A PROJECT REPORT

ON

TOPOGRAPHICAL INFORMATION SYSTEM (TIS) OF PART OF JUDGES QUARTERS, TANKE, ILORIN, ILORIN SOUTH LOCAL GOVERNMENT AREA, KWARA STATE.

BY

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SUBMITTED TO

THE DEPARTMENT OF SURVEYING AND GEO-INFORMATICS, INSTITUTE OF ENVIRINMENTALSTUDIES, KWARA STATE POLYTECHNIC ILORIN.

IN PARTIAL FUFILLMENT OF THE REQUIREMENT FOR THE AWARD OF HIGHER NATIONAL DIPLOMA IN SURVEYING AND GEO-INFORMATICS.

SUPERVISED BY

SURV.A.O AKINYEDE

JUNE, 2025

DECLARATION

I, EMMAMUEL MERCY UNEKWUOJO with matric number HND/23/SGI/FT/0031 hereby declare that the study entitled "Topographical Information System of Part of Judges Quarters was carried out by me in accordance to survey rules, regulation and departmental instructions. The work has not been previously presented in the department or anywhere for degree or publication Information derived from different published and unpublished works of other people are duly acknowledge in the text accordingly.

____

SIGNATURE AND DATE

CERTIFICATE

I hereby certified that the information given in this project was obtained as a result of the observation and measurement made by me and that the survey was carried out in accordance with survey laws, regulations and departmental instructions.

____

EMMANUEL MERCY UNEKWUOJO

HND/23/SGI/FT/031

CERTIFICATION

This is to certify that this project was carried out by EMMANUEL MERCY UNEKWUOJO with Matric No: HND/23/SGI/FT/0031 whose work has been read and approved as meeting part of the requirement for the Award Higher National Diploma (HND) in the department of Surveying and Geo-informatics. Institute of Environmental Studies, Kwara State Polytechnic Ilorin.

I hereby declared that she has conducted herself with due diligence and honesty on the said duties.

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(Project Coordinator)

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DATE

External Supervisor

DEDICATION

This project is dedicated to Almighty God the author and finisher of everything who gave me this great privilege to attain this stage in my education pursuit.

ACKNOWLEDGEMENT

My profound gratitude to Almighty God for the gift of life, favour and strength for seeing me through those difficult and challenging time while carrying out this project, indeed He was my source of help and so He will continually be.

My profuse appreciation goes to my Parents, Mr. And Mrs. Emmanuel, my Brothers and Sisters for their love, support and genuine act of kindness throughout this journey .

I want to express my sincere gratitude to my project supervisor in person of Surv. A.O Akinyede, it is a privileged to serve under you and above all, thanks for your assistance, audience, and advice. I also appreciate the Head of the Department SURV **A. 1 ISAU** and a big thanks to Surv. Ayuba Abdulsalam, Surv. R.S Awoleye, Surv. Asonibare R.O, Surv. A.G Aremu, Surv. B.F Diran, Surv. Williams kazeem and Surv. Kabir Babatunde Thank you for guidance and encouragement, you all are fatherly.

Finally, to my Friends and Colleagues in the department, thank you all for being supportive, amicable and dynamic. May you not be written off in God's sight and may the good God bless you, guide your footsteps and remember you all for greatness (Amen).

ABSTRACT

The need for the production of Topographic Information System (TIS) of Part of Judges Quarters arose due to the absence of Topographic Information System for proper planning of the area. Therefore, TIS was carried out with the main purpose of producing a tool for effective land planning, administration and management within the project area. Field and Office reconnaissance were carried out in order to be familiar with the terrain and do proper planning on the methodology and equipment to be used for the acquisition and assembling of spatial and attribute data. The geometric (spatial) data were acquired by ground survey method using Total station through the process of detailing, traversing and obtaining spot heights which were carried out simultaneously. The data processing were adequately and effectively done using Notepad and Microsoft Excel for editing and preprocessing, AutoCAD for draughting, Surfer for generating the Digital Terrain Model (DTM) and 3DWireframe Map. A model database was generated and structured using the relational table format. GIS analytical functions were performed such as queries and different map were produce. A comprehensive technical report was written at the end of the project.

TABLE OF CONTENTS

CONTENTS **PAGE**

TITLE PAGE I

DECLARATION ....………...I I

CERTIFICATE III

CERTIFICATION IV

DEDICATION V

ACKNOWLEDGEMENT ....V I

ABSTRACT ....………..............................…VII

TABLE OF CONTENTS ....…... VIII

CHAPTER ONE

1.0 INTRODUCTION 1

1.1 BACKGROUND OF THE STUDY ` 1

1.3 AIM AND OBJECTIVES OF THE STUDY 3

1.4 STUDY AREA 4

1.5 SCOPE OF THE STUDY 5

CHAPTER TWO

2.0 LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK 8

CHAPTER THREE…………………………………………………………….…. 27

3.0 METHODOLOGY…………………………………………………………. 27

3.1 DATABASE DESIGN……………………………..…………………… 27

3.1.1 VIEW OF REALITY………………………………………….…………. 27

3.1.2 CONCEPTUAL DESIGN…………………………………..………. 29

3.1.3 LOGICAL DESIGN………………………………………..……. 30

3.1.4 PHYSICAL DESIGN……………………………………………. 30

3.2 RECONNAISSANCE……………..……………………….……….. 32

3.2.1 OFFICE RECONNAISSANCE…………………………….…..….. 32

3.2.2 FIELD RECONNAISSANCE……………………………………… 33

3.3 EQUIPMENT USED …………………………………………………… 35

3.3.1 HARDWARE USED …………………………………………………… 35

3.3.2 SOFTWARE COMPONENT …………………………………...…… 35

3.4 INSTRUMENT TEST ……………………………………….…………..35

3.4.1 HORIZONTAL COLLIMATIONTEST …..…………………….……..35

3.4.2 VERTICAL INDEX ERROR TEST….. …..…………………….…..37

3.4.3 ANALYSIS OF COLLIMATION AND VERTICAL INDEX DATA…………………………………………………………………..37

3.4.4 CONTROL CHECK…………………………………………………… 38

3.5 MONUMENTATION……………..…………………..……….. 39

3.6 DATA ACQUISITION……………..……………………….. 40

3.6 .1 GEOMETRIC DATA ACQUISITION……………………….. 40

3.6.2 ATTRIBUTES DATA ……………………..…………..…… 42

3.7 DATA DOWNLOADING AND PROCESSING……………..... 42

3.7.1 DATA DOWNLOADING AND EDITING ……………..….. 42

3.7.2 DATA PROCESSING AND EDITING …………………….. 42

3.7.3 DATA PROCESSING USING ARCGIS 10.3 ……………….. 42

3.8 DATABASE IMPLEMENTATION……………….……………52

3.8.2 DATABASE MAINTENANCE……………………….……….52

3.9 BACK COMPUTATION……………………………………….54

3.9.1 AREA COMPUTATION………………………………………..54

CHAPTER FOUR……………………………………………..…… 55

4.0 SPATIAL ANALYSIS AND PRESENTATION…..…………… 55

4.1 TESTING OF DATABASE……..……………………………….. 55

4.2 INFORMATION PRESENTATION AND RESULT ANALYSIS 59

4.2.1 THE TOPOGRAPHIC PLAN (COMPOSITE PLAN)………… 59

4.2.2 THE PERIMETER PLAN ……………………………………….. 60

4.2.3 THE SPOT HEIGHT PLAN……………………………………. 61

4.2.4 THE SLOPE ASPECT PLAN…………………………………. 62

CHAPTER FIVE……………………………………………………….63

5.0 COST ESTIMATION, SUMMARY, PROBLEM ENCOUNTERED, RECOMMENDATION AND CONCLUSION………………… 63

5.1 COST ESTIMATION …………………………………………………63

5.2 SUMMARY………………..……………………………………66

5.3 PROBLEMS ENCOUNTERED…………………… ……………66

5.4 CONCLUSION……………………………………………………66

5.5 RECOMMENDATION…………………………………………………67

REFERENCE………………………………………………………… 68

APPENDIX…………………………………………………………… 70

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

The project is based on the use of the principle of Geographical Information System(GIS) as incorporated into Topographical Surveying of Part of Judges Quarters Tanke, Ilorin Permanent Site with a dynamic process of storing data about spatial objects and their attributes for retrieval, decision making and management. The ideology behind the above is based on the facts that surveying is a discipline which entails different method of measurement, storing and analyzing spatial information about the earth and environ, representing this information on a paper or graphically on a computer. Surveying has been described as an important element in every human development activity since the beginning of recorded history. It has been discovered to be an imperative requirement in the planning and execution of every form of meaning development (Bannister et al., 1986).

Provision of infrastructure; planning of towns and cities; management of hazardous natural events and human actions such as erosion, flooding, earthquakes and subsidence; coastal management; exploration and exploitation of minerals; sitting of industries; resources exploitation on the land and on the sea are dependent on land surveying products (Oriola and Asonibare, 2011).

Topography is a term used to describe the detailed study of the surface of the earth. It includes the study of features of land surfaces and its shape. It can be used to represent as a surface, any characteristic and study its continuously changing value other than elevation, for instance, population, geomagnetic data and geochemical data.

Topographical surveying involves the acquisition of topographic data of the features present on the earth's surface, both man-made and natural in three-dimension (x, y, z). This employs the techniques of plane surveying and other special techniques to establish horizontal and vertical controls. The implications of the above are that no meaningful development can be embarked upon by an individual, government and any other agencies without information about the topography of the area where such development is to take place. Topographic information system can be derived from the topographic data with the employment of the analytical capabilities of geographic information system (GIS) (Odo et al, 2015). Geographic Information System (GIS) evolved as a new technology in surveying. It combines geographic data (location) and attribute data about object features on the earth's surface with cartographic representation in order to perform spatial decision making using spatial analysis (Burrough, 1986). 2 Topographic information system can be explained as the combination of human effort and computer-based tools for the collection, storage, analysis, manipulation and retrieval of various kinds of data relating to geographic features (man-made and natural) on the surface of the earth (Lexicon Universal Encyclopedia, 1989).

Topographic information system (TIS) is an aspect of geographic information system (GIS) which may be view as a combination of terrain and computer-based resources with a set of organized procedure that result in the collection, storage, retrieval, dissemination (communication) and use of term-based data for the purpose of efficient and effective management of the resources for decision making as an aim to sustainable development (Oyinloye, 2002).

In summary, Topographic information system (TIS) is a combination of different components for collecting, processing, storing and communicating information related to the measurement of the relief of the terrain and features in an area. The increasing demand for topographic information systems over conventional topographic surveying is as a result of easy retrieval, storage, manipulation of data and display of the result. 1.2 Statement of the Problem Over the years, the demand for topographic information systems for various needs and applications in the school for the management in terms of planning of 3 physical developments and other future desired development. Therefore, as the School keeps expanding and developing, there is a need for accurate spatial information databases that will serve the purpose of planning land use and infrastructural development, facilitate effective planning, management and productive decision making. In other to meet the present need without jeopardizing the future physical development, Then, Topographical Information System (TIS) perform an active role in the planning and management of topographic data.

1.3 Aim and Objectives of the Project

1.3.1 Aim of the Project

The aim is to carryout a topographic information system (TIS) of Part of Judges Quarters with a well structured Geo-database for sustainable use and management of the estate.

1.3.2 Objectives of the Project

This work is set to be achieved through a number of objectives as follows:

1. Design Geo-database for the study area.

2. Establishment of controls and geometric and attribute data acquisition.

3. Implementation of Topographical Information System

4. Spatial analysis and Information presentation (DEM, Slope map, contours etc).

1.4 Study Area

This study was carried out at Part of Judges Quarters, Tanke, which is located in Ilorin South Local Government Area in Kwara State, Nigeria. The extent of the study area is about 8.173 hectares and is located on longitude 4°36'4.4"E and latitude 8°27'41"N. The study area is a developing area having features which include buildings, trees, electricity poles etc.

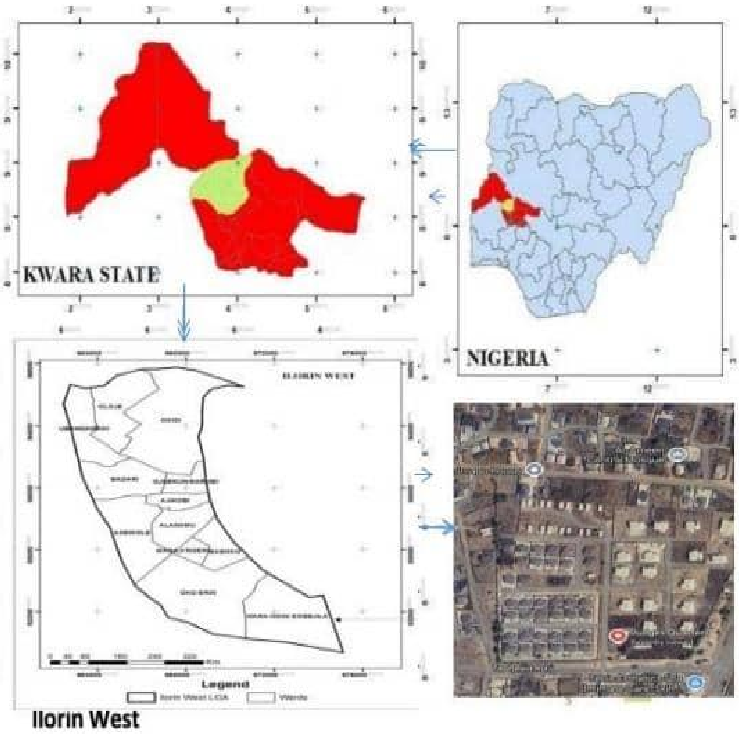

Fig 1.1 Image of the study area.

Fig 1: Map Of Nigeria, Kwara And Ilorin-West (Nig admin):

Plate 1:Satellite Imagery of Part of Judges Quarters (Google Earth).

1.5 Scope of the Project

The following are the operations that was undergone for this research.

- Review of previous projects, literature, journals, reports, textbooks and websites.
- Project Planning.
- Database Design Techniques.
- Reconnaissance Survey of the project area.

Data Acquisition with automated Survey equipment.

- Perimeter traversing and detailing.
- Spot Heighten.
- Attribute Data Acquisition (Features description).

Database creation for both spatial and non-spatial.

- Spatial Analysis.
- Information Presentation (both hard and soft copies).

1.6 Significance of the Study

This study would be of high significance, as it can find applications in the following areas;

1) To understand the topography of the land before planning any structural development on it.
2) To determine the topography relief of the land surface to enable effective socio economic development.
3) To produce an up to date map in digital format.

4) To support the school management with knowledge of the area, provide approximate inventory of available facilities (buildings) with Judges Quarters.
5) To aid in delivering effective planning management as well as serve as a source of information for future development, hence the necessity of this project.

LEVEL OF PARTICIPATION

During the course of executing the project, every member thoroughly participated in almost all phases below;

i. Scheduling, planning and co-ordinating of all field operations
ii. Data acquisition
iii. Data downloading and processing
iv. Data analysis
v. Information presentation and report writing
vi. Costing of the project

PERIOD OF PROJECT EXECUTION

The project was carried out between February 20th and May 15th 2025.

