A PROJECT

ON

DIGITAL SURFACE MODELING

(*A CASE STUDY OF PART OF KWARA STATE POLYTECHNIC*)

BY

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HND/23/SGI/FT/055

SUBMMITTED IN PARTIAL FUFILMENT OF THE REQUIREMENTS OF THE AWARD OF HIGHER NATIONAL DIPLOMAL (HND) IN SURVEYING AND GEO-INFORMATICS TO THE DEPARTMENT OF SURVEYING AND GEO-INFOMATICS,

KWARA STATE POLYTECHNIC, ILORIN KWARA STATE.

JUNE, 2025.

CERTIFICATE

I hereby certified that all the information given in this project were obtained as a result of observations and measurements made by me and that the survey was carried out in accordance with Survey Rules, Regulations and Departmental instructions.

NAME: ILESANMI ESTHER OLUWASEUN

MATRICNO.:HND/23/SGI/FT/055

SIGNATURE: ………………………………….

DATE OF COMPLETION: ……………………………………………….

CERTIFICATION

This is to certify that **ILESANMI ESTHER OLUWASEUN** with matriculation number **HND/23/SGI/FT/055** has satisfactorily carried out this project under our instructions and direct supervision.

______________________	______________________
MR. ABIMBOLA I. ISAU	*SIGNATURE AND DATE*
(PROJECT SUPERVISOR)	
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(PROJECT COODINATOR)	
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MR. ABIMBOLA I. ISAU	*SIGNATURE AND DATE*
(HEAD OF DEPARTMENT)	
______________________	______________________
EXTERNAL MODERATOR	*SIGNATURE AND DATE*

DEDICATION

I dedicate this project to Almighty God, whose guidance, strength, and blessings have been my constant source of inspiration and perseverance.

ACKNOWLEDGEMENTS

All adoration be to God Almighty, the gracious one who has given me the opportunity to complete my HND program in Surveying and Geo Informatics. My appreciation goes to my supervisor **MR.ABIMBOLA.I.ISAU** for his encouragement and motivation as regards the project thank you and God bless you sir.

To all my lecturers in the department of Surveying and Geo Informatics,

SURV. R.O ASONIBARE, SURV. A.G AREMU, SURV. R.S AWOLEYE, SURV. A.O AKINYEDE, SURV. AYUBA ABDULSALAM, SURV. F.D DIRAN AND SURV.BABATUNDE KABIR, may God bless you all (Amen). I also express my sincere gratitude to my wonderful parents **MRS. ILESANMI REBECCA** their parental care and support since the inception of myeducational career, they stood by me when things were tough and rough for me, they gave me hope, I will forever be grateful for the motivation you always gaves to me at all time, if I would have to have parents in my life again, I will pray to have people like you around me again and to all my brothers and sisters **ILESANMI SEYI, ILESANMI MIRACLE.** To all my understanding friends and lovers, I so much appreciate your support and advice thanks so much, May almighty God bless you all (Amen).

ABSTRACT

This project focuses on generating a Digital Surface Model (DSM) for part of Kwara State Polytechnic, located in Moro Local Government Area, Kwara State, Nigeria. To achieve this, a reconnaissance survey was conducted, and spatial data were collected using a Total Station, while non-spatial data were gathered through social surveys, including oral interviews and observations. The collected data were processed and analyzed using various software tools, including ArcGIS 10.1 for geospatial analysis and database design, AutoCAD 2007 for graphical representation, and Surfer 10 for contour generation and Digital Terrain Modeling (DTM). The project resulted in the creation of a comprehensive database that supports spatial search and decision-making processes. The outcome of this project is a topographic dataset in digital format, which can be utilized for various applications. A detailed technical report documenting the project's methodology, findings, and results has also been prepared.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

The surface of the land is an important resource which human activities are continually modifying. Land is the earth's surface, both land and water, plus natural resources in their original state, such as: mineral deposit, wildlife, fish, timber, etc. Particular areas of land can be utilized by humans in diverse ways. These can include residential, institutional, business, industrial, agricultural, forestry, park, and other relatively natural land uses. In order to create a sustainable and favorable living, it is essential to protect our property or investment, in which land surveying helps in the positioning of objects in space and time as well as the positioning and monitoring of physical features, structures and engineering works on, above or below the surface of the earth and the analysis, interpretation and integration of spatial objects and phenomena in GIS, including the visualization and communication of such data in maps, models and mobile digital devices.

A Digital Elevation Model (DEM) is a digital representation of ground surface, topography or terrain. A DEM can be represented as a raster (a grid of squares) or as a triangular irregular network. DEMs are commonly built using remote sensing techniques; however, they may also be built from land surveying. DEMs are used often in geographic information systems, and are the most common basis for digitally-produced relief maps.

A Digital Surface Model (DSM) is a representation of any surface by using three dimensional (3D) coordinates, normally X, Y, Z Cartesian coordinates. The surface might be part of a small object, for example a vase, or it may be a very large object such as the surface of the Earth. When related to the Earth’s surface, these coordinates are often converted into Easting, Northing and Height (E, N and H). A Digital Elevation Model (DEM) specifically relates to elevation and therefore height, and so will be defined as a

DSM of the Earth's surface. It is used generically to define both the ground surface, also called a Digital Terrain Model (DTM), and the ground surface plus the tops of features above the ground surface such as artificial structures and vegetation. The DSM is therefore the first surface that many airborne and spaceborne sensors will interact with. A DTM is normally created by stripping off all above ground surface features from the DSM to reveal a bald-earth Model.

Digital Elevation Model (DEM) represents a very important geospatial data type in the analysis and modelling of different hydrological and ecological phenomenon which are required in preserving our immediate environment. DEMs are typically used to represent terrain relief. DEMs are particularly relevant for many applications such as lake and water volumes estimation, soil erosion volumes calculations, flood estimate, quantification of earth materials to be moved for channels, roads, dams, embankment etc.

There are known methods by which DSMs can be constructed. Such methods include but not limited to digitizing existing topographic maps or by using stereoscopic aerial photographs, with the advance of digital photogrammetry.

Maune (2001) stated that Surface modelling is essential for various applications; orthophoto productions, engineering design, floodplain mapping, telecommunication, etc. all require surface data with different level of detail and accuracy.

1.2 Statement of the Problem

Topographic map of the School Kwara State Polytechnic is not up-to-date and heights of features were not represented. The production of Digital Surface Model will solve the following problems.

i. Lack of current maps for the school's management use.
ii. Lack of information about the height of details within the school.

1.3 Aim of the Project

The aim of the project is to produce a digital surface model of part of Kwara State Polytechnic, Ilorin Kwara State.

1.4 Objectives of the Study

In achieving the above stated aim, the following operations were carried out:

i. Database Design for the study area
ii. Data Acquisition, using Ground survey method (Total Station)
   a) Geometric (Locational) Data Acquisition (X, Y, and Z).
   b) Attribute Data Acquisition (Features description).
iii. Creation of Database for Spatial entities in the study area.
iv. Spatial Analysis.
v. Information Presentation and Management.

1.5 Significance of the Study

The significance of this project are to, as stated below;

i. Easy planning of any meaningful development.
ii. Provide up-to-date Digital Survey Model for the School.
iii. Provision of useful spatial analysis of information about any object for viable decision making and deformation studies.
iv. For map revision purposes i.e. easy retrieval and updating of the database, and
v. To get student acquainted with the knowledge needed for future environmental occurrences.

1.6 Scope of the Project

The scope of the project covers the following:

i. Review of previous projects, literatures, journals, reports and text books.
ii. Project Planning.
iii. Database Design techniques.

iv. DataAcquisition for perimetertraversing,detailing and spotheighting using automated Survey equipment.

v. Data processing, spatial analyses and information presentation.

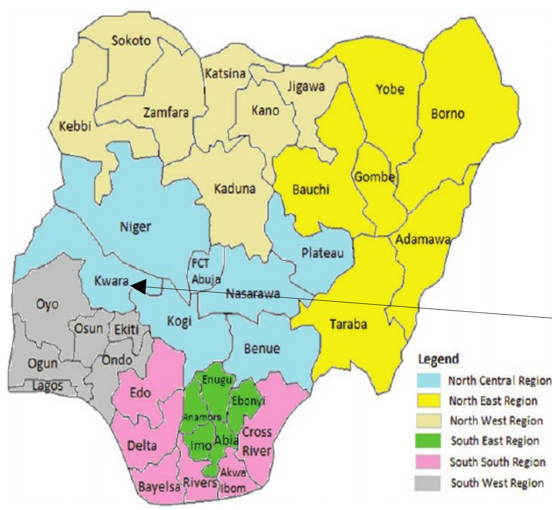
1.7 Personnel

The following are the personnel involved in executing the project:

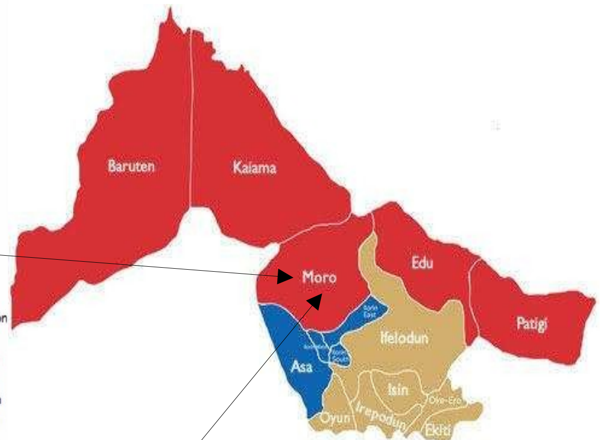
S/N	NAMES	MATRIC/NO	POSITION
1	ILESANMI ESTHER O.	HND/23/SGI/FT/055	Author
2	TIAMIYU ZAINAB OLAITAN	HND/23/SGI/FT/056	Member
3	BABALOLA OLUWATOSIN O.	HND/23/SGI/FT/059	Member
4	ADEOYE AYOBAMI L.	HND/23/SGI/FT/063	Member
5	SHUAIB OLOHUNTOYIN	HND/23/SGI/FT/064	Member
6	OGUNLADE MATHEW K.	HND/23/SGI/FT/065	Member
7	AYINLA ABDULWAHAB B.	HND/22/SGI/FT/094	Member
8	GANIYU MISTURA D.	HND/22/SGI/FT/111	Member

1.8 Location

The project site is part of Kwara state polytechnic Ilorin fall on geographic coordinate of Latitude: 008 33 25.96; Longitude : 004 37 54.39 to Latitude: 008 33 24.78 ; Longitude: 004 38 05.73, covered total area of 5 hects.



Map of Nigeria



Map of Kwara State

Google Imagery of the Study Area

***Figure 1.10**: Study Area Map*

Imagery of Project Site

Showin ***FIG 1.2: Diagram Showing Location of Study***

CHAPTER TWO

2.0 LITERATURE REVIEW

A Digital Surface Model (DSM) is a digital representation of the Earth's surface, including natural and man-made features. The creation of a Digital Surface Model (DSM) is a crucial aspect of various fields, including geography, geology, urban planning, and environmental monitoring. A DSM provides a detailed representation of the Earth's surface, allowing for the analysis of terrain characteristics, land use patterns, and environmental features. This chapter reviews the existing literature on DSM creation, focusing on the methods, techniques, and applications of DSMs.

