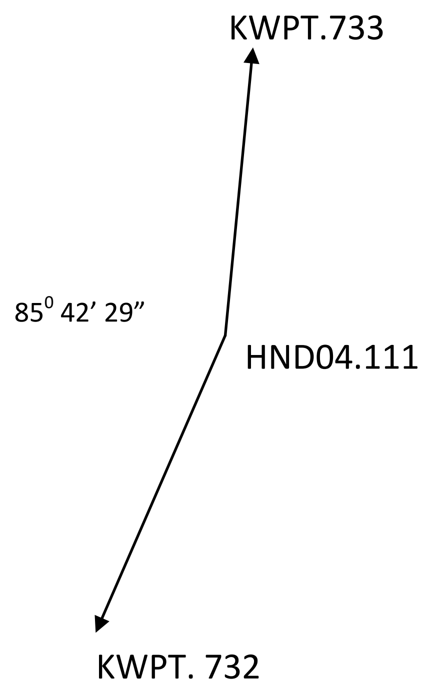



**Figure 3.3: In-situ check Diagram (not drawn to scale).**

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.

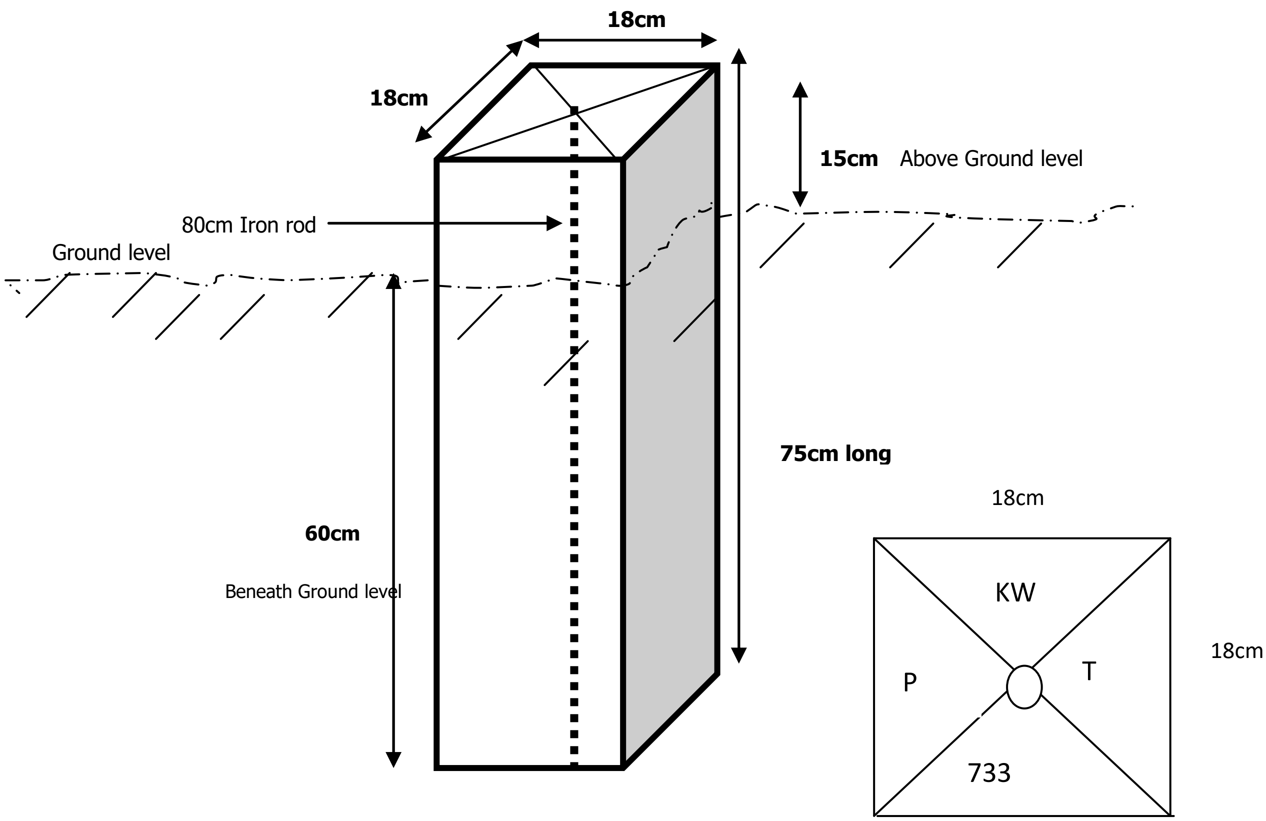



**Figure 1.9: Pre- cast property beacon**

## 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.

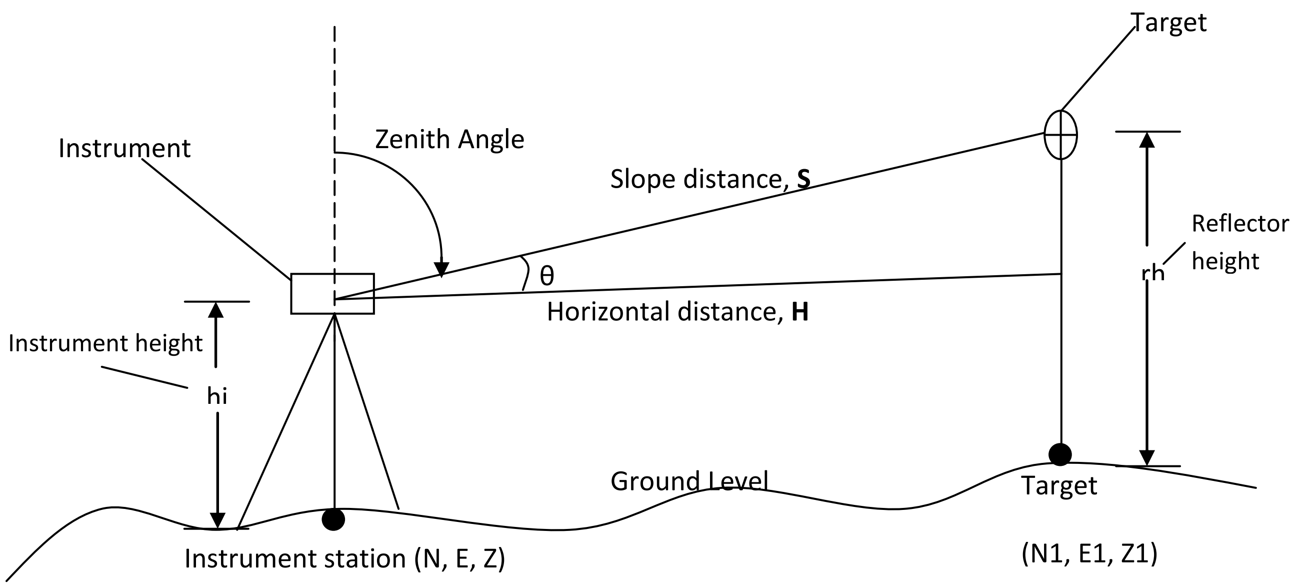



**Figure 1.10: Illustrative diagram of spot height determination**

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) = $S \times \cos\theta$ OR $S \times \sin(90 - \theta)$

Where:

$\theta$ = Angle of inclination

$(90 - \theta)$ = 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 |