PERSONNEL

The following set of people were the group that carry out this project (GROUP 5A)

S/N	NAMES	POSITION HELD	MATRIC NO
1	EMMANUEL MERCY UNEKWUOJO	AUTHOR	HND/23/SGI/FT/031
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6	BELLO IBRAHIM OPEYEMI	MEMBER	HND/23/SGI/FT/038

CHAPTER TWO

2.0 LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

Surveying is define as science and art of determining relatively, accurate measurements of the Earth's surfaces. It includes the determination of points, on, below or above the earth surface, the measurement of data, the reduction and interpretation of the such data to usable form, and, however, the establishment of relative position and size the data according to given measurement requirements. Surveying has been an importance element in the development of the human environment for so many centuries. It is a crucial requirement in the planning, monitoring and execution of nearly every form of construction. Surveying was essential at the dawn of history, and some of the most significant scientific discoveries could never have been implemented were it not for the contribution of surveying. Its principal modern applications are in the fields of apportionment of land, transportation and building.

Thus, surveying has two similar but opposite functions:

(1) The determination of existing relative vertical and horizontal position, such as that needed for the process of mapping and

(2) The establishment of marks for apportionment of land and control constructions or to indicate land boundaries.

Surveying has been essential since the beginning of civilization. Its earliest applications were in measuring and establishing boundaries of property ownership. Throughout the years its importance has steadily increased with the growing demand for a variety of maps and other spatially related types of information and the expanding need for establishing accurate line and grade to guide construction operations (Ghilani and Paul, 2002).

Surveying is the world's oldest profession. About 5,000 years ago, survey were conducted in river Nile of Egypt, India and China to re-established boundaries washed away by annual floodwaters. Today, surveying is becoming increasingly more adventurous. The earth is mapped from airplanes and satellites. The moon and the planet are mapped from rockets and space-craft which take photographs which are relayed to the earth by television (Hoffman, 1994).

Topography is generally refers to as the study of earth surface, and its feature and overall characteristics in term of shape. It also gives the description of the features (such as surface, shapes, vegetation cover & elevations), depicted in maps (Ojiako and Jimoh, 2017). These characteristics are natural and artificial (or man made). Man-made features are buildings, highways, dams, wharfs, bridges and so forth. Topography is the study of the features and shape of land surfaces. The topography of an area could refer to the surface shapes and features themselves, or a description (especially their depiction in maps).

A geographic information system (GIS) is a framework which allows for manipulating, gathering, managing, and analyzing data. Rooted in the science of geography, GIS integrates many data type. It analyzes spatial location and organizes layers of information into visualizations using maps and 3D scenes. With this unique capability, GIS reveals deeper in depth into data, such as patterns, relationships, and situations-helping users make better and smarter decisions.

A geographic information system (GIS) lets us visualize, query, manipulate, analyze, and interpret data to understand relationships, patterns, and trends. "GIS is an integrated system of computer software's, hardware and trained personnel linking topographic, utility, facility, image, demographic, and other resource data that is geographically referenced.” National Aeronautics and Space Administration (NASA)”

The acronym GIS sometimes used for Geographic Information Science is used to refer to the academic discipline that studies Geographic Information Systems and is a large domain within the broader academic discipline of Geo informatics. Geographic Information System (GIS) evolved as a recent technology in surveying. It combines geographic data (location) and attribute data about object feature on the earth‘s surface with cartographic representation in order to perform spatial decision making using spatial analysis (Odo, Idhoko, Oha, Okoro, and Okafor, 2015). GIS is becoming essential to acquiring in depth understanding of what is happening and what will happen in geographic space. Once we understand, we can prescribe action. This new approach to management—managing geographically—is transforming the way organizations operate.

A GIS is a computer-based system that provides the following four sets of capabilities to handle geo referenced data (Otto and Rolf , 2009):

i. Data capture and preparation

ii. Data management, including storage and maintenance. Data manipulation and analysis

iii. Data presentation

A GIS subsystem has a database management system as its core where spatial analysis is carried out,

Geo-Information System Land Information System(LIS), for the contents of a multi-purpose cadaster Topographic Information System(TIS), for the natural and artificial landscape Geographic Information System(GIS), for geographic and thematic contents (large areas)

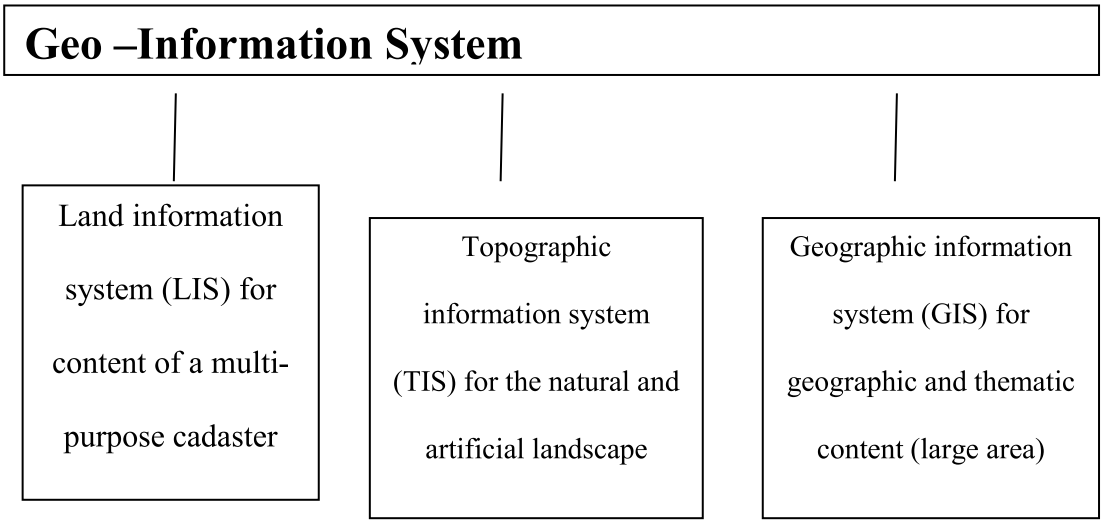


Figure 2.1: Geo-Information Systems and their three essential categories. (D)

Topographic Information Systems (TIS): store the artificial and natural landscape in the form of digital models. These are not very closely detailed but, on the other hand, are not significantly generalized. A digital elevation model (DEM) is a component of a TIS.

Geographic Information Systems (GIS): A geographic information system (GIS) is a computer system for capturing, checking, manipulating, storing, analyzing and displaying data related to positions on Earth's surface. GIS can show many different kinds of data on one map, such as roads, streets, drainages and vegetation. This enables people to more easily see, analyze, and understand patterns and relationships.

A geographic information system (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data. The key word to this technology is Geography – this means that some portion of the data is spatial. In other words, data that is in some way referenced to locations on the earth. Coupled with this data is usually tabular data known as attribute data. Attribute data can be generally defined as additional information about each of the spatial features.GIS is more than just software. People and methods are combined with geospatial software and tools, to enable spatial analysis, manage large datasets, and display information in a map/graphical form (GIS Lounge, 1999)

Geographic Information Systems (GIS) store, analyze and visualize data for geographic positions on Earth's surface. GIS is a computer-based tool that examines spatial relationships, patterns and trends. By connecting geography with data, GIS better understands data using a geographic context.

The 4 main ideas of Geographic Information Systems (GIS) are (https://gisgeography.com/what-gis-geographic-information-systems/):

- **Create** geographic data.
- **Visualize** it on a map.
- **Analyze** and find patterns.
- **Manage** it in a database.

The definition of GIS has changed over time in response to the wide applications it is now used for and in response to the definition as viewed through the opinion of the end user. The development of GIS paralleled other technological developments such as computer information systems, software, and analytical algorithms. This led to a moving target of definitions over time. Here are some examples GIS definitions:

(Burrough, 1986) "Set of tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes. "

(ESRI, 1990) "An organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information. "

(Clarke, 1997) "Automated systems for the capture, storage and retrieval of spatial data."

(Goodchild, 1997) "A system for input, storage, manipulation, and output of geographic information; a class of software; a practical instance of a GIS combines software with hardware, data, a user, etc., to solve a problem, support a decision, help to plan…"

(Longley et al, 2005) Everyone has their own favorite definition of a GIS, and there are many to choose from. These include GIS as: "A container of maps in digital form. A computerized tool for solving geographical problems. A spatial decision support system. A mechanized inventory of geographically distributed features and facilities. A tool for revealing what is otherwise invisible in geographic information.

A tool for performing operations on geographic data that are too tedious or expensive or inaccurate if performed by hand"

(ESRI, 2008) "Integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information." Components of Geographic Information Systems

Digital technology was successfully introduced in the field of mapping in the late 1960's as means of speeding up map production (Perera and Shanta, 2002). With the change in technology the growth in the number of spatial information systems, the concept of topographic database has been introduced in several mapping 16 surveying organizations in the world, in order to deliver more Geo-information to the user community.

Topographic information system can be derived from the topographic data with the employment of the analytical capabilities of GIS (Onuigbo, Zita, Gbedu, Pious, and Samaila, 2015). The modern digital techniques for the gathering and compilation of topographic maps greatly differ from the conventional methods.

Today, the collection of topographical data by modern digital tools is achieved with the view of building a complex topographic multi-purpose system. Thus, the focus of topographic surveying has shifted from production of analogue topographic maps printed on paper to the structuring, production, capture and maintenance of an organized and regulated database of digital spatial information (Igor, 2010).

Topographic Information System is very crucial in this present age in other to be able to store, update maps, retrieve and analyze necessary data at any given time with minimal efforts. Topographic Information System can be explained as the combination of human effort and computer-based tools for the collection, storage, analysis, manipulation and retrieval of various kinds of data relating to geographic features (man-made and natural) on the surface of the earth (Lexicon Universal Encyclopedia , 1989).

In view of this, it is necessary to create Topographic Information System for different locations because the information acquired from such system can be used for various purposes in physical planning and decision making in such locations. Some of the usefulness and advantages of this digital database for such system over the conventional maps include:-

i. Possibility of fast amendment and dynamic updating of data

ii. Computing slope maps, aspect maps, slope profiles that can be used to produce shaded relief and aid in other geo morphological problems. For example, TIS have been shown to be useful in mapping flood areas. These maps can be used to predict which areas may be adversely affected by high water.

iii. Analysis of many important spatial problems

iv. Versatility in integrating data collected from various sources

v. Flexibility output possibilities

vi. Provides bases for additional information with relative ease for production of maps.

A topographic survey is a survey carry out to acquire the geometric data needed for gathering, compiling and the preparation of a topographic map. This geometric data consists of the horizontal and vertical locations of the features to be display on the map. Topographic Surveys are surveys made to determine the configuration of the earth's terrain and to locate natural and man-made features on, above or below it. It establish the different man-made and the natural features of land. This type of survey can be very beneficial to home owners, industrial owners, or even for properties under construction. Land may include hills, trees, fences, buildings, water and ravines. A topographical survey will provide exact figures of the size, height and position of different changes that have occurred over the course of time with respect to their presence or that of any manmade structures.

Specifically, it shows their location, size, height and any changes in elevation with time. As at today, GIS has been developed from the need to combine attribute information about land with its cartographic representation in order to perform spatial analysis. (Genovese, 2005).

It is used to Produce topographic maps, Construct topographic (cross-sectional) profiles and Establish vertical and horizontal control for accurately defining locations

A graphic representation of the topography of this area is called a topographic map. A topographic map is simply a drawing that shows the natural and artificial features of an area. Topographic maps with larger scales as well as digital map products are necessary for better planning (Charles and Paul, 2012).

Topography is generally known as the study of earth surface, and its features and shape. It also gives the description of the features (such as surface, shapes, vegetation cover & elevations), depicted in maps (Ojiako and Jimoh, 2017). These characteristics are natural and artificial (or man-made). A topographic survey is a survey carried out to gather the data needed for the preparation of a topographic map. This data consists of the horizontal and vertical locations of the features to be depicted on the map. Topographic Surveys are surveys made to determine the configuration of the earth's surface and to locate natural and cultural features available on it. Topographic surveys establish the different manmade and the natural features of land.

Topographic map is a map that uses colors and symbolic patterns to represent the general surface features of the earth, such as grassland, forest, marsh, agricultural, urban, and barren rock (Pradeep, 2007). The information typically contained in a map consist of: i. Points, lines, polygons, and symbols describing the features.

ii. Title, captions, legend, keys etc.

iii. Spatial data of one or more themes.

iv. Textual information of attributes of the graphic features.

v. Map projection, scale and geographic coordinates.

Since a topographic map is a representation of a portion of the surface of the earth, the distance between any two points shown on the map must have a definite ratio to the corresponding distance between the points on the ground. The ratio is known as the scale of the map. The topographic maps fall roughly into three classes according to the map scale employed as follows (Paul, 2012).

i. Large-scale maps: 1 in 1000 or larger
ii. Medium-scale maps: 1 in 1000 to 1 in 10,000
iii. Small-scale maps: 1 in 10,000 or smaller.

The scale to which a map is plotted depends primarily on the purpose of the map. For reconnaissance operation, a small scale maps are enough, the large-scale maps would be necessary for detailed planning. The scale is usually determine even before preceding the field work.

Topographic surveying which is defined by (Chandra, 2005) as "the process of determining the location of selected ground natural and man-made features of a given area, and determining the configuration of the terrain". Topographic surveys are surveys which are carried out to depict the topography of the mountainous terrain, rivers water bodies wooded areas and other cultural details such as roads, railways, townships etc. The purpose of topographic survey is to provides information on surfaces relief and characteristics, that is, on the overall “shape” of the land. Ground elevations data are measured at different selected points, and positions of hills, valleys and ridges and changing gradient of the ground surface are determined. Topographic survey is carried out to gather data necessary to portray topographic maps which serves as basis for designing and planning environmental and engineering projects. Topographic survey entails two basic operations (Waheed, 2019):

Establishing system of horizontal and vertical controls over the area, which consists of selected stations connected by measurement of high precision. Identify and locating details, including ground points, by measurement of lower precision from the control points.

There are several techniques to which data can be collected to portray topographic map, with each having its own benefits and disadvantages. Besides individual techniques has its own set of conditions which will render certain other techniques/methods more suitable than others. Often, it may be required to combine different techniques/methods. The following are methods used for elevation data collection. Ground Surveying , Digital Aerial Photogrammetric , LiDAR

DATA can be defined as the value of an attribute of an entity. Data can also be define as a quantitative measure of the content of information. Data is measured, collected and reported, and analyzed, whereupon it can be represented using graphs, images or other analysis tools. Data as a general concept refers to the fact that some existing information or knowledge is represented or coded in some form suitable for better usage or processing.

Raw data ("unprocessed data") is a collection of numbers or characters before it has been "cleaned" and corrected by researchers. Raw data needs to be corrected to detect and remove outliers or obvious instrument or data entry errors.

Data processing commonly occurs by stages, and the "processed data" from one stage may be considered the "raw data" of the next stage. Data are characteristics or information, usually numerical, that are collected through observation. In a more technical sense, data is a set of values of qualitative or quantitative variables about one or more persons or objects (Bhojaraju and Koganurmath, 1999).

Database management system is systematic collection of interrelated data and a set of computer software to access the data. The primary goal of DBMS is to provide an environment that is efficient and convenient to use in managing, retrieving, storing, database information. A database management system (DBMS) is a collection of programs that enables you to store, maintain, manipulate and extract information from a database. This collection of data is called the Database which ease storage, retrieval and management of information.

Database systems are designed to manage and modify large bodies of information. The management of data involves both the definition of structures for the storage of information and the provision of mechanisms for the manipulation of information. In addition, the database system must provide for the safety of the data stored, despite system crashes or attempts at unauthorized access. If data are to be shared among several users, the system must avoid possible anomalous results.