A digital surface model represents the elevation associated with the surface of the earth including topography and all natural or human-made features located on the surface of the earth. There is a variety of DSM source data available for developed areas and the suitability of this available data is depending on the project specifications. In remote regions around the World, were little or no source data is available, the DSM can be produced automatically from stereo satellite scenes, from satellite sensors such as IKONOS, SPOT-5 and Terra-ASTER l;tography at various resolutions, depending on the quality and scale of the aerial photography.

Digital Surface Model stands for the Earth’s surface including all the objects on it, for instance, trees, plants, buildings, and other features elevated above the "Bare Earth”. On the other hand, the Digital Terrain Model represents the bare ground surface without any object. An important fact that has to be taken into account in the DTM generation is the resolution attribute, the higher the resolution capture, more feasible the DTMs generation which depends on the application of complex algorithms. LiDAR is a good example of high-resolution capture, the advantages of using the LiDAR include the high density of sampling, high vertical accuracy, and the opportunity to derive these set of surface models given that some laser scanning systems can already provide at least two versions of the surface: the vegetation canopy (first returns) and ground surface (last returns).

Digital Surface Models (DSMs) offer the possibility of extracting the elevations of surface features to leave the ground surface DEM. For many applications in the urban environment this separation of above-surface feature information from ground information canoffer a useful combination of data sets. For example, detailed knowledge of the elevation of the ground surface is essential for predicting good inundation and the potential effects of sea level rise, whilst a detailed model of the man-made objects that would be affected is essential for property owners, planning authorities and insurance companies. This paper discusses several such applications and focuses on how Airborne Laser Scanning devices can provide digital surface models which can be used to separate surface features from the ground for modeling flood inundation from rivers in urban and semi-urban environments. DEMs can be constructed by digitizing existing topographic maps (Gao, 1995, 1997) or by using stereoscopic aerial photographs. With the advance of digital photogrammetry, DSMs can be created using stereo image matching techniques (Smith & Smith, 1996). Many authors (Abanmy, Khamees, Scarpace & Vonderohe, 1995; Jaafar & Priestnall, 1998) have considered the potential for these DSMs to provide the heights of surface features such as buildings. Recently LiDAR (Light Detection And Ranging) has become an established technique for deriving geometric information in three dimensions. The system is seen to offer a relatively quick technique for extracting accurate surface models and thus offers the potential for the creation of DEMs and other mapping products (Kost, Loddenkemper& Petring, 1996; Lohr, 1998).

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Digital Surface Models (DSMs) are often used to model the first reflective or visible surface, while DTMs typically refer to the bare earth without trees, buildings, and other natural or manmade features. DSMs and DTMs are common products derived from various sources, such as (digital) photogrammetric systems, optical satellite imagery through block adjustment, real-time kinematic GPS, topographic maps, total station surveys, and LIDAR mapping, among others. In modern map production, DSMs and DTMs serve as valuable information sources for scene analysis, change detection, GIS database updating, 3D feature extraction and reconstruction, inter-visibility calculations for optimizing telecommunication antenna locations, risk mapping, generating true ortho-images, mission planning and rehearsal, virtual and augmented reality applications, and urban planning.This definition implies that the built environment though delicate, but an integral part of the human environment has witnessed unprecedented use and re-use, hence the need for an efficient and rational action towards making it sustainable. Since resources are scarce and are fast diminishing, even as demands on them are on the increase, planning as an intelligent and rational form of decision making becomes inevitable as a means of reducing waste, of producing greatest return from the employment of resources and of ensuring efficiency in the utilization of resources to achieve maximum economic growth and national development.

However, because of the peculiar nature and importance of the built environment, planners around the world have emphasized the need to cater for physical development within the cities and other human settlement using the planning principles and concepts. The essence of this is to achieve a livable settlement described as ‘a welcoming, organized and comprehensible environment, where physical elements is unifying, accessibility within and without facilitate communication and promote interactions and flexibility, involving the design and development of buildings, circulation and service/utility system adapt to the needs of an evolving environment' (Office of University Planning,1997). Physical development planning which is concerned with the process of ordering the use of land and siting of buildings structures and communications to secure the maximum degree of economy, functionality, convenience, and beauty (Keeble, 1969) has, therefore, come to be accepted as a major area of planning because it encompasses all other facets of human interaction with land, including building engineering, mining or other operations in, on, over or under any land.

The above statement is vividly captured in the UN Agenda 21 and Habitat Agenda summed up in the concept of urban physical sustainability defined as an intervention to enhance the livability of buildings and urban infrastructure for all city dwellers, without damaging or disrupting the urban region environment (Adriana and Nicholas, 2002).

Surveying, which is also interchangeably called geomatics, has been defined as the science, art, and technology of determining the relative positions of points above, on, or beneath the Earth's surface, or of establishing such points. In a more general sense, however, surveying can be regarded as that discipline which encompasses all methods for measuring and collecting information about the physical earth and our environment, processing that information. and disseminating a variety of resulting products to a wide range of clients (Ghilani& Wolf 2008).

Surveying has been important since the beginning of civilization. Its earliest applications were in measuring and marking 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& Wolf 2008).

Topographic surveys are three-dimensional; they employ the techniques of plane surveying and other special techniques to establish both horizontal and vertical control. The relief or configuration of the terrain and the natural or artificial features are located by measurement and depicted on a flat sheet to form a topographic map. Contour lines, connecting points of the same elevation, are used to portray elevations at any one of various intervals measured in meters or feet.

GIS technology has made topographical mapping and geo-visualization more accurate, appealing and a large area can be mapped within a far lesser time frame. It has the power to visualize geographic data by allowing the user to dynamically integrate multiple data sources, unconstrained by format, scale and coordinate system. Also, the capability of GIS technology to visualize and analyze spatial and non-spatial information from diverse sources make it a powerful platform for multilevel decision making, and so greater credit should be given to its geo-visualization capabilities. They enable a large volume of geographic data to be summarized into a map which, without doubt, facilitates fast visual interpretation (Nkeki, 2013a). In this paper, GIS technology is viewed from two dimension–the spatial data gathered with sensor-based space satellite devices used for producing topographic maps such as DEM and those used for manipulating and geo-visualizing the DEM data such as GIS software and algorithms. Geo-visualization (geographic visualization) refers to the technologies and procedures of displaying geographic data for quick visual interpretation. Presently, this method of visualizing geographic dataset is fast replacing the cumbersome paper topographical map. It is capable of visualizing multiple spatial data and presents a friendly interface between the map and the user.

3D city models are digital representations of the Earth's surface and related objects belonging to urban areas (like cities, factories, buildings etc.). Several disciplines like urban planning, architecture, telecommunication, tourism, environmental protection and many others have an increasing demand for digital 3D city models, in order to use such complex data for planning, analyses, visualization and simulation in different applications. Additionally, the open geospatial viewers (e.g. Google Earth, Virtual Earth, etc.) increase the demand on 3D city models (Remondino et al., 2006). 3D city model and its update require the development of automatic methods for acquisition of Digital Surface Models (DSM) (Toutin and Gray, 2000). Digital photogrammetry, both airborne and spatial, is efficient modern technique for DSM acquisition as a base for 3D city modelling.

A digital surface model represents the elevation associated with the surface of the earth including topography and all natural or human-made features located on the surface of the earth. There is a variety of DSM source data available for developed areas and the suitability of this available data is depending on the project specifications. In remote regions around the World, were little or no source data is available, the DSM can be produced automatically from stereo satellite scenes, from satellite sensors such as IKONOS, SPOT-5 and Terra-ASTER l;tography at various resolutions, depending on the quality and scale of the aerial photography.

2.1 Methods for DSM Creation

Several methods can be employed to create DSMs, including:

1. Ground Surveying: Traditional ground surveying methods, such as Total Station and leveling, can be used to collect data for DSM creation. These methods provide accurate measurements of terrain features and are suitable for small-scale projects(Kahmen & Faig, 2012).

2. Remote Sensing: Remote sensing technologies, including photogrammetry and LiDAR (Light Detection and Ranging), have become increasingly popular for DSM creation due to their ability to collect data over large areas. LiDAR technology uses laser pulses to measure distances and create detailed 3D models of the terrain(Wehr & Lohr, 1999).

3. Interferometric Synthetic Aperture Radar (InSAR): InSAR is a technique that uses radar images to generate DSMs, particularly useful for areas with persistent cloud cover or dense vegetation. InSAR can provide accurate measurements of terrain

deformation and is widely used in geological and environmental applications (Hanssen, 2001).

2.2 Techniques for DSM Generation

Various techniques can be applied to generate DSMs from collected data, including:

1. Triangulation: Triangulation methods, such as Triangulated Irregular Network (TIN), can be used to create DSMs from irregularly spaced data points. TIN is a popular method for generating DSMs from LiDAR data(Peucker et al., 1978).
2. Grid-based Methods: Grid-based methods, such as Inverse Distance Weighting (IDW) and Kriging, can be employed to generate DSMs from regularly spaced data points. IDW is a simple and efficient method, while Kriging is a more complex method that takes into account the spatial autocorrelation of the data(Burrough & McDonnell, 1998).

2.3 Applications of DSMs

DSMs have a wide range of applications, including:

1. Urban Planning: DSMs can be used to analyze urban morphology, identify areas of high population density, and plan infrastructure development. DSMs can also be used to simulate the impact of urban development on the environment (Barnsley & Barr, 1997).
2. Environmental Monitoring: DSMs can be employed to monitor land use changes, track deforestation, and analyze terrain characteristics. DSMs can also be used to study the impacts of climate change on the environment (Kourgialas& Karatzas, 2017).

3. Natural Hazard Assessment: DSMs can be used to assess the risk of natural hazards, such as landslides and floods, by analyzing terrain characteristics and land use patterns. DSMs can also be used to identify areas prone to erosion and sedimentation (Guzzetti et al., 2006).

2.4 Advantages and Limitations of DSMs

DSMs have several advantages, including:

1. Detailed Representation: DSMs provide a detailed representation of the Earth's surface, allowing for accurate analysis and decision-making.
2. Flexibility: DSMs can be used in various fields and applications, from urban planning to environmental monitoring.
3. Cost-Effective: DSMs can be generated using a range of methods, including remote sensing and ground surveying, making them a cost-effective solution for many applications.

However, DSMs also have some limitations, including:

1. Data Quality: The quality of the DSM depends on the quality of the input data, which can be affected by various factors, such as sensor accuracy and data resolution.
2. Data Complexity: DSMs can be complex and require significant computational resources to process and analyze.
3. Interpretation: DSMs require careful interpretation and analysis to extract meaningful information and insights.

2.5 Project Review

In conclusion, DSMs are a powerful tool for understanding the Earth's surface and have a wide range of applications in various fields. The choice of method and technique for DSM creation depends on the specific application and data availability. DSMs provide a detailed representation of the terrain and can be used to analyze terrain characteristics, land use patterns, and environmental features.

CHAPTER THREE

3.0 METHODOLOGY

3.1 PROJECT PLANNING

Before beginning any survey assignment, project planning is a crucial requirement. It entails a careful investigation of the topic matter about a certain land region that is being evaluated. This crucial step in the surveying process allows the surveyor to become acquainted with the chosen location before starting work. During the reconnaissance phase, the survey's goals, requirements, and required precision levels are examined because these elements have a big impact on the choice of survey tools and techniques. In the end, this project resulted in the development of a first working diagram. Reconnaissance is divided into two phases: (i) Office Planning and (ii) Field reconnaissance.

3.1.1 FIELD RECONNAISSANCE

As part of this process, a surveyor or student must physically visit the site to gain a thorough understanding of its topography, including any vegetation, accessibility, existing frame work, as well as the social and economic 19 activities that take place there. The optimal approach and tools for improved decision-making must also be chosen. This on-site visit gives the surveyor or student a comprehensive grasp of the entire region and allows them to look at the entire area of the land. To guarantee correct orientation, the locations of all accessible horizontal and vertical controls in the region of the research area will be visited, and their outlooks will be viewed. This exercise makes it easier to create a Recce diagram, which is shown below but is not drawn to scale:

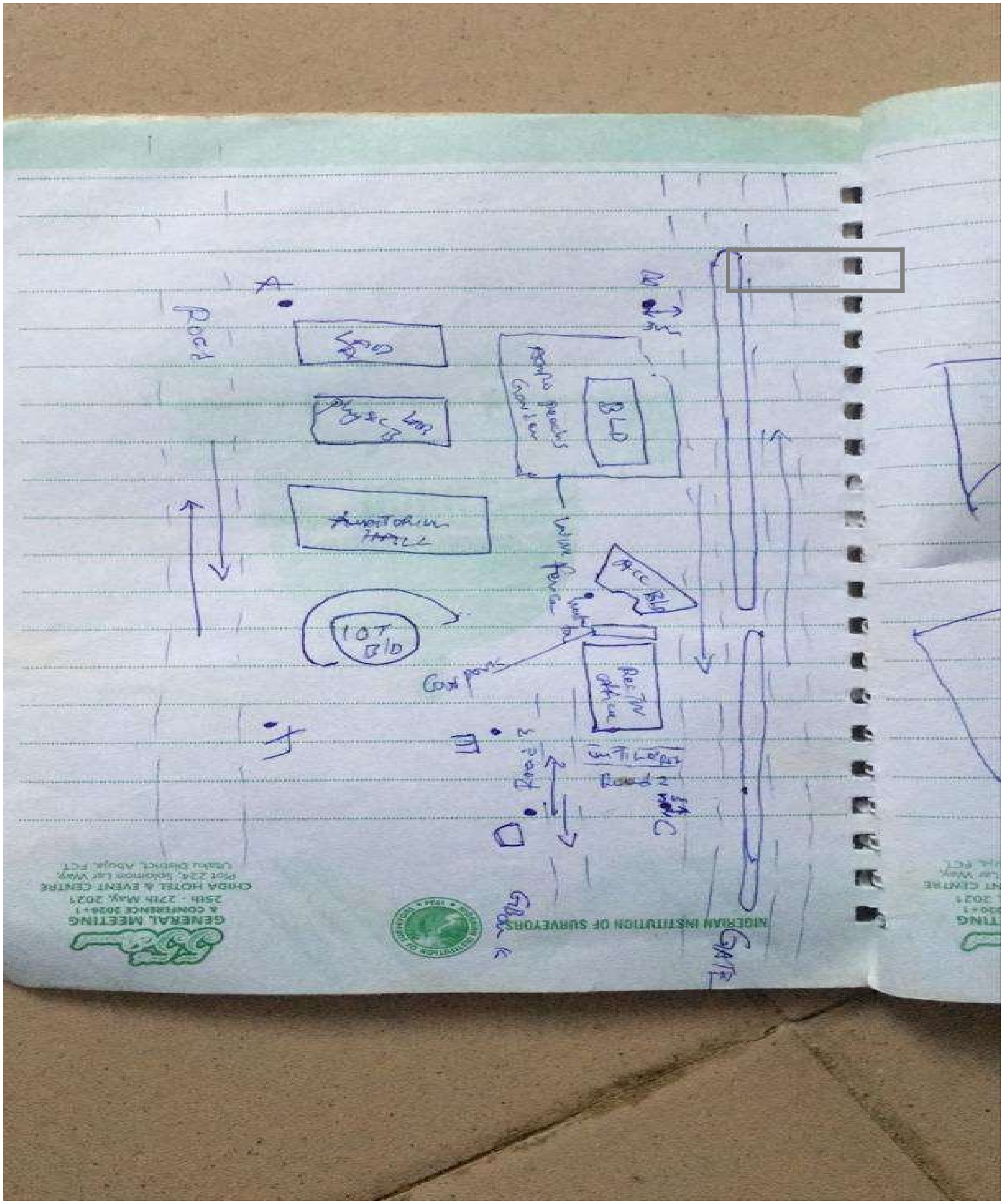

Figure 1.4: RECCI DIAGRAM

3.1.2 OFFICE PLANNING

Gathering crucial project information is the focus of this phase, which is usually done in an office setting. It is the initial phase of planning that comes before the fieldwork itself and entails gathering and analyzing a variety of project-related data. This covers a range of requirements for the project, scheduling, budgeting, and generating the coordinates for the control points under the project control prefix. It includes figuring out the best process, picking the right tools, as well as subscription for the CORS station.

3.2 EQUIPMENT USED/ SYSTEM SELECTION SOFTWARE

The following equipment was used:

i. Total station and accessories

ii. One Tripod

iii. Two Prism

iv. One 7.5 meters short tape

v. One Plumb bob

vi. One Cutlass

vii. Bottle corks and nails

viii. Writing materials.

3.2.1 HARDWARE USED

Model: HP 15 Note book PC

System Manufacturer: Hewlett-Packard

Rating: 1.0 Windows Experience Index.

Processor: Intel(R) Core(TM) i5-3230M CPU @ 2.60GHz, 2601 Mhz, 2 Core(s), 4 Logical Processor(s)

Installed Memory RAM: 8.00 GB

System Type: x64-based PC.

Product ID: F9F84EA#ABV

3.2.2 SOFTWARE USED

Some of the software used includes:

i. AutoCAD 2007
ii. Notepad
iii. Microsoft Word 2007
iv. Microsoft Excel 2007
v. Arc GIS 10.5

3.3 DATA ACQUISITION

This involves using different surveying methods and tools to gather data and make observations in the field. To acquire data for this project, Handed GPS and Total station were both used.

3.3.1 PRIMARY DATA SOURCE: This is a type of data source in which data is direct acquired from the field such as data acquired from field survey operations.

3.3.2 SECONDARY DATA SOURCE: This data source are already made data or gotten from research work, which has been acquired for future use. This involves downloading satellite imagery used for the project area and Google map as guide.

3.4 TEST OF INSTRUMENT

Testing of instruments is very crucial when carrying out any survey operation. Having collected the required instruments from the department, the check was carried out on the accuracy and precision of both the Handed GPS and TOTAL STATION to ensure they were in proper working condition before the actual field observation of the project.

3.4.1 TEST FOR TOTAL STATION

The horizontal collimation and vertical index inaccuracies of the instrument were confirmed. Once the device was positioned on a rather flat surface, the required temporary modifications, including focusing, centering, and setting, were made. Configuration information, such as extra parameters and fast settings, was examined and adjusted as necessary. The configuration parameters selected collimation, namely horizontal collimation. Next, to focus on a distant object, the means' option located on the left side of the device was chosen. The instrument was transited, and the right side went through the same procedure. Then, when the 'accept' button was pushed, the table that was displayed showed the old and new values for the vertical index errors and horizontal collimation. Re-press "ok" signified acceptance of the updated values, which were minimal.

The diagrammatic representation of the procedure and the readings obtained are shown below

Table 3.4.1 COLLIMATION TEST OF TOTAL STATION

STN	SIGHT	FACE	HCR	REDUCTION	VCR	REDUCTION

A	B	L	126º 07' 11.33"		67º 22'40"	
	B	R	306º 07' 31.3"	180º 00' 20"	292º 37' 1"	359 º 59' 41"

HORIZONTAL COLLIMATION ERROR = 180°00'20'' - 180°

=00°00'20''

=00°00'20''/2 =00°00'10''

VERTICAL INDEX ERROR=360° - 359°59'41.6''

=00°00'18.4''

=00°00'18''/2 =00°00'9.2''

The instrument's satisfactory operation was validated by the acceptance of the updated readings. It appears from this result that any possible issues can be resolved or at least greatly reduced.

3.4.2 REFERENCING AND ORIENTATION OF TOTAL STATION

Tripod Setup:

- Place the tripod over the station point (known or assumed).
- Level the tripod head as much as possible by adjusting the legs.

Mount the Total Station:

- Fix the total station onto the tripod head.
- Ensure it's securely locked in place.

Centering and Leveling:

- Use the optical plummet or laser plummet to center the instrument exactly over the survey station mark (station point).
- Level the instrument using the foot screws and circular bubble.
- Fine-tune leveling using the electronic level display.

Power On and Instrument Configuration

- Switch on the Total Station.
- Set the correct project, coordinate system, and units.
- Select the appropriate survey mode (e.g., topographic survey or station setup).

Orientation (Station Setup)

Orientation means establishing the direction of the horizontal angle reference (back sight direction).

Orientation by Known Coordinates (Resection or Free Station)

Used when both the instrument station and a back sight point have known coordinates.

1. Input the coordinates of the instrument station (or let the instrument compute it later).
2. Sight and measure to one or more known reference points (minimum of 2 for better accuracy).
3. The Total Station calculates the instrument position and orientation using these known points.

3.3.7 PERIMETER TRAVERSING

The perimeter of the project area was traversed for the purpose of the coordinating the boundary points. HandedGPS (GALAXY G1) was connected to kwara state CORS station for referencing and orientation after which all the boundary points were traversed using HandedGPS from the initial until each successive boundary is occupied.

3.3.8 DETAILING

All features such as roads, buildings, electric poles, street light, trees, etc. were captured by coordinating their edges simultaneously as the perimeter is being measured within the project area. Buildings were measured and identifiers (BD) were used to differentiate them from other features. Roads were also measured and labelled (RD) accordingly. Data captured here were basically in 3Dimension i.e. Easting, Nothings and Elevations (X, Y, and Z) coordinates.

3.3.9 REMOTE ELEVATION MEASUREMENT

All the features such as buildings, electric poles, street light, etc. captured by coordinating their edges from a subsidiary traverse stations created within the project area.

Buildings heights were measured and recorded. Electric poles height were also measured and recorded accordingly. So also the same was repeated for the trees. Data captured here were basically in 3Dimension i.e. Easting, Nothings and Elevations + Heights (X, Y and Z + H) coordinates. The following procedures were followed:

i. Escape key was pressed then F1 for MENU
ii. The REM programme was selected.
iii. Observation was made again and the height of reflector was displayed.
iv. The telescope was tilted to the top of the object and the height keeps changing until F4 is been pressed to stop.
v. The value was recorded.