A database management system (DBMS) is a software package designed to define, maintain, retrieve, store and manage data in a database. A DBMS generally manipulates and modify the data itself, the data format, field names, record structure and file structure. It also defines rules to validate and manipulate this data. A database management system receives instruction from a database administrator (DBA) and accordingly instructs the system to make the necessary changes. These commands can be to load, retrieve or modify existing data from the system.

The functions of geo data base include:

1. Maintenance of data quality including updating.
2. Consistency with little or no redundancy.
3. Security including access control.
4. High performance by database management system with database language.

Components of a DBMS :

A DBMS is a complex structure that is used to manage, store and manipulate data and the metadata used to describe the data. It is utilized by a large variety of users to retrieve and manipulate data under its control. A system is a composed of set of interrelated components (Bhojaraju and Koganurmath, 1999)

1. At least one person who owns and is responsible for the database.
2. A set of rules and relationship that defines and governs the interactions among elements of the database.
3. People who put data into the database.
4. People who get data out of the database.
5. The database itself

An Architecture for a Database System:

Data Abstraction: Many database system users are not computer trained, developers hide the complexity from users through several level of abstraction, to simplify users' interaction with the system. The architecture is divided into three general levels:

i. Internal / Physical level: The internal level is the one closest to physical storage i.e. one concerned with the way in which the data is actually stored. It is the lowest level of abstraction describes how the data are actually stored. At the physical level, complex low level data structures are described in detail.

ii. Conceptual / Logical level: is a "level of indirection" between the internal and external. The next higher level of abstraction describes what data are stored in the database, and what relationship exists among those data. The entire database is thus described in term of a small number of relatively simple structures. This level is used by Database Administrators (DBA), who must decide what information is to be kept in the database.

iii. External / View level: The external level is the one closest to the users, i.e. the one concerned with the way in which the data is viewed by individual users. It is the highest level of abstraction describes only part of the entire database. Despite the use of simpler structures at the logical level, some complexity remains, because of the large size of the database. Many users of the database system will not be concerned with all this information. Instead, such users need to access only a part of the database so that their interaction with the system is simplified, the view level of abstraction is defined. The system may provide many views for the same database.

If the external level is concerned with the individual user views, the conceptual level may be thought of as defining a community user view. In other words, there will be many" external views," each consisting of a more or less abstract representation of some portion of the database, and there will be a single "conceptual view," consisting of a similarity abstract representation of the database in its entirety. Likewise, there will be a single "internal view," representing the total database as actually stored.

Three components of a datum are of directs relevance to Geographic Information System (GIS) (Waheed, 2019):

1. Attribute information that describes the substance, characteristics, variable, values, and similar qualities of the entity.

2. Geographic information that describes the position of the entity in space relative to other things in space.

3. Temporal information that describes the instant or period of time during which the entity is at a defined location or in an observed state or condition.

The information from a database can be presented in a variety of formats. Most DBMSs include a report writer program that enables you to output data in the form of a report. Many DBMSs also include a graphics component that enables you to output information in the form of graphs and charts.

Characteristics of Database Management System

- ✓ Provides security and removes redundancy
- ✓ Self-describing nature of a database system
- ✓ Insulation between programs and data abstraction

- ✓ Support of multiple views of the data
- ✓ Sharing of data and multiuser transaction processing
- ✓ DBMS allows entities and relations among them to form tables.
- ✓ It follows the ACID concept (Atomicity, Consistency, Isolation, and Durability).
- ✓ DBMS supports multi-user environment that allows users to access and manipulate data in parallel.

Musa, Idowu and Zemba (2016) created a "Database Design And Implementation – The Mautech Experience". For the purpose of this research, two base maps of the study area was added to the map document in Arc Map. Most of the ground features was digitized from this image. The world file attached to the image made geo referencing unnecessary. The second base map used was the scanned boundary map of the university. From the scanned map, survey features (namely property beacons and survey boundary lines) were digitized. The boundary map was geo referenced using the combination of GPS coordinates from the field. With the base maps in place, creation and implementation of the database began. The design successfully eliminated data redundancy which gives room for querying the database and spatial search all with the help of GIS.

Ojiako, Akindiya, Igbokwe and Idhoko (2015) Design"Automated Topographic Information System Of Emmanuel Alayande College Of Education (Isokun Satellite Campus), Oyo, Oyo west local government area, Oyo State". The locational geometric data for the project site was acquired using digital equipment: CHC Global Position System (DGPS), Total Station. The process was divided into four stages; Control densification to the project site with the use of CHC DGPS, Perimeter survey, Detailing, Spot Height with the use of Total Station.

The software used include: ArcGIS 10.2.2., Ashtech Solution for GPS post-processing, Leica Geo office Tools, Microsoft word 2010, Microsoft excel 2010 and so on. Attribute data were acquired through oral interview method. Social survey was carried out during which information such as; building name, building type, building use and other related data about features were obtained from the staffs and students within the school. All these data make up the attribute data necessary for database creation. Base on the database created various analysis done include: overlaying operation, spatial search, topographical operations and other GIS analysis. Topographic analysis were done to generate composite map, aspect map, slope map, Triangulated irregular map (TIN), Hill shaded map and contour map of the study area. Overlay Operation by combining two or more maps to form a new one which served as a base for thematic comparison and link between layers.

Ojiako and Jimoh(2017) carried out "Topographic Information System of Federal School of Surveying, Oyo East Local Government Oyo State, Nigeria "The primary data collected include the coordinates of some pillar around the study area of known description for the purpose of geo-referencing the plan. The secondary data used include a hard copy layout plan of the project area and attributes of the plots. The layout plan of the project area was scanned and then exported to ArcGIS 10.2 for dereferencing and digitized, also for query generation, spatial analysis and information presentation. Surfer 11 for generating the Digital Terrain Model (DTM) and 3D Wireframe Map. Attribute database model was created and structured using the relational table format. The database were processed and queried to provide useful cadastral information. The interpretation of the maps and queries produced, supports decision making policy needed to plan infrastructural projects in the school. For the purpose of this project, conventional survey method was utilize for obtaining terrain information of the study area. These data collected are data defining the location of features, which includes manmade and natural features, with their attributes to further describe such geospatial data present in the site. These information's will communicate on the developmental need of the developed or underdeveloped area so as to cater for the whole populace and facilitate conducive and good academic environment.

Adewara Babalola and Kolawole (2017) carry out Topographic Information System (TIS)of part of west campus of the Federal Polytechnic Ilaro (FPI), South West Nigeria which is characterized by inadequacy of some fundamental utilities such as walkways, drainage system etc. This west campus required a Topographic Information System (TIS) to serve as a decision making tool to enable proper facility management and address flood related issues around the area. Landsat 8 (2010) image of the project site was used during the planning stage to have a general overview of the project site. Field data were collected using Total station instrument and processed using the Microsoft excel spread sheet, then AutoCAD Civil 3D 2013 for scripting and generation a surface contour. Topographic information System (TIS) was created in the computer based on the collected datasets. Digital Terrain Model was created for further enhancement of the slope map, aspect map, hill shade and view shed analysis of the area using ArcGIS 10.5 and Surfer 15 software. The TIS is available for manipulations and querying. The study concludes that TIS was essential for physical planning and accurate decision making as it is a system that allows easy updating of information and quick retrieval of information for better planning and environmental management.

CHAPTER THREE

3.0 METHODOLOGY

This phase outlines the methods and procedures employed in the planning, data acquisition, data processing, and development of both the database and the database management system, as well as the presentation of information. These activities were systematically organized and executed in sequential stages, including the design of the database. The process typically involves a spatially referenced, structured digital database, along with suitable application software for geospatial analysis. It essentially highlights the techniques and principles applied throughout the project. Geographic Information System (GIS) methodologies were utilized to achieve the intended outcomes.

3.1 DATABASE DESIGN

The design of any database involves three stages namely;

i. Conceptual design
ii. Logical design
iii. Physical design

3.1.1 VIEW OF REALITY

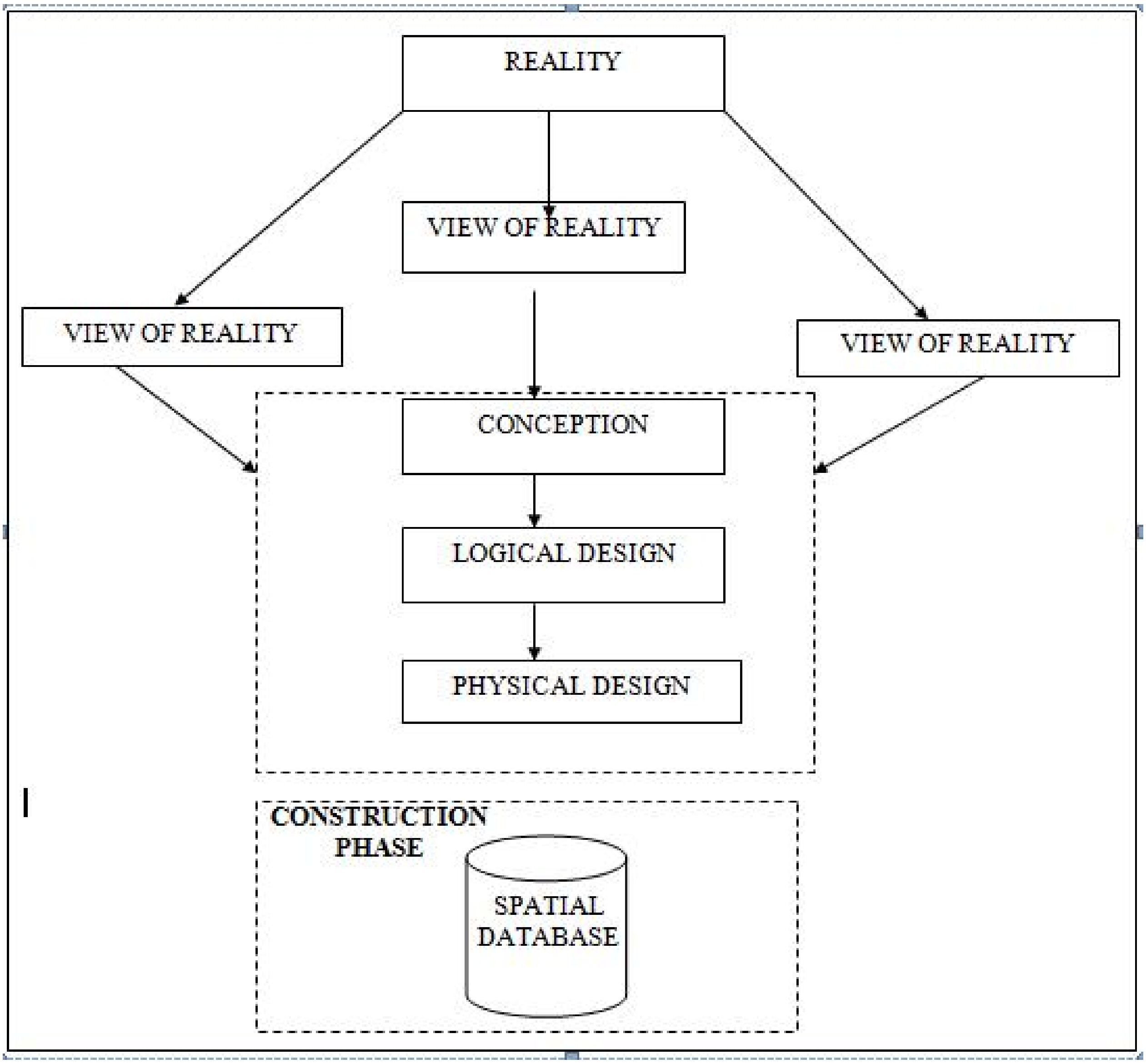
In database design, it is essential to consider *reality*, which refers to the actual physical phenomena that exist encompassing all elements, whether or not they are perceived by individuals. A *view of reality*, however, is a mental abstraction tailored for a specific application or set of applications.

For this project, the view of reality is based on the topographical features of the study area. Since it is not feasible to replicate the real world exactly, the approach involves conceptualizing and modeling the real-world environment in a structured way to allow for accurate representation and analysis.

The key features of interest in this project include:

- Roads
- Electric Poles
- Trees
- Building

Fig. 3.1 Design and Construction Phases in Spatial Database



3.1.2 CONCEPTUAL DESIGN

Vector data model is the data type adopted for this project, which is represented, by points, lines and polygon. The identified entities are:-

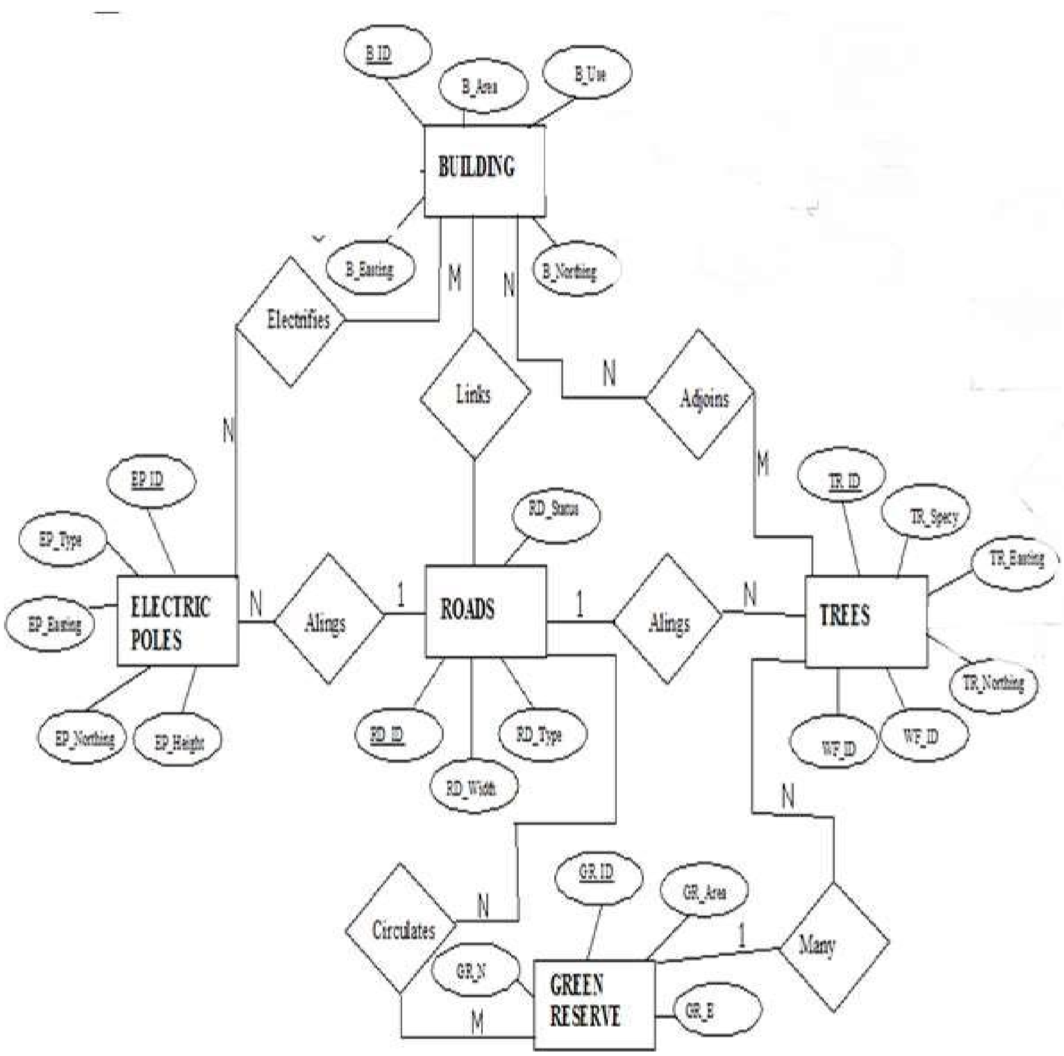
a. Roads (line)

b. Electric poles (point)

c. Trees (point)

d. Buildings(polygon)

Fig. 3.2: E-R Diagram (Entity relationship diagram)



3.1.3 LOGICAL DESIGN

This is the design aspect of the database refers to the process of creating a conceptual framework or model that represents the structure and organization of spatial data within the system. It involves defining the data element, their relationship, and the rules for datamanipulation and analysis. In this phase, the entities, their attributes and their relationships are represented in a single uniform manner in form of relation in such a way that would be noinformation loss and at the same time no unnecessary duplication of data. In this study, the logical database design is employed to generate a geo-relation database structure. Each entity has unique identifier in bold type. An attribute type or combination of attribute types that serves to identify an entity type is termed an identifier.

i. Building(B_ID, B_Area, B_Name, B_Easting, B_Northing)
ii. Roads (R_ID, R_Width, R_Type, R-Condition, R_Easting, R_Northing)
iii. Vegetation (V_ID,GR_Area,)
iv. ree (TR_ID, TR_spp, TR_Importance, TR_Easting, TR_Northing)
v. Electric Pole (EP_No, EP_Type, EP_Height,EP_Easting, EP_Northing)

3.1.4 PHYSICAL DESIGN

Table 3.1: Building and its attribute

ENTITY	DESCRIPTION
B_ID	Building Identification
B_name	Building Name
B_Area	Building Area
B_Easting	Building Easting
B_Northing	Building Northings

Table 3.2: Road and its attributes

ENTITY	DESCRIPTION
R_ID	Road Identifier
R_Length	Road Length
R_Width	Road Width
R_Type	Road Type
R_Condition	Road Condition

Table 3.3 : Trees and its attributes

ENTITY	DESCRIPTION
TR_ID	Tree Identifier
TR_Spp	Tree specy
TR_E	Tree_Easting
TR_N	Tree Northing

Table 3.4: Electric Poles and its attributes

ENTITY	DESCRIPTION
EP_ID	Electric pole Identifier
EP_Type	Electric pole Type
EP_Height	Electric pole Height
EP_E	Electric pole Easting
EP_N	Electric pole Northing

Table 3.5: Vegetation and its Attributes

ENTITY	DESCRIPTION
V_ID	Vegetation Identifier
V_Area	Vegetation Area
V_E	Vegetation Easting
V_N	Vegetation Northing

3.2 RECONNAISSANCE

This stage represents the groundwork laid prior to the execution of the project. It involves gathering all available and relevant information about the project area to ensure a smooth and effective implementation.

The necessary steps for the successful execution of the project are divided into two main phases:

1. Office Planning
2. Field Reconnaissance

3.2.1 OFFICE RECONNAISSANCE

This phase entails the collection and review of information related to the study area. It also includes testing the instruments intended for use during the project, listing the required equipment, estimating the number of days needed for field activities, and outlining how each task will be performed. Additionally, responsibilities are assigned to team members based on the supervisor's guidance and instructions.

Table. 3.6: Coordinates of Controls

Station	Northing (m)	Easting (m)	Height (m)
PBIL3306	940288.197	678281.701	355.212
PBIL3304	940275.508	678254.250	350.532
PL1	939677.97	678331.46	349.087

Source: Surveying and Geo-informatics Department Kwara state polytechnic.

3.2.2 FIELD RECONNAISSANCE

The field reconnaissance is the first visitation to the project site to get intimated with theenvironment.

i. Boundary points was selected
ii. The distribution of features was studied
iii. Controls to be used were located
iv. Method and type of instrument to be uses was determined
v. Subsidiary point for Ground control Points were picked and define using nail and bottle cock
vi. A diagram of the study area was drawn.

Fig. 3.3: Recce diagram of the study area (not drawn to scale)

3.3 EQUIPMENT USED/ SYSTEM SELECTION AND SOFTWARE

3.3.1 HARDWARE USED

i. Total station
ii. 1 reflector with a tracking rod.
iii. 1 Tripod
iv. One (1) 50m tape
v. One (1) umbrella
vi. 1 cutlass
vii. Hand held GPS
viii. Hammer
ix. Nails and bottle cover
x. Field book and writing materials
xi. 1-No of Personal Computer HP655 and its accessories
xii. 1-No of HP DeskJet K7100 A3 printer
xiii. 1-No of HP DeskJet 1110 A4 printer

3.3.2 SOFTWARE COMPONENT

i. Notepad.
ii. Microsoft Excel.
iii. AutoCAD 2007
iv. ArcGIS 10.3
v. Surfer 2010
vi. Microsoft Word.

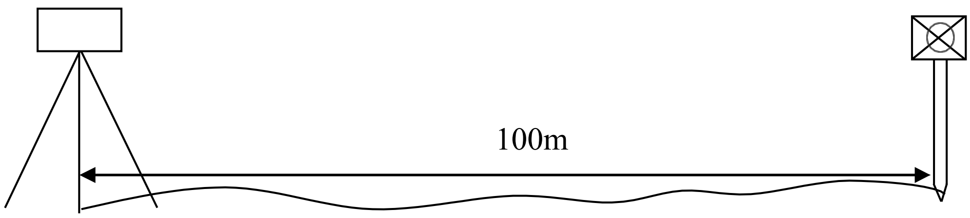
3.4 INSTRUMENT TEST

To ensure data quality, the Total Station used in this project was tested for both **vertical index error** and **horizontal collimation error**. These tests were conducted to confirm the instrument's accuracy, efficiency, and overall reliability before use. The procedures followed are detailed below.

3.4.1 HORIZONTAL COLLIMATION TEST

This test was conducted to ensure that the line of sight was perpendicular to the trunnion axis. The Total Station was positioned over a specific point, and initial adjustments were made to ensure proper alignment, leveling, and focus (to eliminate parallax in the telescope). Avertical target was placed at a distance of 100 meters from the Total Station. To access the configuration menu of the Total Station, the menu key was pressed and held for approximately 2 seconds. From the main menu, the calibration sub-menu was selected, and within that, the horizontal collimation test option was chosen. The target was then observed and divided into two halves, with horizontal readings recorded for Face left and Face right. The readings are shown in Table 3.4.1 below.

Total Station REFLECTOR (TARGET)



STATION A Fairly Level Ground STATION B

Fig 3.4: Horizontal Collimation and Vertical Index error test.

Table 3.7: Horizontal Collimation Data

Station	Target	Face	Hz Reading	Difference	Error
A	B	L	38˚42‟32”		
		R	218˚42‟35”	180˚00‟03”	03”

3.4.2 VERTICAL INDEX ERROR TEST

This test was conducted to verify the accuracy of the vertical angle measurement when the line of sight is perfectly horizontal. The expected reading for this test is exactly ninety degrees (90°); any deviation from this value is known as the **vertical index error**.

The Total Station was set up over a designated point, with necessary temporary adjustments made to ensure proper alignment and functioning. A target was placed approximately 100 meters away, and the instrument was carefully aimed at it. The target was bisected by aligning the instrument in the **Face Left** position, and the corresponding vertical angle reading was recorded. The process was then repeated with the instrument in the **Face Right** position, and that reading was also documented. The recorded values are presented below.

Table 3.8: Vertical Index Data

Instrument Station	Target Station	Face	Vertical	Sum	Error
A	B	L	90˚00‟00”		
		R	270˚00‟02”	360˚00‟02”	02”

3.4.3 ANALYSIS OF COLLIMATION AND VERTICAL INDEX DATA

The reading obtain during calibration were reduced to obtain new collimation and verticalerrors.

Horizontal collimation = {(FR – FL) – 180}/2 = {(00˚00‟03"}/2 = 1.5"

Vertical collimation = {(FL + FR) – 360} = (90˚00‟00" + 270˚00‟02") - 360} = 02"The result shows that the instrument is still in good working condition.

3.4.4 CONTROL CHECK

Three control beacons (PBIL3306, PBIL3304) were utilized in this project. To verify their positions on-site, a check was performed by measuring the angles between these beacons and comparing the observed angles with those calculated from their known coordinates.

The Total Station was set up on the control beacon PBIL3304. After completing all necessary temporary adjustments, the reflector was positioned on the control beacon PBIL3306, designated as the back station. A horizontal angle reading was taken and recorded with the instrument set to **Face Left**.

Next, the reflector was moved to the control beacon PL1, the forward station. Horizontal angle readings were then recorded in both **Face Left** and **Face Right** positions. Finally, the reflector was returned to the back station, and a horizontal angle reading was recorded with the instrument set to **Face Right**.

Table 3.9: Table showing the back computation of the control coordinates

From STN	Bearing	Dist(m)	ΔN	ΔE	Northing(m)	Easting (m)	To STN
					940288.197	678281.701	PBIL3306
PBIL3306	65°11'30"	30.242	-12.689	-27.451	940275.508	678254.250	PBIL3304
PBIL3304	7°21'45"	602.506	-597.538	77.21	939677.97	678331.460	PL1

Table 3.1 0 : Table showing the distance observation result of the control check

FROM	OBSERVED DISTANCE(m)	COMPUTED DISTANCE (m)	TO
PBIL3306	30.140	30.242	PBIL3304
PBIL3304	602.451	602.506	PL1

Table 3.11: Table showing the observation result of the control check

STN	SIGHT	FACE	OBSERVED HZ ANGLE	REDUCED HZ ANGLE	MEAN
	PBIL3306	L1	357° 08' 35"		
PBIL3304	PL1	L2	291° 57' 00"	65°11'35"	
	PL1	R2	111° 57' 1"	65°11'25"	
	PBIL3306	R1	177° 08' 35"		65°11'30"

Difference in angle (observed - computed) =65° 11' 30"-65° 11' 25"

= 00° 00' 05"

Since the allowable accuracy (angular) of third order traverse of one station is 00° 00' 30" and the result obtained from the control check (00° 00' 05") is less than allowable error. Therefore, the controls were angularly intact.

3.5 MONUMENTATION

The boundary of the area carved out was demarcated with the precast concrete beacons, after clearing the required line of sights. The identified points of changes in directions were dug and beacons were buried on it, leaving about 15cm part of the beacon above the ground level. The beacons were buried at convenient distances as dictated by the nature of the boundary.

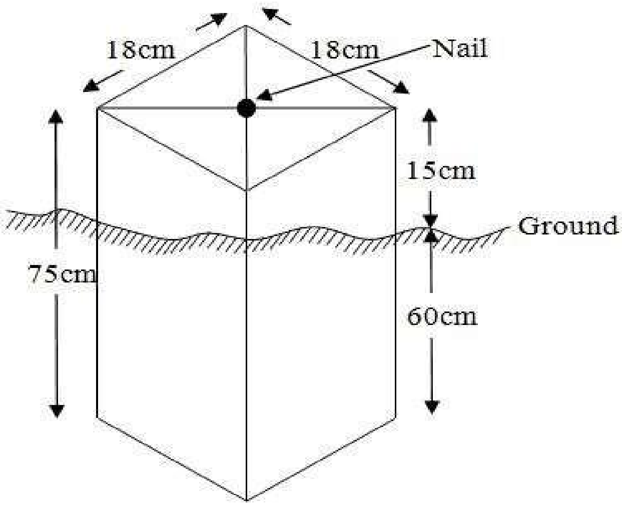


Fig. 3.5: Pillar Description

3.6 DATA ACQUISITION

PRIMARY DATA SOURCE

Field observation served as the primary data source for this project. A ground-based method was employed to collect data using a Total Station instrument, which involved recording X, Y, and Z coordinates from Ground Control Points (GCPs) established at prominent locations throughout the study area.

SECONDARY DATA SOURCE

An updated imagery of the area was obtained from Google Earth and used to determine the extent of coverage for the project area.

3.6.1 GEOMETRIC DATA ACQUISITION

The Total Station instrument was carefully set up on control point PBIL3304, with a back sight taken to PBIL3306 after performing the necessary station adjustments, which included centering, leveling, and focusing. The following procedures were then followed to determine the position of the next point (PL1), and this process was repeated sequentially until the entire site was covered. The data acquisition method used on site was the **radiation method**, where two or more points are coordinated from a single instrument station.

Procedure:

i. After setting up the instrument and completing temporary adjustments, the instrument was powered on, and a new job was created under the job menu in the instrument's internal memory. The job was named **GROUP 5A**.

ii. The coordinates of the three control points were entered into the instrument's memory, along with relevant codes such as:

- 'RD' for roads
- 'SP' for spot heights
- 'BD' for buildings, etc.

iii. The instrument height and reflector height were measured and saved in the instrument memory.

iv. In the coordinate menu, orientation was set by inputting the coordinates of the instrument station and the back sight. The reflector at the back station was carefully bisected before confirming the orientation by selecting 'yes'.

v. After orientation, the reflector was bisected at the next point (nail), and the **'obs'** (observe) option was selected. The three-dimensional coordinates (East, North, Height) of the point were displayed on the instrument's screen, and **'rec'** (record) was pressed to save the data. For subsequent observations, the **'all'** option was used to streamline the process without separately pressing 'obs' and 'rec'.

vi. It was ensured that the prism center of the reflector was precisely bisected and securely set on the tripod to minimize height measurement errors.

vii. The instrument was then moved to the next point after all details—including spot heights and boundary points visible from the current station—were recorded. Temporary adjustments were made after repositioning.

viii. This sequence was repeated until all boundary points and their heights were accurately coordinated.

ix. Spot heights in this project were acquired randomly rather than at regular grid intervals. Additionally, three edges of each building were surveyed.

x. Upon completion of the data acquisition, all collected details were properly recorded and mapped to their respective positions on the project plan.

3.6.2 ATTRIBUTES DATA ACQUISITION

Attribute data is information about spatial features. They provide the characteristics, description and nomenclature about spatial objects. Thus the attributes data acquired includes names of buildings and their uses such as classrooms, roads, water facilities and prominent natural features likes river and trees found and vegetation were properly identified within andaround the study area.

3.7 DATA DOWNLOADING AND PROCESSING

3.7.1 DATA DOWNLOADING AND EDITING

This is stage whereby all data acquired which were automatically stored in the Total Station were downloaded into personal computer. This was done with the aid of downloading cable connected to the computer and some associated complementing software installed on the System.

3.7.2 DATA PROCESSING AND DATA EDITING

The geometric data downloaded were further processed in order to convert it to a useful format and to enhance its accuracy. The output coordinates, were edited and exported in *.txt, *.xls and *.pdf format. Thereafter, they were imported into Arc GIS 10.3 for further operations and to carry out spatial analysis.