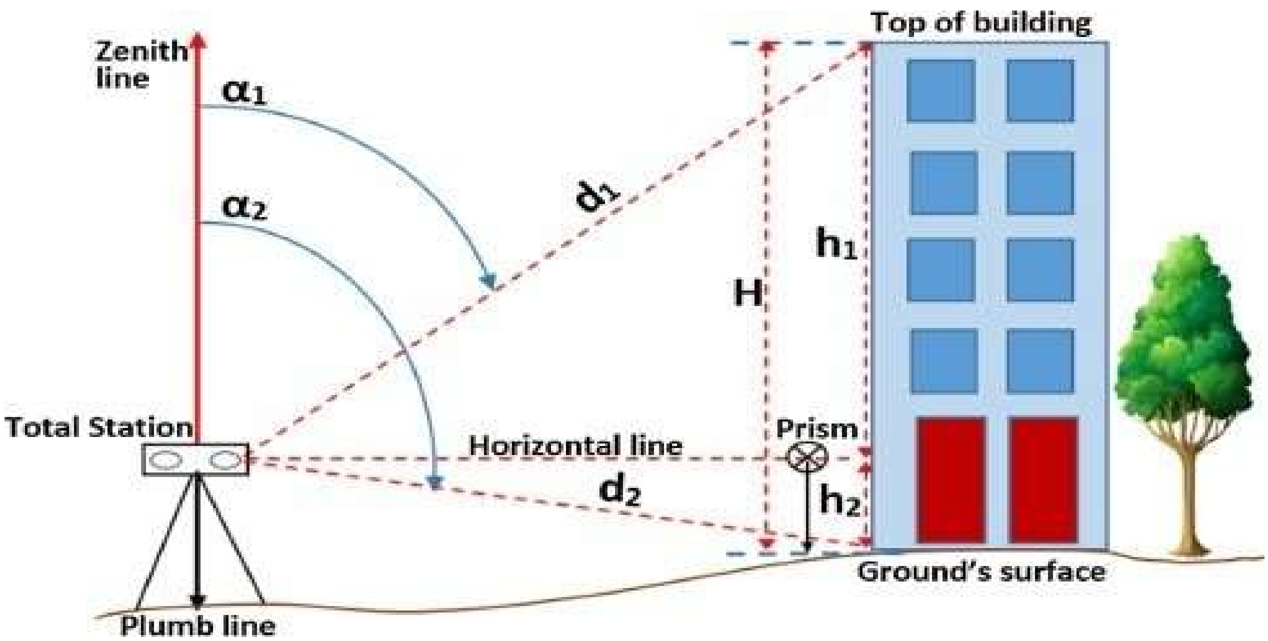

Figure 3.3.9: REM OBSERVATION STRATEGY

3.3.9A SPOT HEIGHTINGS

This was carried out by occupying randomly the subsidiary points within the project area and taking measurements (Easting, Nothings and Heights) along the terrain at approximate intervals to determine the difference in height between points and some areas within the project location. Spot heighten is very important in producing topographical information of the area with the aid of ArcGIS 10.5.

3.4 PHYSICAL DESIGN

At this stage, all geospatial (attribute) data were structured and organized to form a database in a format acceptable by the implementing software and hardware. This was done in a way that, stored information can be accessed and retrieved at any time. Also, for regular updates when the need arise and to allow for analytical functions to be carried out answering generic questions. Also, it provided integrity and security that must be obeyed before such data could be accepted into the records. These virtues are as show in the tables below. ArcGIS 10.5 was used for database creation of the project area.

Table 3.4A TREE TABLE

ATTRIBUTE	DATA TYPE	WIDTH	DECIMAL
T_ ID	String	5	-
T_NAME	Float	20	-
EASTING	Number	10	3
NORTHING	Number	10	3
T_USE	Float	10	-
T_HEGHT	Number	7	3

Table 3.4B ROAD TABLE

ATTRIBUTE	DATA TYPE	WIDTH	DECIMAL
POINT_ID	String	10	-
NORTHING	Number	10	3
EASTING	Number	10	3
RD_HEIGHT	Number	7	3

Table 3.4C ELECTRIC POLE TABLE

ATTRIBUTE NAME	DESCRIPTION OF ATTRIBUTE	DATA TYPE	WIDTH	DECIMAL
POINT_ID	Electric pole identifier	Number	6	-
NORTHING	Coordinate	Number	15	3
EASTING	Coordinate	Number	15	3
EP_TYPE	Type of Electric pole	Text	15	-
EP_HEIGHT	Height of the Electric pole	Number	5	2

Table 3.4D BUILDING TABLE

ATTRIBUTE	DATA TYPE	WIDTH	DECIMAL
P_ID	String	15	-
NAME	Text	15	-
CONDITION	Text	15	-
USE	Text	15	-
HEIGHT	Number	15	2
AREA_METERS	Number	15	2

Table 3.4E STREETLIGHT TABLE

ATTRIBUTE NAME	DESCRIPTION OF ATTRIBUTE	DATA TYPE	WIDTH	DECIMAL
POINT_ID	Street light identifier	Number	6	-
NORTHING	Coordinate	Number	15	3
EASTING	Coordinate	Number	15	3
SL_HEIGHT	Height of the street light	Number	5	2

3.5 DATABASE CREATION

Database is an organized integrated collection of data stored so as to be capable of use by relevant application with data being accessed by different logical part. This was the construction phase where database was created. After the table has being populated via the keyboard, some attributes such as area, perimeters of parcel were automatically displayed by special command in the ArcGIS 10.5 version.

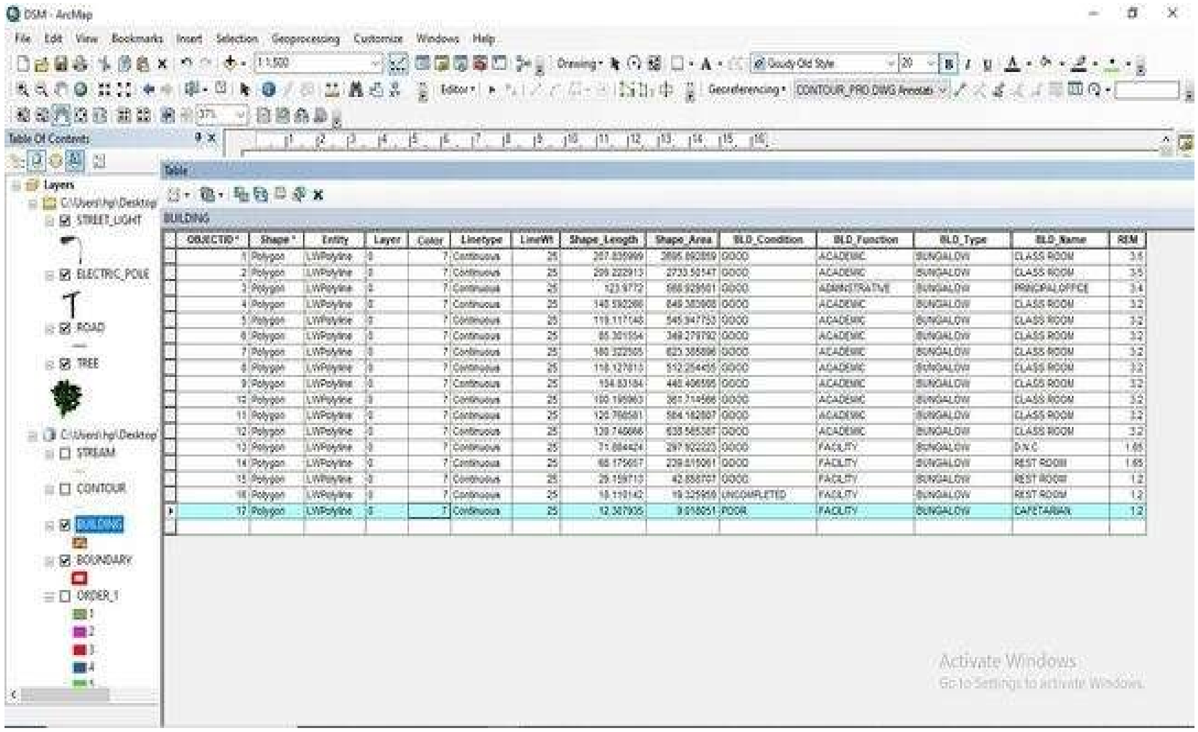

Figure 3.5: ABSTRACTED OF TABLE CREATED

3.5.1 ATTRIBUTE DATA ACQUISITION

The data about the characteristics of features especially man-made features were acquired through oral interview method and online source (Google Earth). Social survey was carried out during which information such as; building name, building use and related data about features were obtained from the students and staffs within the school. All these data formed the attribute aspect of the feature necessary for the database creation.

3.6 DATA PROCESSING

3.6.1 TOTAL STATION DATA DOWNLOADING PROCEDURE

Data downloading is the process of transferring data from the instrument into the computer system connected through the connection cable or wireless such as Bluetooth with the help of software in the computer, the process is as follows as performed on Total station.

i. Connection of the two devices (computer and the instrument).
ii. Go to project working folder created on the instrument.
iii. Click on export.
iv. Input the name of file

v. Indicate the file extension for the output

vi. Permit the other device to receive the file.

3.6.2 DRAFTING AND PLOTTING

The script file created containing the refined coordinates was then opened in the AutoCAD environment and the boundary of the project area was plotted using AutoCAD 2007. This was followed by the details, which included buildings, roads, trees, sport facilities and electric poles.

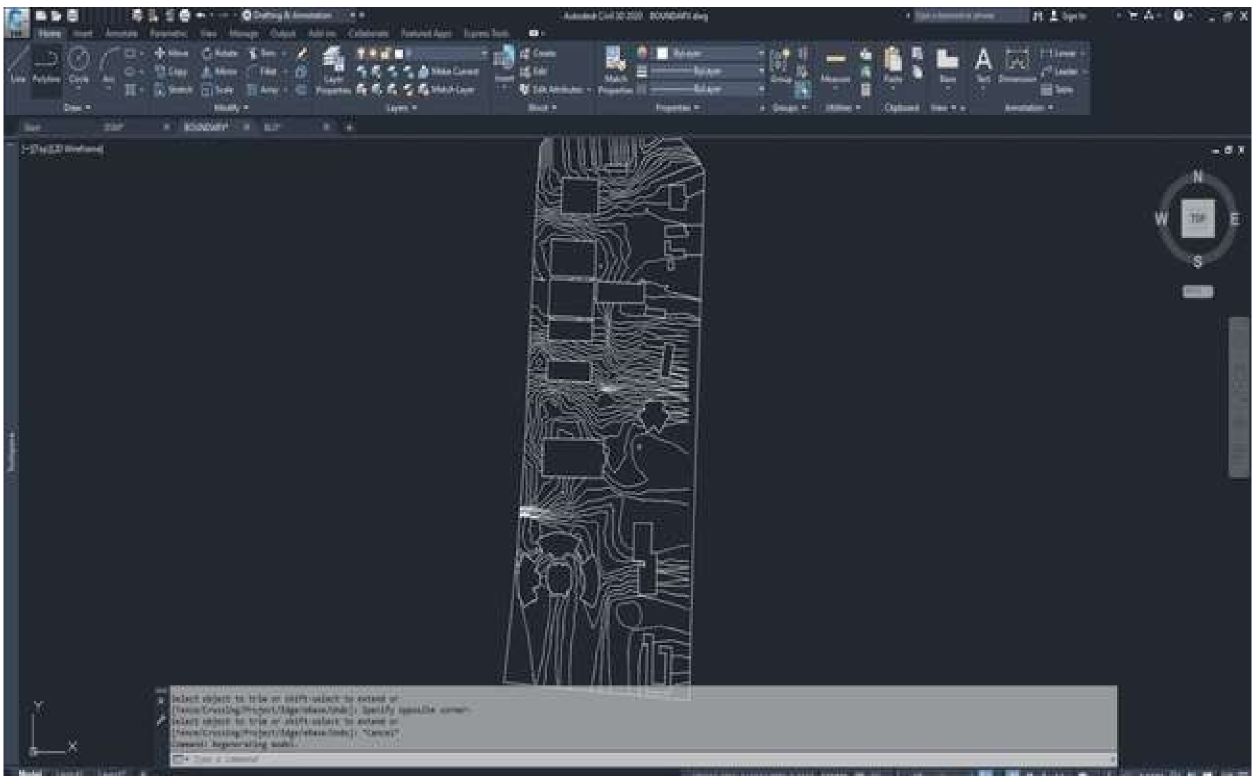

Figure 3.6.2: AUTOCAD PLOTTING.