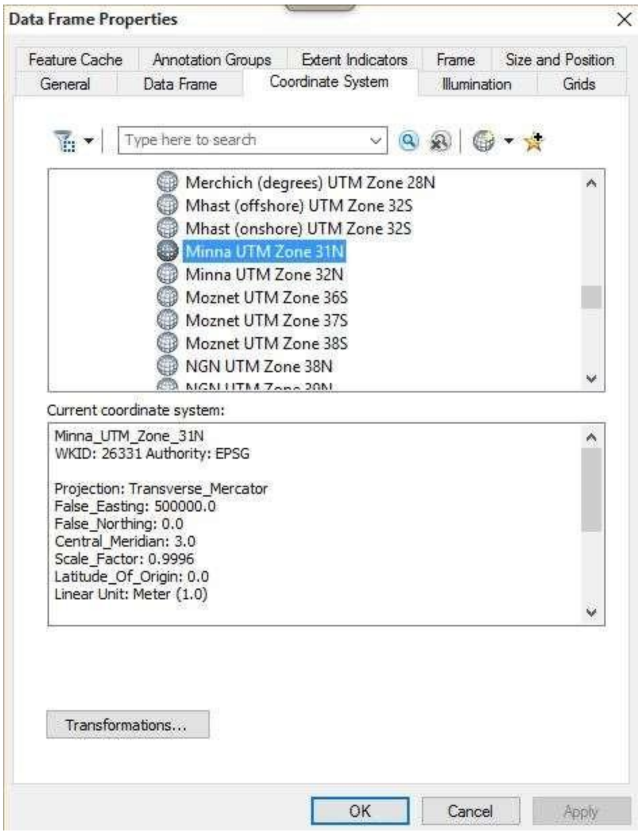
3.7.3 DATA PROCESSING USING ARCGIS 10.3

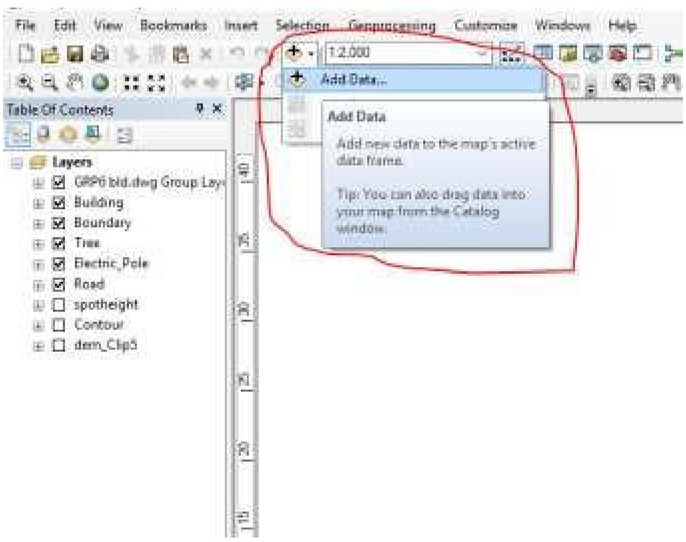
Before launching ArcGIS, AutoCAD was used to plot feature data, which were saved separately in different files named **road**, **boundary line**, **buildings**, **trees**, and **electric poles**.

Steps to load and prepare data in ArcGIS 10.3:

1. Launch **ArcMap** in ArcGIS 10.3.
2. In the dialog box that appears, click **A NEW EMPTY MAP** to create a new project.
3. On the menu bar, click **Tools**, then select **Extensions**. Check all available extensions, then close the window.
4. On the left-hand side (LHS), right-click on **Layers**, and select **Properties**.

5. In the **Properties** window, go to the **Coordinate System** tab to set the projection system to **MINNA DATUM ZONE 31N**. Then, go to the **General** tab to set the map units. Click **Apply** and then **OK**.
6. Click **Add Data** on the toolbar, browse to the saved AutoCAD files, select all relevant files, and load them into the **Table of Contents** (Layer section).

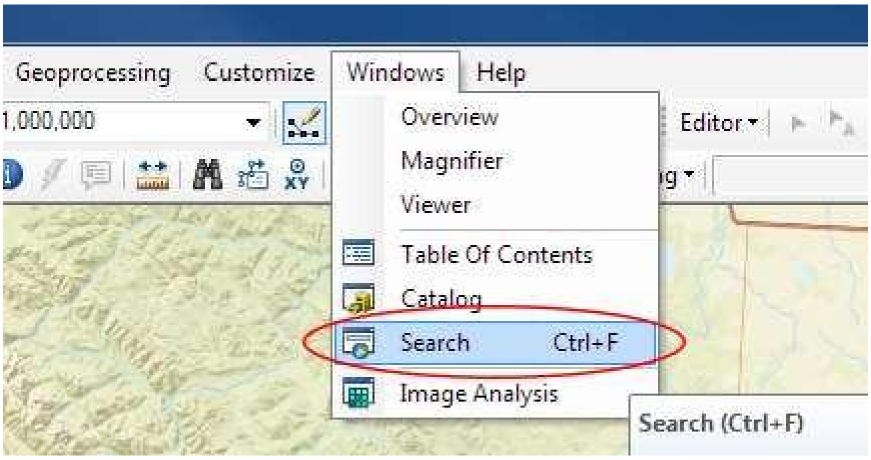




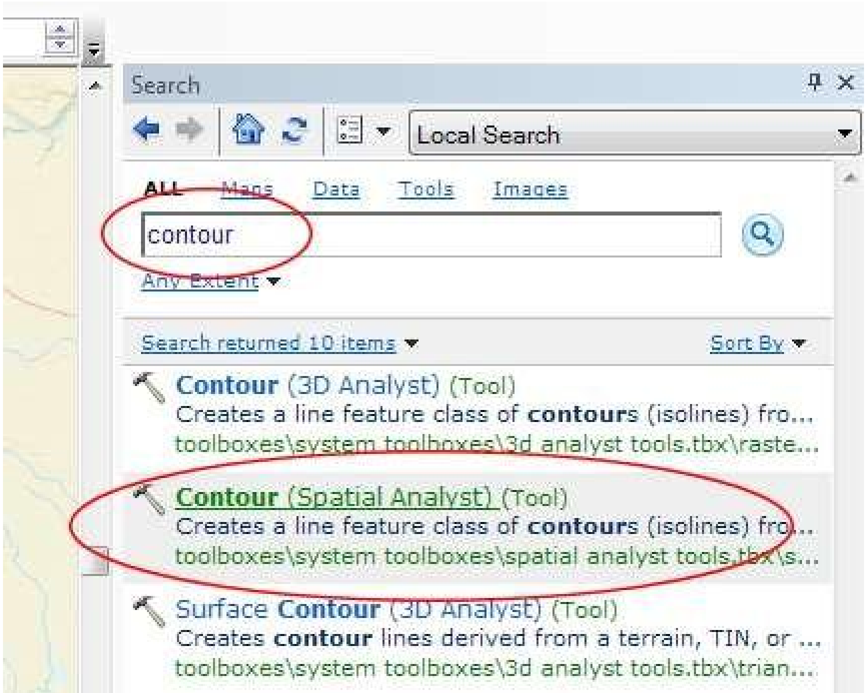
All drawing was exported to shape file. After the feature class has been creates, click onEditor to start Editing, and then click on the load object.

Creating Contours

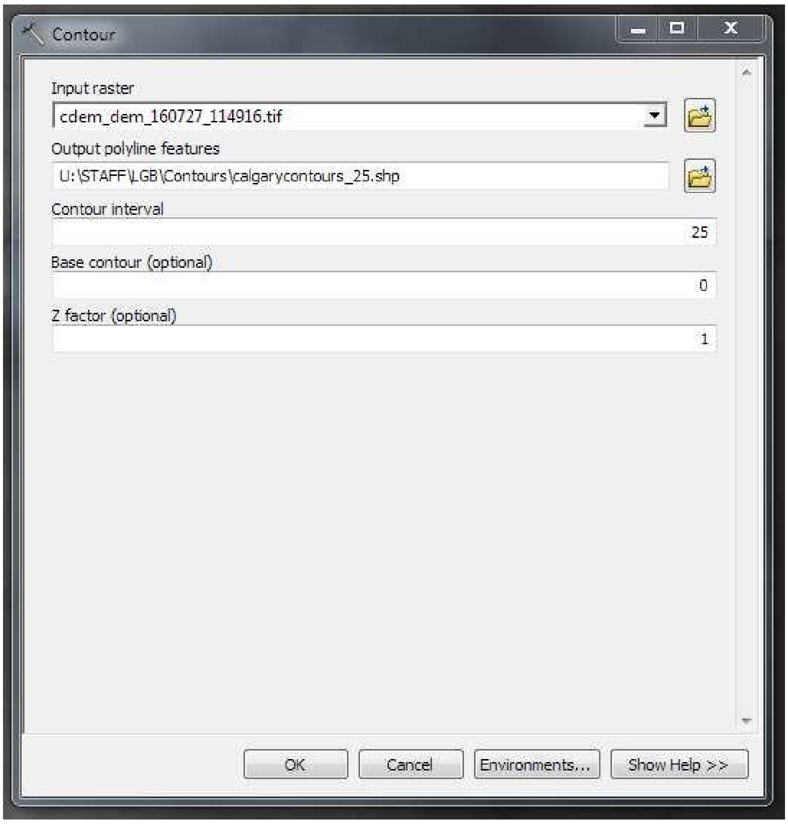
1. First, a Digital Elevation Model (DEM) was created by using the **Natural Neighbor** interpolation method. To do this, open the **Search** bar and type **Interpolation**, then select **Natural Neighbor**.
2. Choose the **XYZ** data as the input for creating the DEM, setting the project **boundary line** as the extent for the interpolation.
3. To generate contours, ensure that the **Spatial Analyst** toolbar is enabled. You can activate it by navigating to **Customize > Toolbars > Spatial Analyst**.
4. Alternatively, open the search bar by clicking **Windows > Search** or by clicking the search icon and type relevant commands or tools.



In the search bar type **Contour**, and select **Contour (Spatial Analyst)** from the searchresults list.



After choosing **Contour**, a dialogue window will appear, prompting you for five settings: **Input raster:** select the DEM file from which you want to generate contours by locating it on your hard drive or in the dropdown menu, showing layers present in the Table of Contents **Output polyline features**: indicate where you want to save your output contours **Contour interval:** set the distance between contour lines in meters – the smaller the number, the greater the number of lines **Base contour (optional):** the starting point from which the lines are generated – for example, the default is 0 so with an interval of 25 meters, the contours are generated at 25, 50, 75, 100…, but if the base contour is set at 40, then the contours are generated at 65, 90, 115, 140 and so on **Z factor (optional):** can be used to adjust the units of data; for example, if you have data in meters and you want to produce your contours in feet, use a z-factor of 3.28 because 3.28 feet equals one meter.



The generated contours will automatically be added to the map.

Input the data which is the AutoCAD drawing and select the feature type you want to load,

- Click Add and Next, then select the Target layer you want it to be
- Load it into from the feature class created on the ARCGLS.
- Click on Next, then select "only the features that satisfy the
    - Query" and click on Query Builder to query for the feature to be loud e.g. "layer" = Boundary".

- Click on Next....................... Then finish

Right click on the Boundary In the table of content and click on zoom to layer to display thefeature.

EDITING, CONVERTING AND MERGING GEODATABASE

- Remove all necessary features by right clicking on it and press "REMOVE"
    - Convert some features that are not in their correct „features -type‟ like point, line, and polygon features etc.

To convert a GOEDATABASE FEATURE CLASS to another the following steps weretaken:

- FOR LINE FEATURE CLASS TO POLYGON FEATURE CLASS
- Go to WINDOW on the menu bar and select ARC Toolbox.
    - Select DATA MANAGEMENT TOOLS, click on FEATURES, and then Select FEATURE TO POLYGON.
    - ON INPUT FEATURES, select feature to be converted, on OUTPUT FEATURE CLASS, then save on the GRP6C FOLDER, press OK and CLOSE.
    - Then remove the converted feature class in the LAYER Menu and ARC CATALOGfiles.
    - On INPUT DATASETS, select features to be merged, on OUTPUT DATASETS,then save on the GRP6C folder, press OK and CLOSE.
    - Then remove the converted feature class in the LAYER Menu and ARC CATALOGfiles.

TABLE CREATION

There is need to create attribute tables for the features so as to be used for queries. NOTE: The editor on the menu bar must be stopped before adding field to its table. **THE FOLLOWING PROCEDURES WERE FOLLOWED:**

- Right click on the feature class, then select OPEN ATTRIBUTES TABLE click on OPTIONS and select ADD FIELD.
- Give it FIELD NAME, click on TYPE and select [SHORT INTEGER or LONG INTEGER for SHORT or LONG WHOLE VARIABLES or DOUBLE FOR

DECIMAL VARIABLES OR TEXT variable or DATE for DATE], then enter precision or LENGTH for text width and scale for DECIMAL PLACES, and then click OK

- To input variables on the ATTRIBUTE TABLE, go to the EDITOR on Menu bar, select START EDITING,
- Click on ATTRIBUTE on menu bar [behind the TARGET], click on the features on the DATA VIEW display, and then input the variables of data acquired through SOCIAL SURVEY or DATA ACQUIRED ON THE FIELD.
- Save it after the input by selecting SAVE EDITS on the editor menu. To switch to other layers, select STOP EDITING on the EDITOR menu. Then repeat the above step to create other fields. Populate the table and save.

Table 3.12: Building

Table

BUILDING_A

OBJECTID *	SHAPE *	SHAPE_Length	SHAPE_Area	BLD_OWNER	BLD_USES	X	Y
1	Polygon	84.406847	363.400803	MR RASAQ	<Null>	678416.667	363.400803
2	Polygon	82.710406	369.490638	MRFLORENCE	<Null>	678447.669	369.490638
3	Polygon	36.843475	83.366956	<Null>	<Null>	678455.057	83.366956
4	Polygon	23.084988	33.209357	<Null>	<Null>	678468.524	33.209357
5	Polygon	83.503462	368.60541	<Null>	<Null>	678478.957	368.60541
6	Polygon	79.190294	336.66112	<Null>	<Null>	678441.819	336.66112
7	Polygon	76.940109	316.408618	<Null>	<Null>	678456.75	316.408618
8	Polygon	84.123322	349.316367	<Null>	<Null>	678493.961	349.316367
9	Polygon	78.026213	345.930362	<Null>	<Null>	678556.675	345.930362
10	Polygon	83.563237	343.435734	<Null>	<Null>	678586.112	343.435734
12	Polygon	84.974994	360.811561	<Null>	<Null>	678520.952	360.811561
13	Polygon	86.676746	381.806738	<Null>	SHOP	678499.834	381.806738
14	Polygon	86.169928	382.667674	<Null>	<Null>	678481.732	382.667674
15	Polygon	31.811369	55.853679	<Null>	<Null>	678520.253	55.853679
16	Polygon	44.346327	101.287692	<Null>	<Null>	678387.814	101.287692
17	Polygon	48.472223	119.325622	<Null>	<Null>	678464.797	119.325622
18	Polygon	83.685035	365.801723	<Null>	<Null>	678428.05	365.801723

Table 3.13: Road

ENTITY	FIELD ALIAS	DATA TYPE	FIELD SIZE
R_ID	Road Identifier	Numeric	-
R_Length	Road Length	Numeric	-
R_Width	Road Width	Numeric	-
R_Type	Road Type	Text	10
R_Condition	Road Condition	Text	10

Table 3.14: Trees

ENTITY	FIELD ALIAS	DATA TYPE	FIELD SIZE
TR_ID	Tree Identifier	Numeric	-
TR_Spp	Tree specy	Text	10
TR_E	Tree_Easting	Numeric	-
TR_N	Tree Northing	Numeric	-

Table 3.15: Electric Poles

ENTITY	FIELD ALIAS	DATA TYPE	FIELD SIZE
EP_ID	Electric pole Identifier	Numeric	-
EP_Type	Electric pole Type	Text	10
EP_Height	Electric pole Height	Numeric	-
EP_E	Electric pole Easting	Numeric	-
EP_N	Electric pole Northing	Numeric	-

ADDING SPOT HEIGHTS DATA

- NOTE: STOP EDITING on the EDITOR MENU before adding data field,
- Go to FIELD ON THE MENU BAR, scroll to add Data and then ADD XYZ DATA
    - Browse the EXCEL FILE for SPOT HEIGHTS, select EASTING VALUE on X - FIELD and NORTHING VALUE on Y - IELD and ELEVATION
    - « Select DATA the EXPORT DATA, locate the folder created and give it name then YES AND OK, remove the previous layer by right clicking on it and select REMOVE.

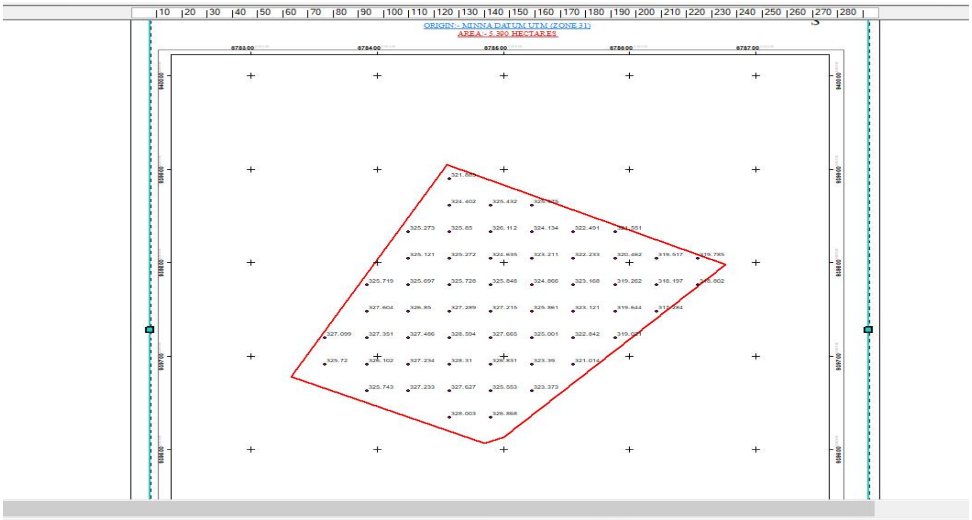


Fig. 3.6 shows the spot height

TIN, ASPECT AND SLOPE CREATION USING ARCMAP

NOTE: Making sure the 3D Analyst Extension is active, select VIEW on MENU bar, then click TOOLBARS and MARK the 3D Analyst EXTENTION Then X, Y Data

TO CREATE TIN

- Click on 3D Analyst arrow, select create TIN and then create TIN from FEATURE.
- On layers mark the SPOTHEIGHT LAYER, select height data on HEIGHT, then ok.

TO CHANGE THE FACE OF THE TIN ACCODING TO ITS ELEVATION

- RIGHT CLICK on the TIN, select PROPERTIES, and click on SYMBOLOGY.
    - Then ADD, select FACE ELEVATION WITH COLOR RAMP, click ADD, and then select APPLY and OK.

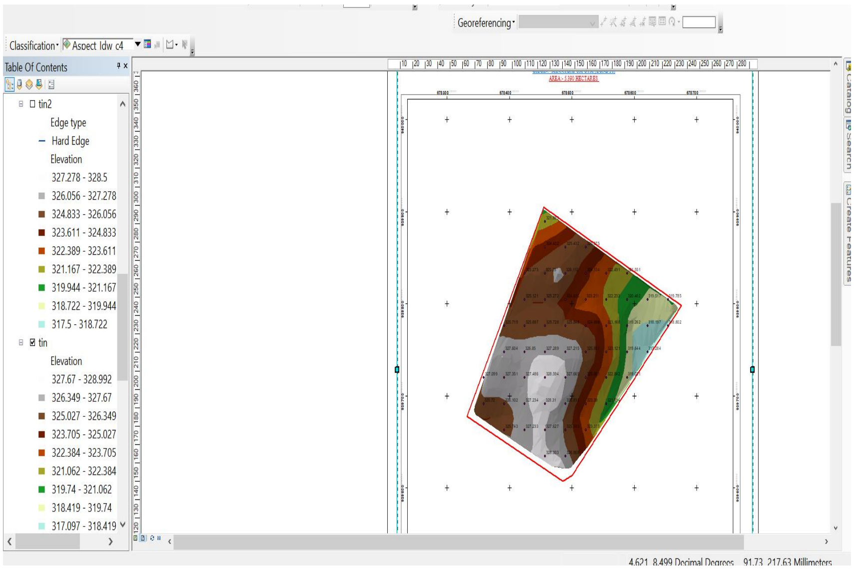


Fig. 3.7: Shows the Tin creation

TO CREATE ASPECT

- Click on 3D analyst arrow, select SPATIAL ANALYST TOOLS, SURFACE and THEN DOUBLE CLICK on ASPECT.
- Browse to where the raster format of all the acquired data created from the surfer was saved to.

- Browse to where you want the OUTPUT RASTER to be saved
- You can change the OUTPUT MEASUREMENT to Degree OR percent
- Click OK [then it displays on the data view screen], then Close.

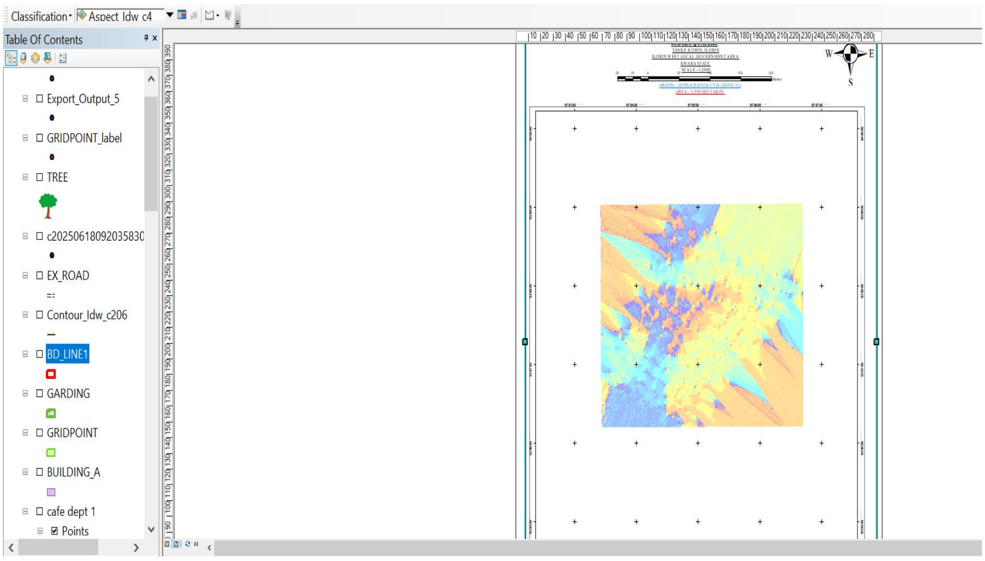


Fig. 3.8 shows the slope aspect

3.8 DATABASE IMPLEMENTATION

This is the database creation phase. Having completed the three stages of design phase (i.e. Reality, Conceptual and Logical design), the database was created using ArcGIS 10.3 software. It involves the combination and storage of acquired graphic data and attributes data in creating the database for the purpose of spatial analysis and query.

Database is an organized integrated collection of data stored so as to be capable of use by revenant application with data being accessed by different logical part. After the Attribute table was populated via the keyboard, some attributes such as areas of settlements were automatically displayed by special command in the ArcGIS 10.3 version. The ArcGIS software was used to link the graphic data and table for query generation.

3.8.1 DATABASE MANAGEMENT SYSTEMS

Database management refers to a collection of software designed for creating, storing, manipulating, updating, organizing, and querying information within a database (Kufoniyi, 1998). A Database Management System (DBMS) functions as intermediary software that manages the database on behalf of the user.

A good DBMS should provide the following key functions:

a. Efficient storage and retrieval of data.

b. Concurrent access by multiple users.

c. A standardized interface between the database and application programs.

d. Standardized data access and clear separation of data storage/retrieval from the application logic.

e. Maintenance of data security and integrity.

3.8.2 DATABASE MAINTENANCE

After creating the database, proper maintenance practices were implemented to ensure it met its stated objectives. Maintenance allowed for the addition of new data and removal of outdated or irrelevant information. Regular updates are essential to reflect physical changes in the landscape over time. Additionally, security and data integrity measures were enforced to maintain the database's reliability and effectiveness.

Consistent updating and management of the database are crucial for maintaining its currency and quality, which in turn enhances its suitability as part of a Spatial Decision Support System (SDSS). The overall quality of a database depends on its timeliness and fitness for use within a decision support framework.

It is also important to periodically review the storage media to prevent data inaccessibility or deterioration due to physical damage. Care must be taken when populating the database, as its value directly depends on the accuracy and quality of the input data.

For long-term archiving, stable storage media should be used, such as:

- Computer-compatible tape readers
- Magnetic tapes
- Optical discs and compact discs

3.9 BACK COMPUTATION

Table ***3.16: Back Computation***

S/N	BEARING	DIST	Δ N	Δ E	X	Y
PT1					678331.46	939677.97
PT2	28.517403	258.4696	227.11	123.40	678454.86	939905.08
PT3	64.10621	245.4521	-107.19	220.81	678675.67	939797.89
PT4	43.628299	254.3273	-184.09	-175.48	678500.19	939613.80
PT5	65.699528	16.52403	-6.80	-15.06	678485.13	939607.00
PT1	65.210911	169.2667	70.97	-153.67	678331.46	939677.97

3.9.1 AREA COMPUTATION

Table 3.17: Area Computation

X	Y	P	Q
678331.46	939677.97		
678454.86	939905.08	637567185177.817	637529085581.434
678675.67	939797.89	637610445888.245	637890709905.404
678500.19	939613.80	637693025256.246	637653046926.599
678485.13	939607.00	637523528025.330	637513991242.794
678331.46	939677.97	637557529633.586	637364988136.220
		3187951713981.220	3187951821792.450
		2A	107811.227
		AREA	53905.614
		HECTARES	5.391

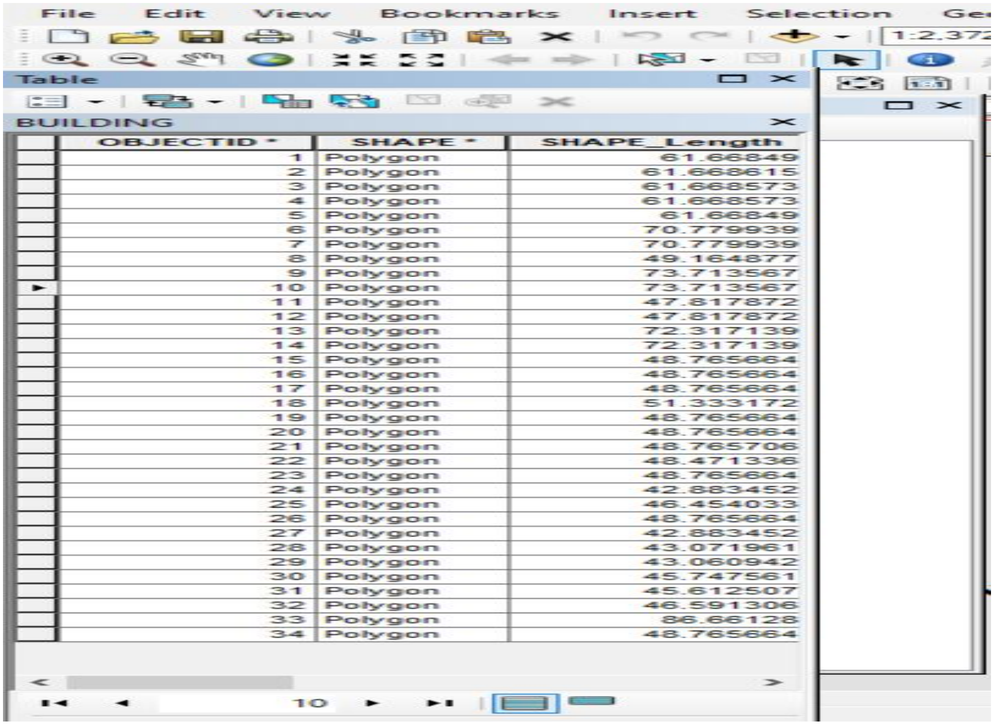
CHAPTER FOUR

4.0 SPATIAL ANALYSES AND PRESENTATION

GIS stands out among other information systems due to its powerful spatial analytical capabilities, including overlay operations, buffering, spatial search, topographic analysis, as well as neighborhood and connectivity operations. GIS leverages these capabilities to answer fundamental questions related to location, condition, trends, routing, patterns, and modeling through the manipulation and analysis of spatial data. In this project, the major analyses performed were overlay operations, topographic analyses, and spatial searches.

4.1 TESTING OF DATABASE

This test was conducted to evaluate the relationships between data modeled as entities in the spatial database and to assess the database's retrieval capabilities. A sample query with specific conditions was designed and executed to verify whether the desired results could be obtained.



OBJECTID *	SHAPE *	SHAPE_Length
1	Polygon	61.66849
2	Polygon	61.668615
3	Polygon	61.668573
4	Polygon	61.668573
5	Polygon	61.66849
6	Polygon	70.779939
7	Polygon	70.779939
8	Polygon	49.164877
9	Polygon	73.713567
10	Polygon	73.713567
11	Polygon	47.817872
12	Polygon	47.817872
13	Polygon	72.317139
14	Polygon	72.317139
15	Polygon	48.765664
16	Polygon	48.765664
17	Polygon	48.765664
18	Polygon	51.333172
19	Polygon	48.765664
20	Polygon	48.765664
21	Polygon	48.765706
22	Polygon	48.471336
23	Polygon	48.765664
24	Polygon	42.883452
25	Polygon	46.454033
26	Polygon	48.765664
27	Polygon	42.883452
28	Polygon	43.071961
29	Polygon	43.060942
30	Polygon	45.747561
31	Polygon	45.612507
32	Polygon	46.591306
33	Polygon	86.66128
34	Polygon	48.765664

Fig. 4.1: Shows the attribute database

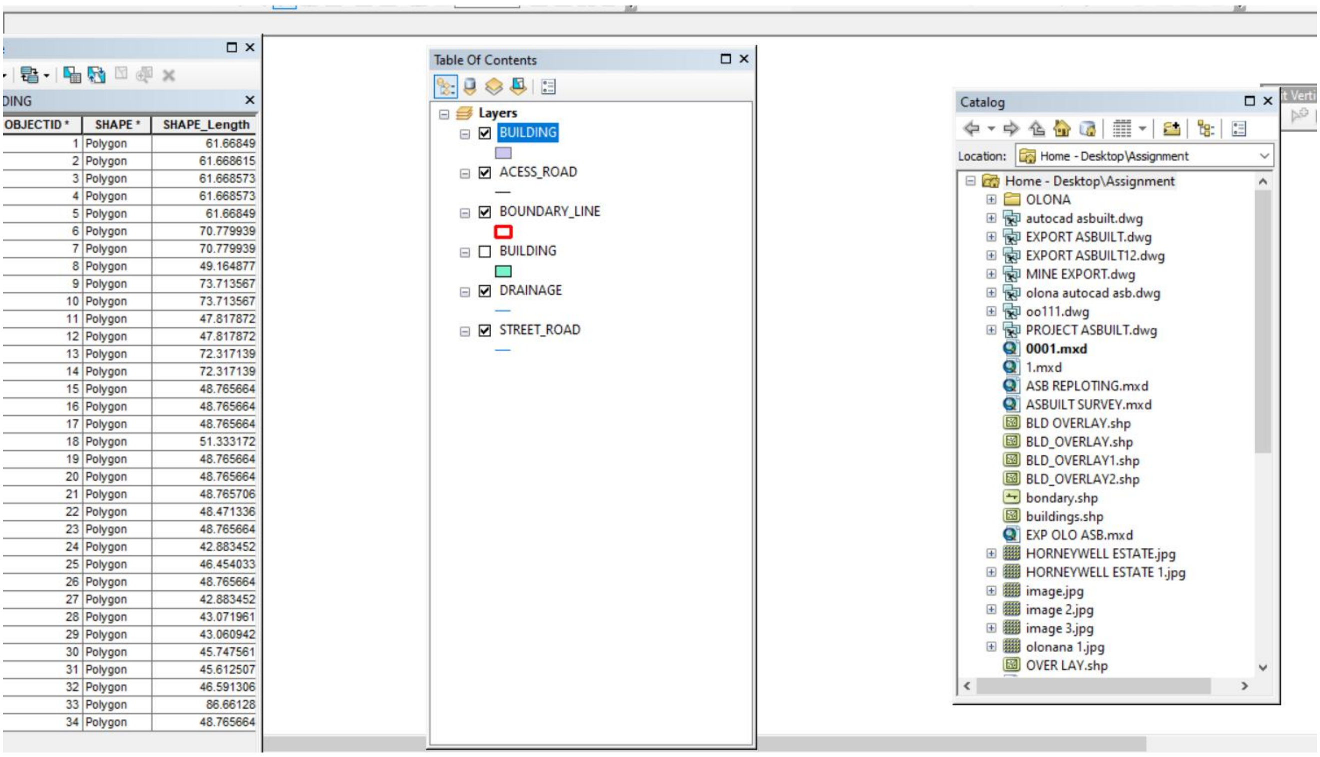


Fig. 4.2: Showing catalog, attribute table and table of content

Analysis of Result

The query retrieved contours with elevation values greater than or equal to 350 meters, indicating areas likely to be less prone to flooding within the project area, as shown in Figure 4.5 (Query 1). These contours represent points with elevations above 350 meters.