3.7 DATABASE MANAGEMENT

3.7.1 DATA SECURITY

This is the security measure used the protection of the database security is very important since it is vital for data integrity. The strategic measure used included controlling access to database by use of password.

3.7.2 DATA INTEGRITY

This ensures that data in the database is accurate and that cases of violation of integrity can be detected automatically by the system. Here, care was taken while entering data into the system, such that, accurate data were entered and updating could be done accurately without tampering with existing data. Backups are provided to cater for any loss of data through system failure. Also a member of the project group was appointed for quality assurance and checks therefor do checks the consistency, accuracy and integrity of the input data.

3.8.3 DATABASE MAINTANANCE

Having created the database, proper maintenance practice was made to meet its stated objectives. The ability to include more data and remove irrelevant data can be possible. There is every need for the data to be updated regularly because of the physical changes that tends to occur on the landscape with time, even as a result of development.

Both security and integrity were also exercised to ensure maintenance and to meet its stated objectives.

CHAPTER FOUR

4.0 SPATIAL ANALYSIS AND INFORMATION PRESENTATION

4.1 TESTING OF DATABASE

This is the test carried out to determine whether the relationship between the spatial data of a feature and their attributes is capable of being retrieved. This is necessary to ascertain the quality of data in the database, its reliability to satisfy the demand of the user. The spatial data were arranged logically in an organized manner with respect to their attributes. This was carried out by designing a sample query and running the query to see if the desired result would be achieved. In this project, the database was queried to show different categories of information levels in the project area. Hence the database was confirmed fit for analysis. A sample of the attribute table in the database design can be found on the next page.

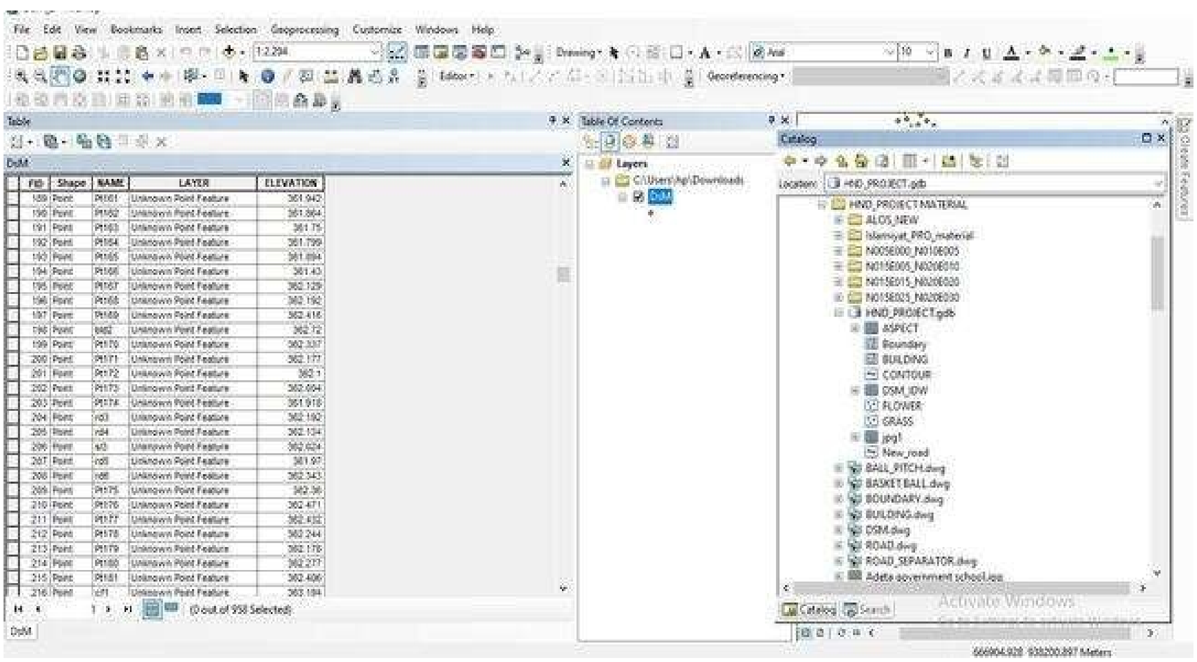

Figure 2.1: SAMPLE OF ATTRIBUTE TABLE

4.2 SPATIAL QUERY

Queries were designed for the purpose of retrieving information from the database. The queries performed in this project gave answers to certain generic questions asked from the database. This was made possible as a result of the implicit link of both the spatial and attributes data. The queries were based on the products from the analysis carried out on the database.

4.2.1 SINGLE CRITERIA QUERY

A single criterion is carried out where one condition is used to design query. This condition is used to retrieve the information from the database.

QUERY ANALYSIS 1 (selection by attribute)

ANALYSIS ONE

Analysis Name: Database extraction

Analysis Type: Single criteria analysis

Syntax: Query analyses showing buildings that are used for Administrative.

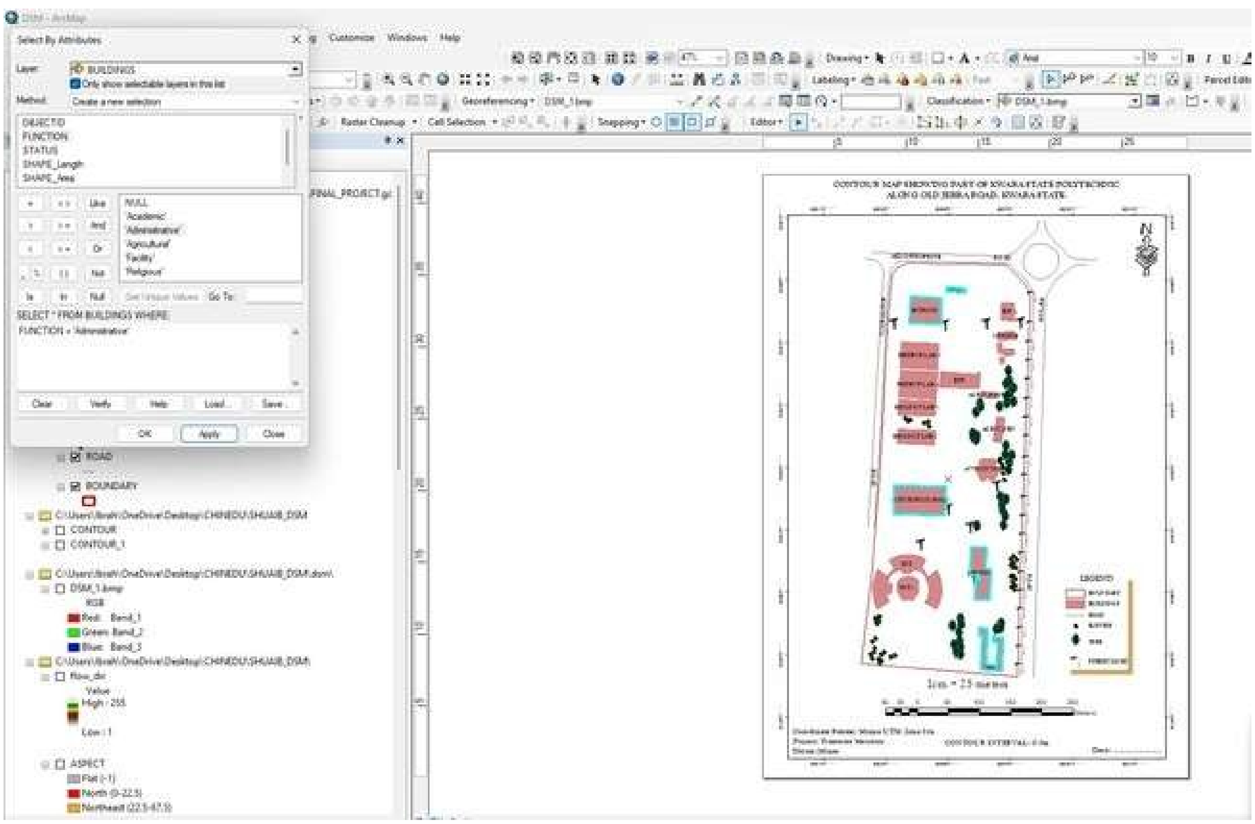

Figure 4.2.1.1 RESULT OF QUERY: (BLD_FUNCTION = “ADMINISTRATIVE”).

Analysis Name: Database extraction

Analysis Type: Single criteria analysis

Syntax: “BLD_ Function” =”Agricultural”