The attribute table confirmed that the northeast part of the institute has the highest elevation. Elevation is a critical factor when considering terrain surface and slope. Conversely, the southwest part of the school has the lowest elevation and is therefore more susceptible to erosion. Buildings planned for this region should have foundations elevated significantly above ground level to mitigate potential damage.

The results of this query provide valuable information to the school management, enabling informed decisions about terrain characteristics and appropriate building designs across different regions of the project area.

SINGLE SELECTION CRITERION

Query 1: Retrieving Area whose height is Greater than 350 meters

SELECT* **FROM** Contour **WHERE** "CONTOUR">3.007

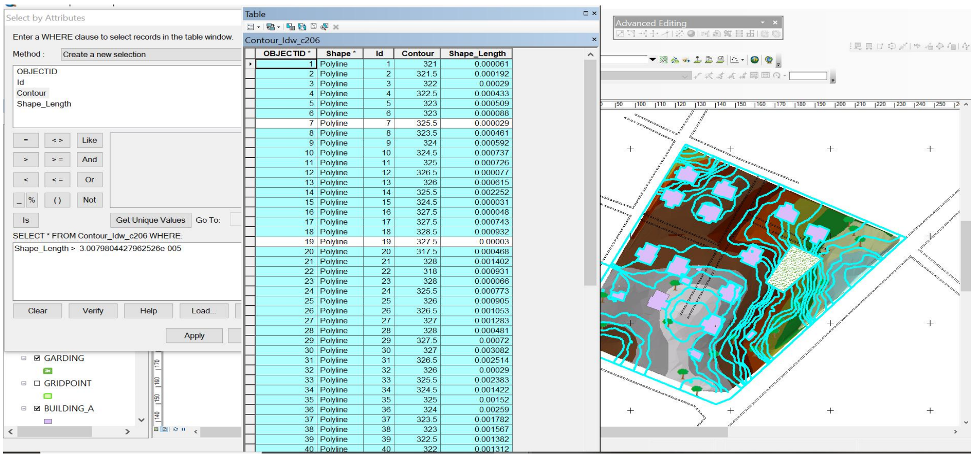


Fig 4.3.: Retrieving Area whose height is greater than 3.007 meters

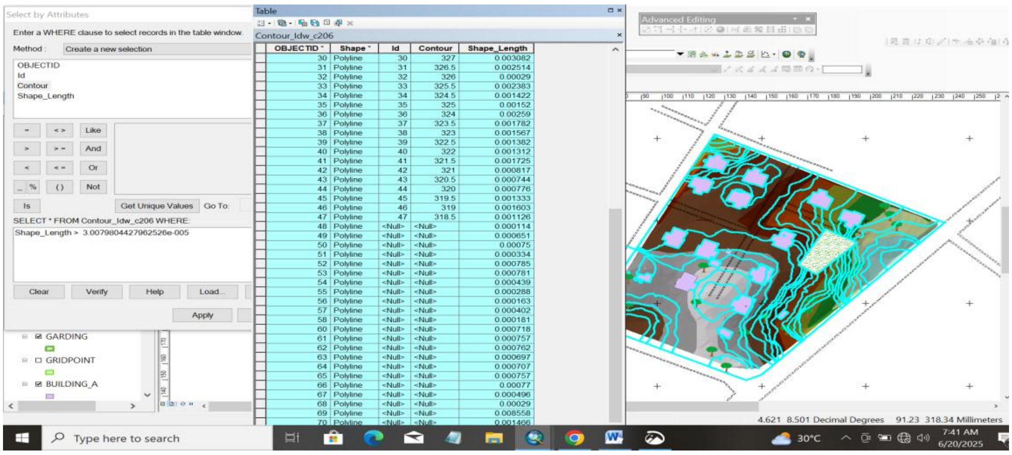


Fig 4.4: Result of area whose height is greater than 3.007 meters

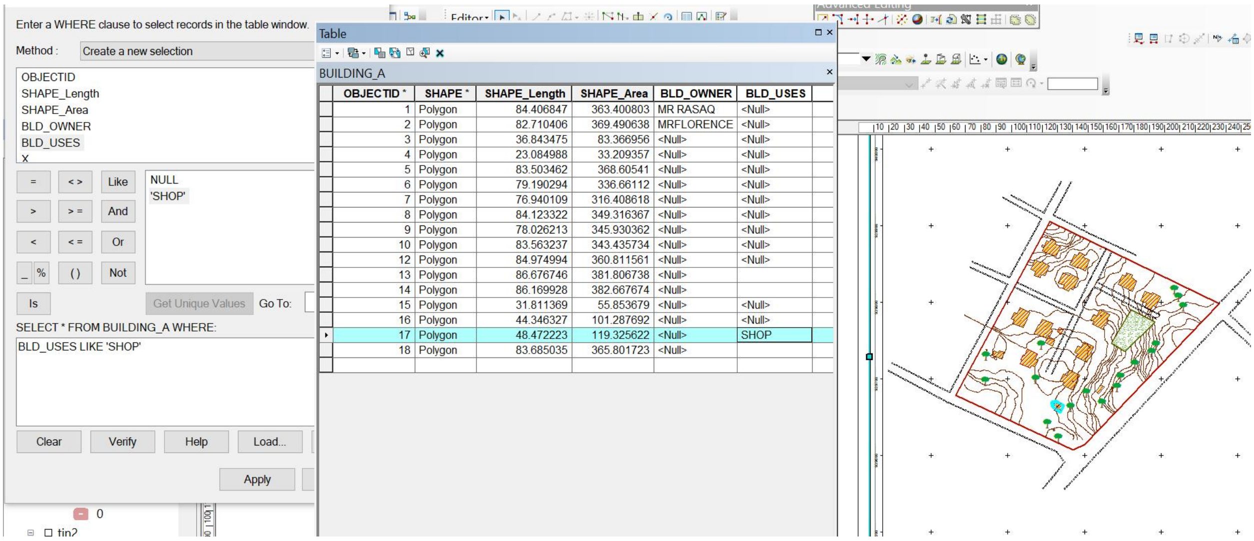
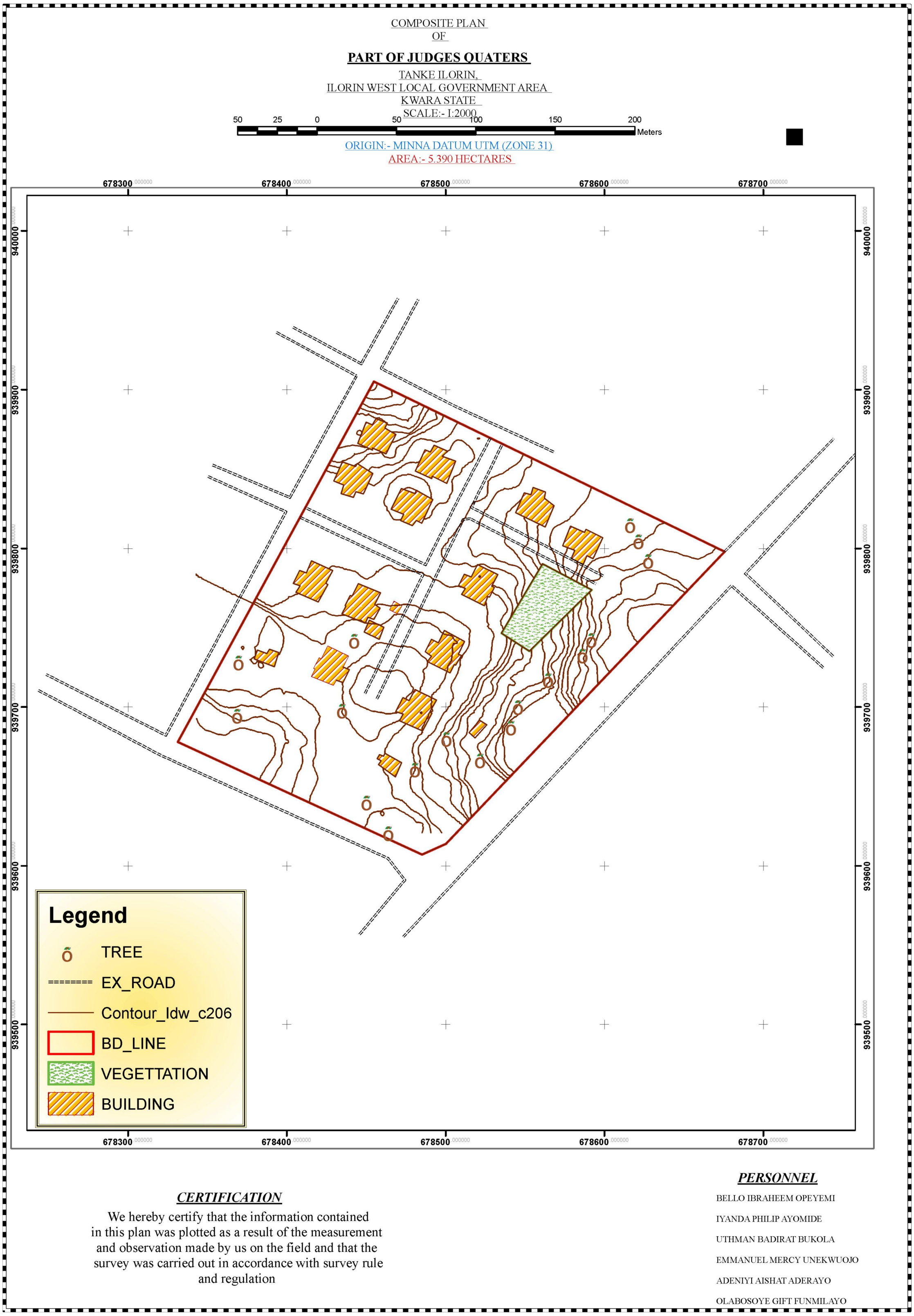


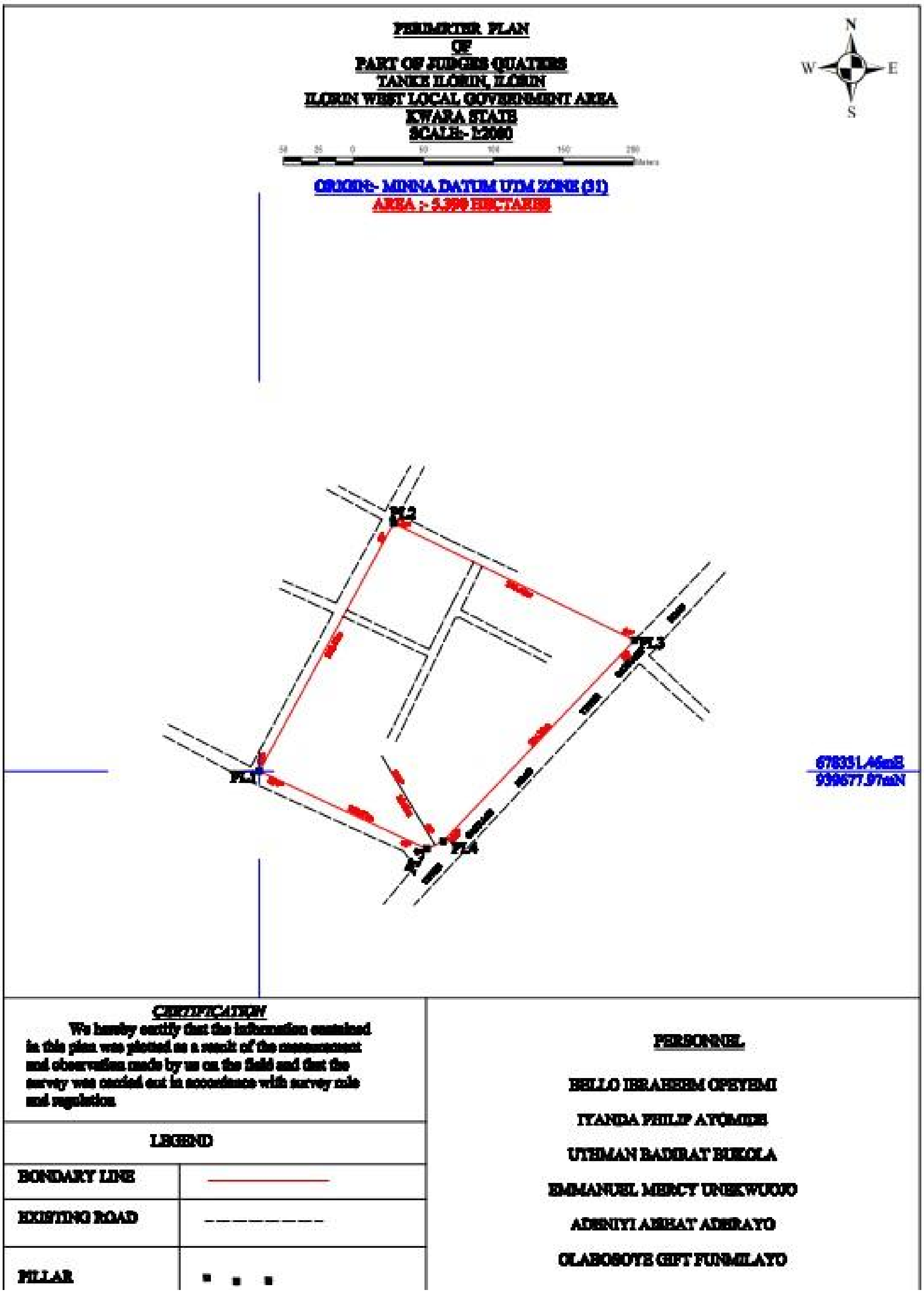
Fig 4.5: Shows the building use for shop