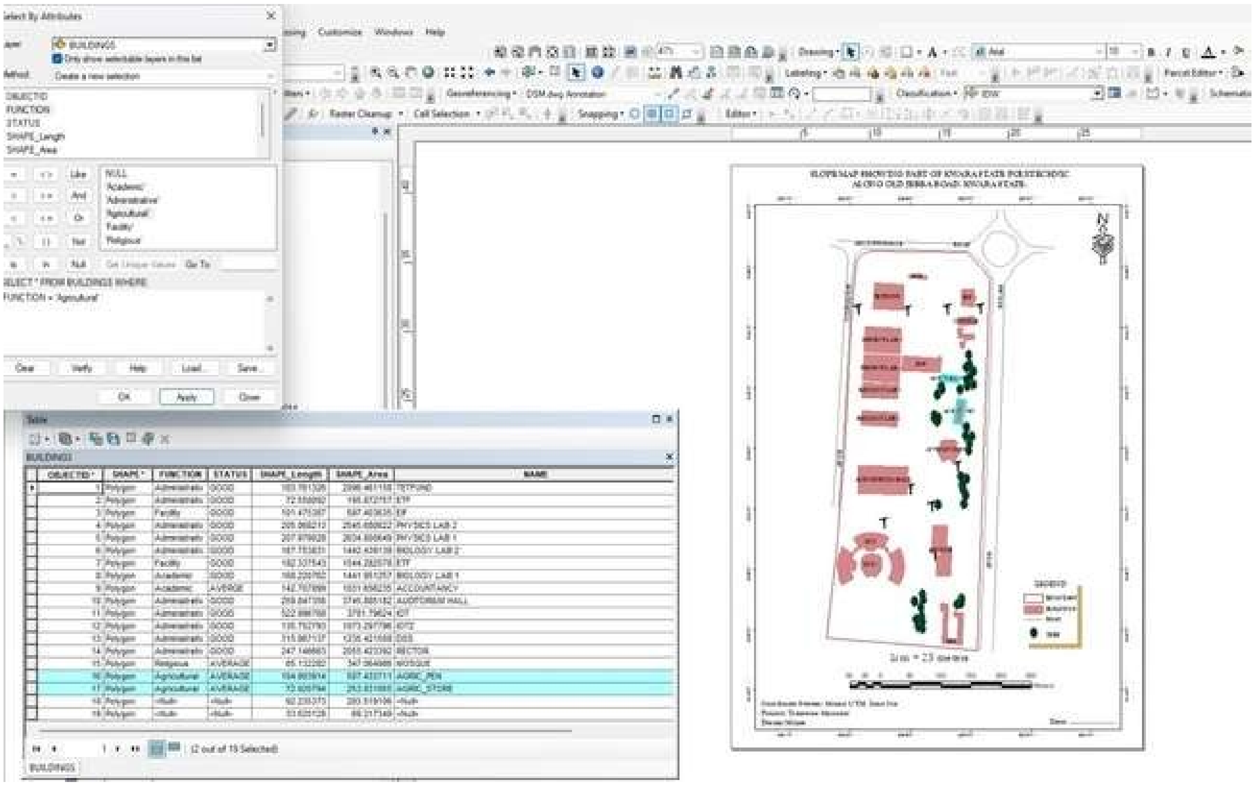

Figure 4.2.1.2: RESULT OF QUERY: (BLD_FUNCTION = “AGRICULTURAL”).

ANALYSIS THREE

Analysis Name: Database extraction

Analysis Type: Single criteria analysis

Syntax: “BLD_ CODITION” =”ACADEMIC”

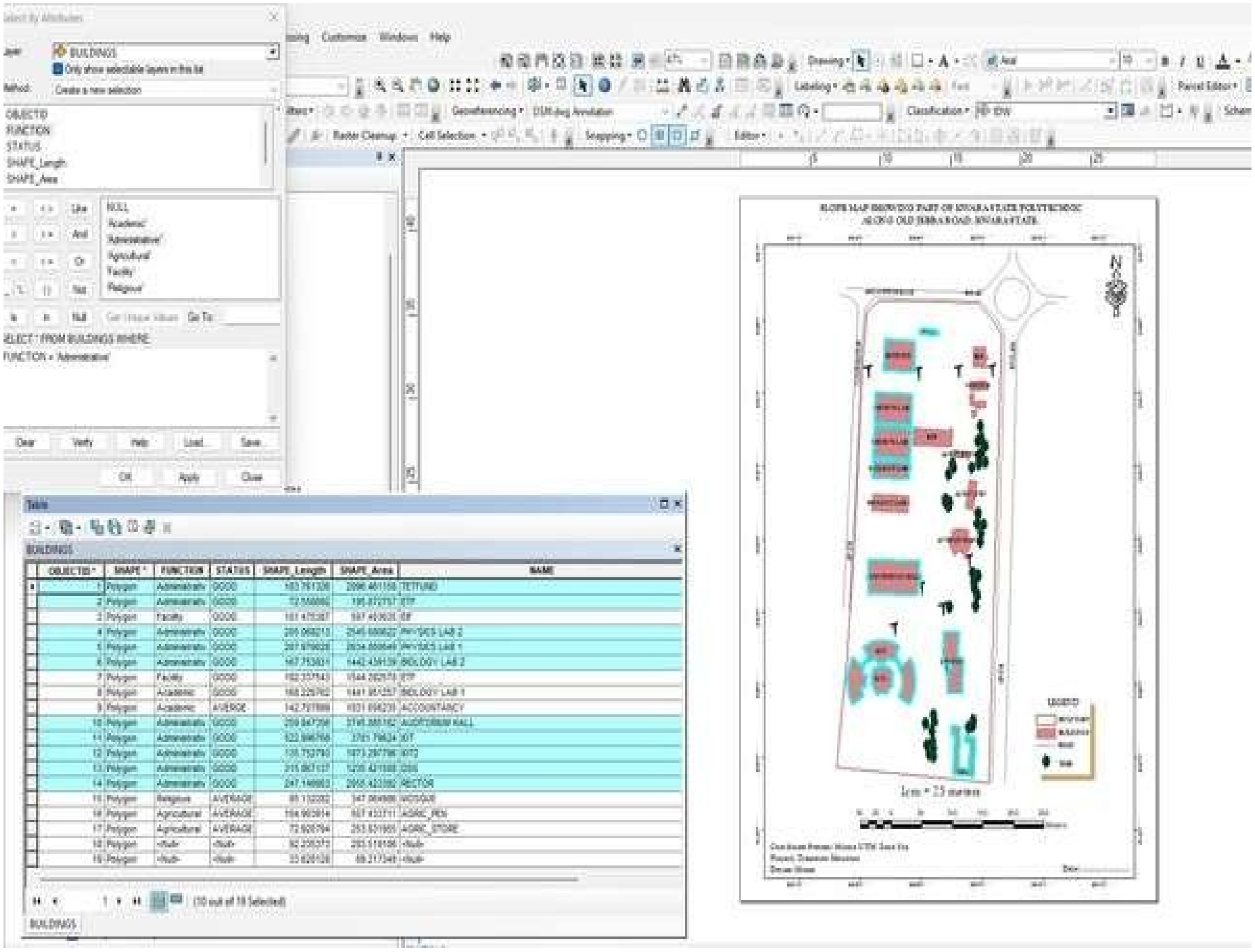

Figure 4.2.1.3: QUERY BLD_FUNCTION"ACADEMIC"

ANALYSIS FOUR

Analysis Name: Database extraction

Analysis Type: Single criteria analysis

Syntax: “**TREE_FUNCTION= ORNAMENT”**

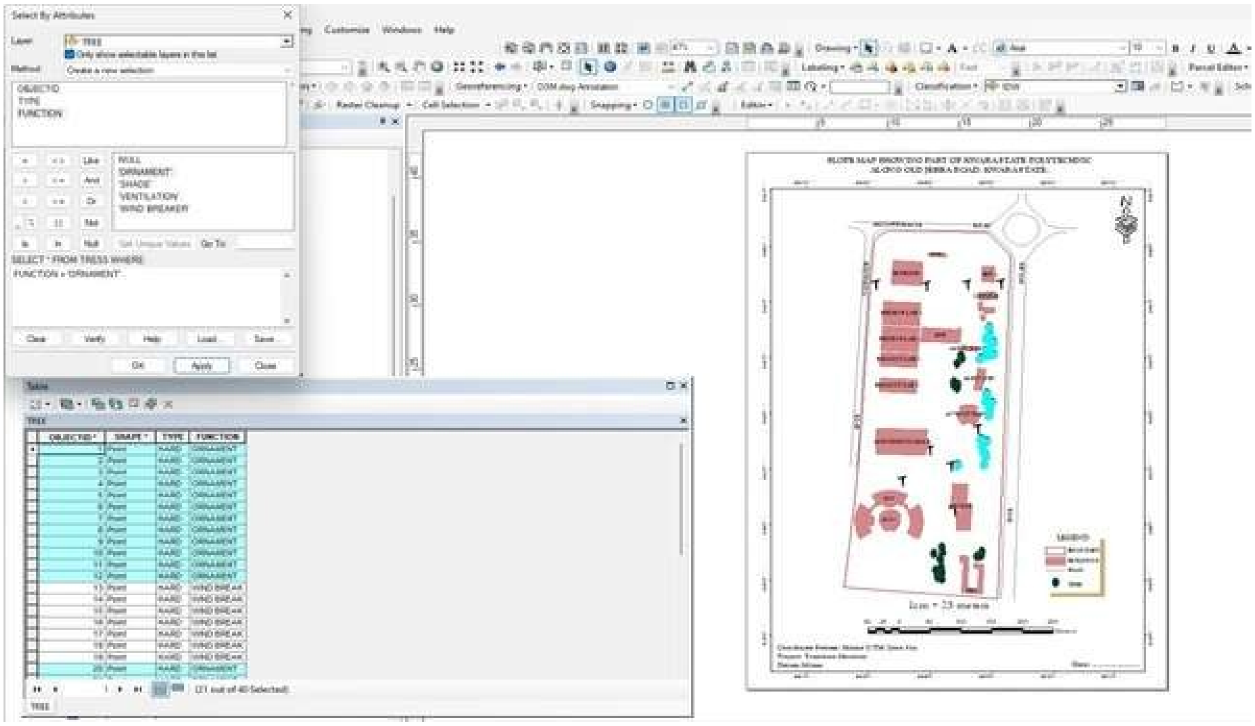

Figure 4.2.1.4: RESULT OF QUERY: (TREE_FUNCTION "ORNAMENT").

4.2.2 MULTIPLE CRITERIA

This is a situation where two or more conditions are used to design a query. The conditions determine the information that may be requested by the user from the database.

Query for QUERY: TREE_FUNCTION "ORNAMENT" AND TREE_TYPE "HARD"

ANALYSIS FOUR

Analysis Name: Database extraction

Analysis Type: Multiple criteria analysis

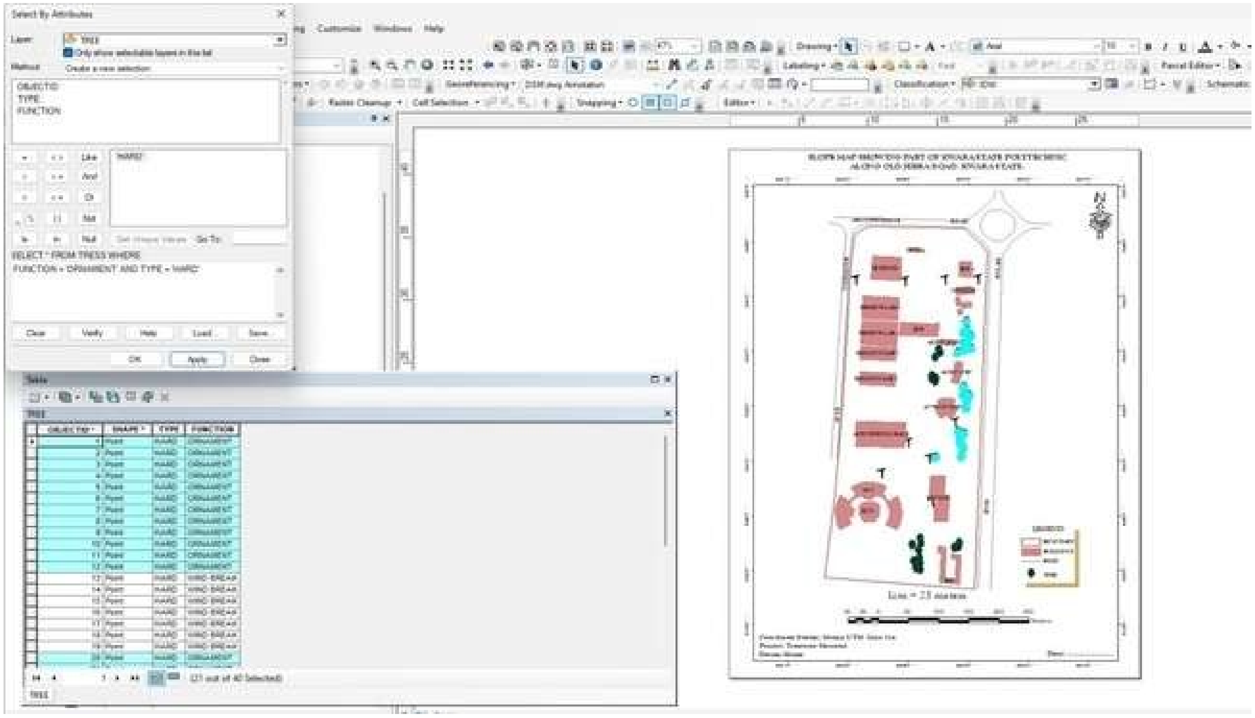

Figure 4.2.2.1 RESULT OF QUERY: TREE_FUNCTION "ORNAMENT" AND TREE_TYPE "HARD"