4.2 INFORMATION PRESENTATION AND RESULT ANALYSIS

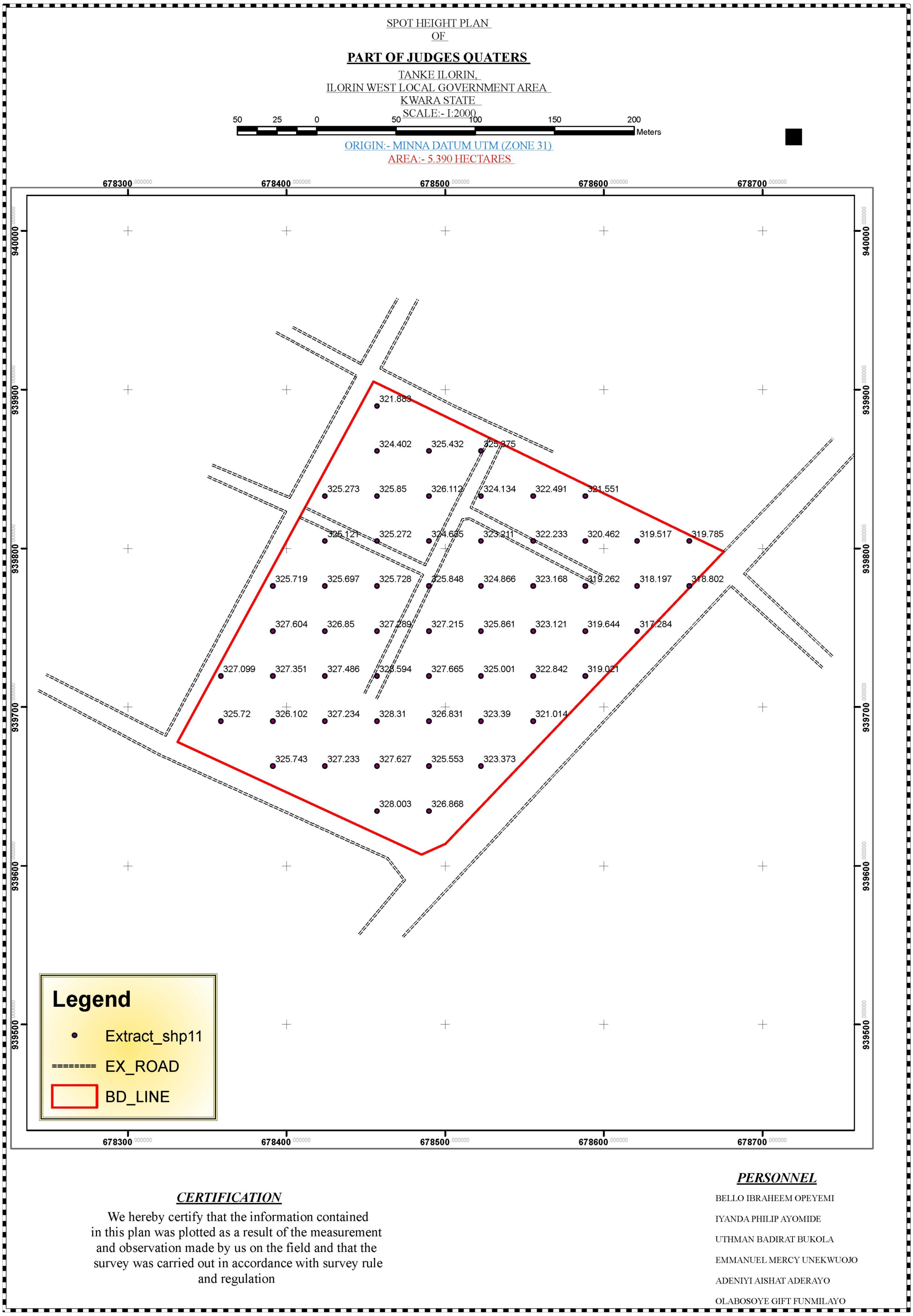
4.2.1 THE TOPOGRAPHIC PLAN (COMPOSITE PLAN)



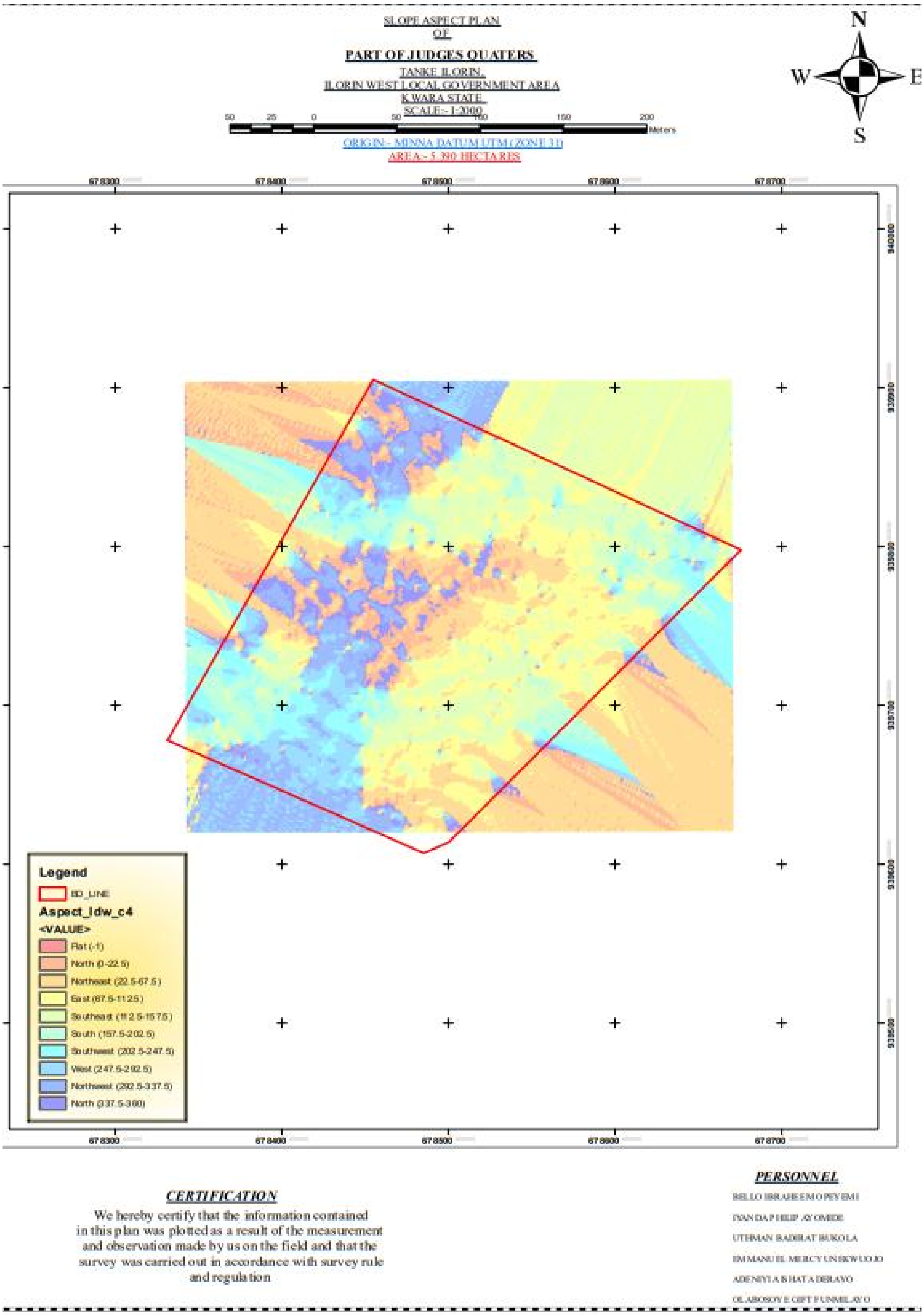
4.2.2 THE PERIMETER PLAN



4.2.3 THE SPOT HEIGHT PLAN



4.2.4 THE SLOPE ASPECT PLAN



CHAPTER FIVE

COSTING, SUMMARY, PROBLEM ENCOUNTERED, CONCLUSION AND RECOMMENDATIONS

5.1 COST ESTIMATION

This stage the total cost spent on the project from day one to the final stage.

Table 5.1.1: Direct cost parameters

S/N	DIRECT COST		
1	**Reconnaissance (1 day)**		
	PERSONNEL	**Rate**	**Total Amount (₦:K)**
	1 x surveyor	10500	10500
	1 x assistant surveyor	7500	7500
	1 x technical officer	6500	6500
	3 x skilled labour	4000	12000
	basic equipment	5000	5000:00
	transportation (vehicle, Driver and fuel)	10000	10000:00
		sub-total	**51,500**
2	**Monumentation (1 day)**		
	PERSONNEL		
	1 x assistant surveyor	7500	7500
	1 skilled labour	4000	4000
	transportation (vehicle, Driver and fuel)	10000	10000
	basic equipment	5000	5000:00

	Beacon (6)	1000	6000
		sub-total	**32,500**
3	**Data acquisition (2 days)**		
	PERSONNEL		
	1 x assistant surveyor	7500	7500
	1 x technical officer	6500	6500
	3 x skilled labour	4000	12000
	Total Station and accessories	15000	15000
	transportation (vehicle, Driver and fuel)	10000	10000
		sub-total	**51,000**
5	**Data Processing (2 days)**		
	PERSONNEL		
	1 x surveyor	10500	10500
	1 x assistant surveyor	7500	7500
	1 x technical officer	6500	6500
	computer / accessories	15000	15000
		sub-total	**39,500**
7	**Technical Report (1 day)**		
	PERSONNEL		
	1 x surveyor	10500	10500
	1 x assistant surveyor	7500	7500

	1 x secretary	5000	5000:00
	computer / accessories	15000	15000:00
		sub-total	**38,000**

TOTAL (DIRECT COST) 212,500 MOBILIZATION/DEMOBILIZATION = 5% of Direct Cost

= 0.05 × 212,500

= **₦10,625**

CONTINGENCY ALLOWANCE

= 5% of Direct Cost

= 0.05 × 212,500

= **₦10,225**

GRAND TOTAL = ₦212,500 + ₦10,625 + ₦10,625

= ₦233,750

VAT (@5% GRAND TOTAL) = 0.05 × 233750

= **₦11,687.5**

TOTAL COST PAYABLE = GRAND TOTAL + VAT

= ₦233,750+ ₦11,687.5

= ₦245,437.5

5.2 SUMMARY

The main aim of the project is to carry out the topographical information system of Judges Quarter Estate, Taoheed Road Ilorin. Kwara State. It was done in accordance with the survey rule and regulation and the departmental instruction. A digital ground survey method was basically use for data acquisition. A data base was created to house all the relevant data collected on the field, AutoCAD, suffer Microsoft word, Microsoft Excel and Notepad were combined to carryout data processing manipulation, Analysis and retriever. The final presentation of information was produced in form of digital map both in hard copy/soft copy.

5.3 PROBLEMS ENCOUNTERED

During the execution of this project the problem encountered are the followings:

1. The pegs used for monumentation were removed repeatedly, but this was overcome by referencing each peg to a fixed mark with the distance of the peg from the reference mark noted.

5.4 CONCLUSION

The aims of the project were achieved as the expected accuracy and the obtained results conformed to required accuracy of a third order job also the task actually exposed and broadened my knowledge on the scope, concepts and skills, involved in topographical surveying, more so, the project has been successfully executed as adequate data were acquired processed and represented in plans.

This project was interesting in spite of the numerous problems encounter thought the execution of the project.

The exercise was not an easy task, it is much cumbersome. It consume money, energy, time and other tangible factors, but at the end of it, I realize that it had helped me in the practical aspect of land surveying and exposed me to that types of problem. Surveyors usually encounters on the field.

5.5 RECOMMENDATIONS

Having successfully carried out the project assignment, I hereby recommend that.

1. The x, y and z coordinates of the features were which confirm the position of the features
2. The topographical surveys of the area enhanced the use of various surveys of software's such as AutoCAD; suffer e.t.c and the preparation of plan. Hence it is highly recommended for further studies.
3. The authority should make modern instrument like global positioning system (GPS) receiver, total station, and digital level etc. available to the prospective student of Higher National Diploma so as to be widely exposed to them for easy operation.
4. I also recommend that instrument should be released to the student on time for quick execution of the project.

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APPENDIX I

S/N	X	Y	Z
PT1	678457.2303	939634.3698	328.003
PT2	678490.0255	939634.3698	326.868
PT3	678391.6401	939662.7202	325.743
PT4	678424.4352	939662.7202	327.233
PT5	678457.2303	939662.7202	327.627
PT6	678490.0255	939662.7202	325.553
PT7	678522.8206	939662.7202	323.373
PT8	678358.8449	939691.0705	325.72
PT9	678391.6401	939691.0705	326.102
PT10	678424.4352	939691.0705	327.234
PT11	678457.2303	939691.0705	328.31
PT12	678490.0255	939691.0705	326.831
PT13	678522.8206	939691.0705	323.39
PT14	678555.6158	939691.0705	321.014
PT15	678358.8449	939719.4209	327.099
PT16	678391.6401	939719.4209	327.351
PT17	678424.4352	939719.4209	327.486
PT18	678457.2303	939719.4209	328.594
PT19	678490.0255	939719.4209	327.665
PT20	678522.8206	939719.4209	325.001
PT21	678555.6158	939719.4209	322.842

PT22	678588.4109	939719.4209	319.021
PT23	678391.6401	939747.7712	327.604
PT24	678424.4352	939747.7712	326.85
PT25	678457.2303	939747.7712	327.289
PT26	678490.0255	939747.7712	327.215
PT27	678522.8206	939747.7712	325.861
PT28	678555.6158	939747.7712	323.121
PT29	678588.4109	939747.7712	319.644
PT30	678621.206	939747.7712	317.284
PT31	678391.6401	939776.1216	325.719
PT32	678424.4352	939776.1216	325.697
PT33	678457.2303	939776.1216	325.728
PT34	678490.0255	939776.1216	325.848
PT35	678522.8206	939776.1216	324.866
PT36	678555.6158	939776.1216	323.168
PT37	678588.4109	939776.1216	319.262
PT38	678621.206	939776.1216	318.197
PT39	678654.0012	939776.1216	318.802
PT40	678424.4352	939804.4719	325.121
PT41	678457.2303	939804.4719	325.272
PT42	678490.0255	939804.4719	324.635
PT43	678522.8206	939804.4719	323.211
PT44	678555.6158	939804.4719	322.233

PT45	678588.4109	939804.4719	320.462
PT46	678621.206	939804.4719	319.517
PT47	678654.0012	939804.4719	319.785
PT48	678424.4352	939832.8223	325.273
PT49	678457.2303	939832.8223	325.85
PT50	678490.0255	939832.8223	326.112
PT51	678522.8206	939832.8223	324.134
PT52	678555.6158	939832.8223	322.491
PT53	678588.4109	939832.8223	321.551
PT54	678457.2303	939861.1726	324.402
PT55	678490.0255	939861.1726	325.432
PT56	678522.8206	939861.1726	325.375
PT57	678457.2303	939889.523	321.883