Query for BLD_FUNCTION ="RELIGIOUS" AND BLD_STATUS= "AVERAGE"

ANALYSIS FOUR

Analysis Name: Database extraction

Analysis Type: Multiple criteria analysis

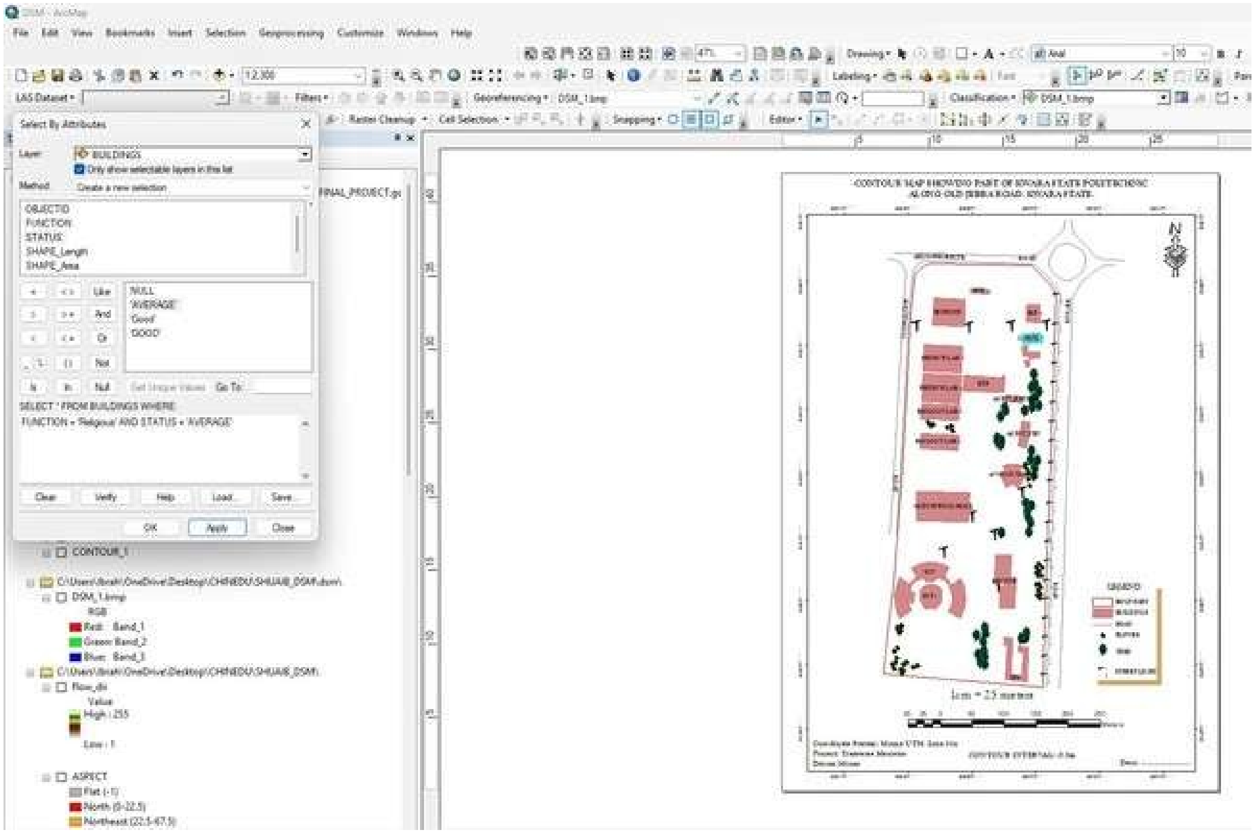

Figure 4.2.2.2 RESULT OF QUERY: BLD_FUNCTION =“RELIGIOUS” AND BLD_STATUS= “AVERAGE”

4.2 SPATIAL ANALIYSIS

This makes Geographic Information System (GIS) a unique analytical tool or technique because of its ability to combine spatial attribute data to produce information relevant for decision making. The basic GIS analysis performed in this project includes overlay and topographic operations. Maps on various themes were overlaid since they were from the same geometric origin.

4.2.1 OVERLAY OPERATION

This overlay operation is the presentation that shows different features within the project area. The outcome of overlay operation could be composite plan if it shows all the existing features, and boundary.

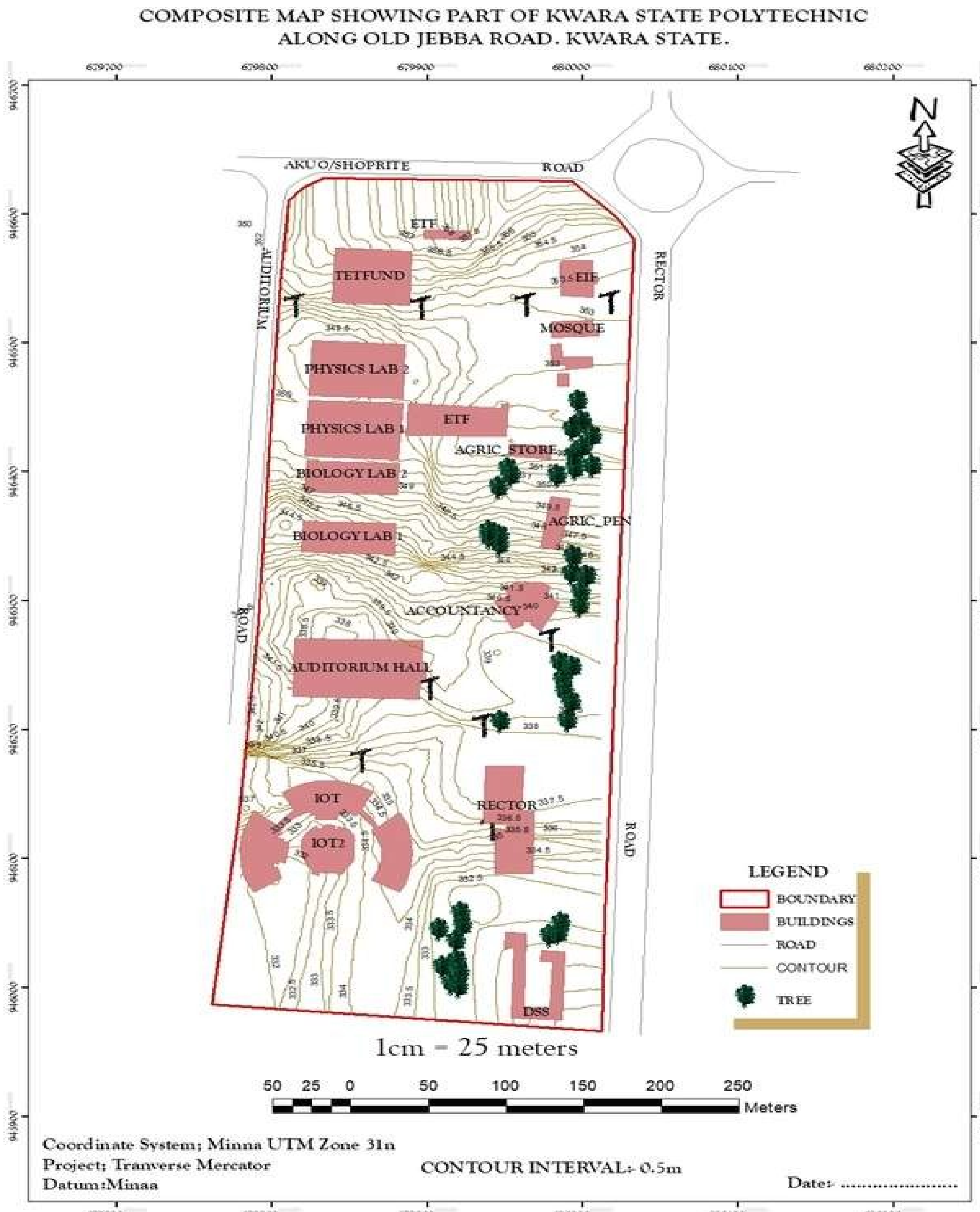

Figure 4.2.1: COMPOSITE MAP OF THE PROJECT AREA.

4.2.2 TOPOGRAPHICAL OPERATIONS

Topographic operations were carried out to determine the surface characteristic of the area which showed the relief of the project. These operations were performed on the Digital Elevation Model (DEM) generated from the use of relevant software, in this case, ArcGIS 10.5 and ArcScene 10.5 was used. The following maps were produced from the topographic operations and analysis:

i. **TRIANGULATION IRREGULAR NETWORK (TIN):** this shows series of triangulated surface automatically generated from ArcGIS 10.5 using 3D analysis tools. This is applicable in finding suitable place for building or any engineering construction

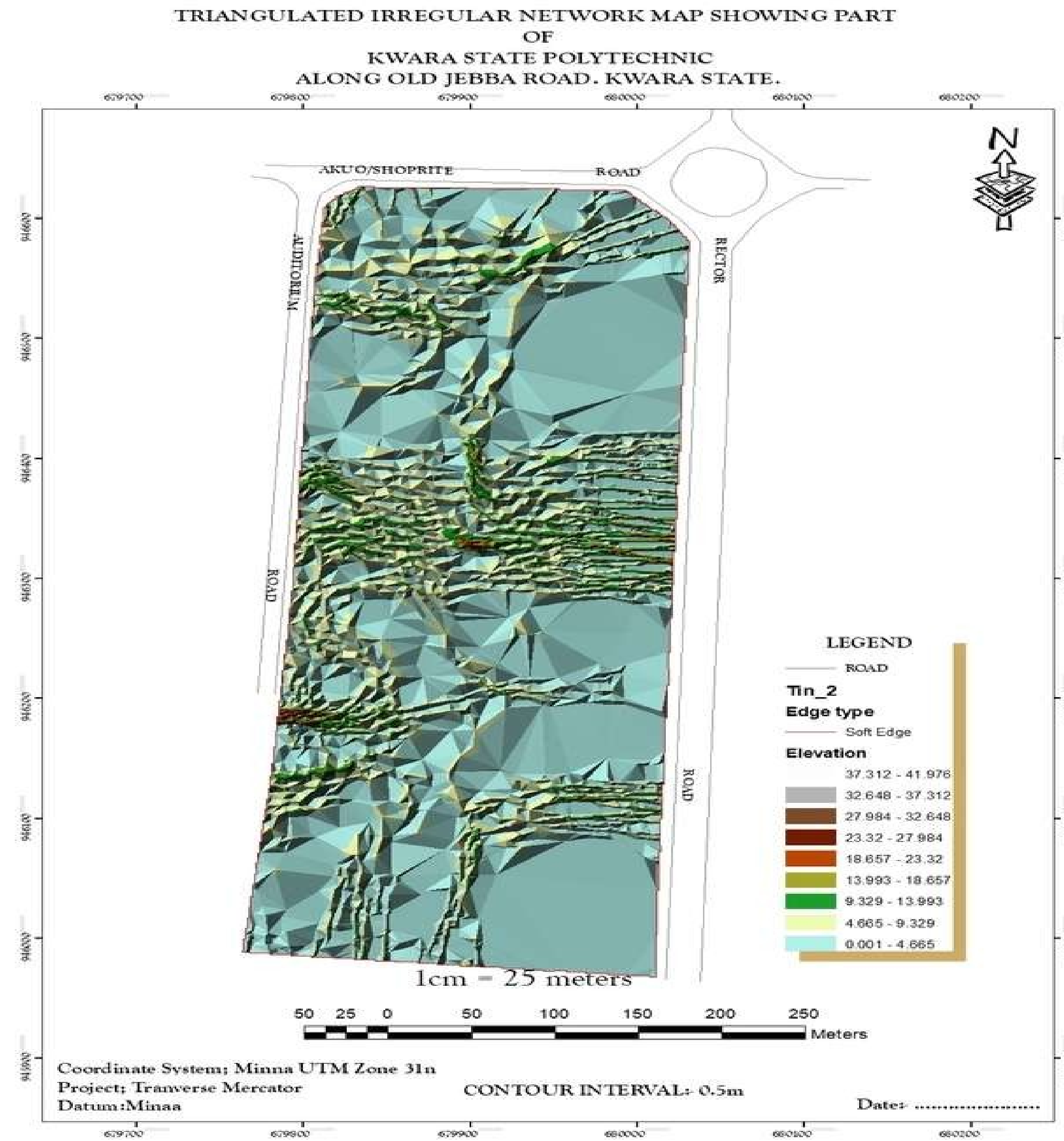

Figure 4.2.2.1: TIN AND DETAILS OVERLAY MAP OF THE PROJECT AREA

ii. **SLOPE MAP**: A slope map represents the gradient or steepness of the terrain's surface. It calculates the rate of change in elevation between neighboring pixels or points on a digital elevation model (DEM). Typically, slope is measured in degrees or percentage. Steeper slopes are represented by higher values, while flatter areas have lower values.

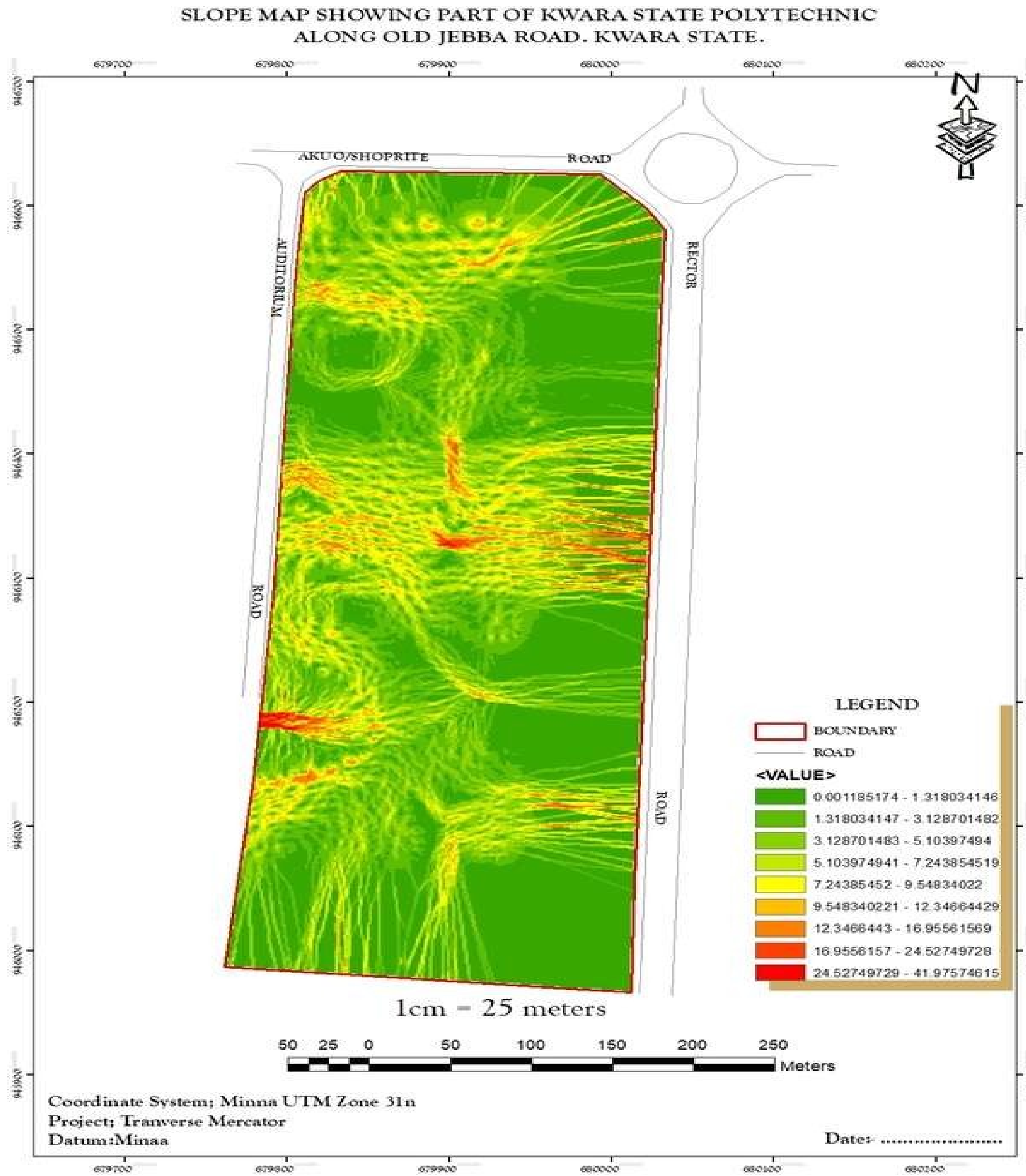

Figure 4.2.2.2: SLOPE MAP OF THE PROJECT AREA

iii. **THE ASPECT MAP**:

This shows the direction of the surface faces. It is used to determine how much sun a hill received and the information can be used to put building where they will get enough sun. Also the aspect map shows the suitable place for plane landing i.e. the flat terrain area and also solar illumination which can affect the diversity of life i.e. Vegetation and soil studies; glaciology.

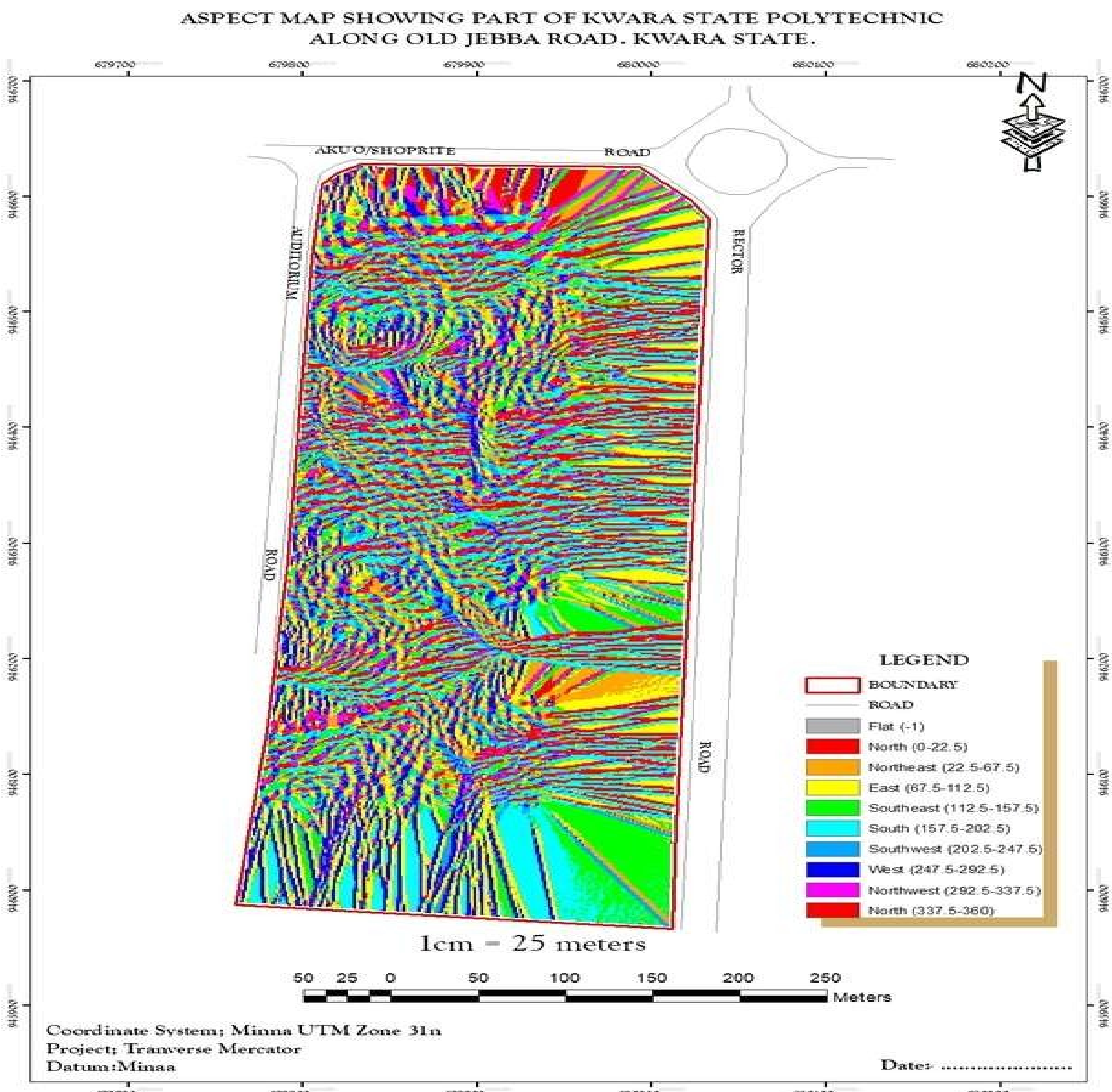

Figure 4.2.2.3: ASPECT MAP OF THE PROJECT AREA.

iv. **THE CONTOUR MAP**:

Contour maps display lines connecting points of equal elevation on the terrain surface. These lines, called contour lines, depict the shape and elevation of the land. Contour maps are widely used in topographic mapping and land surveying for visualizing elevation changes and terrain features. This provides a very intuitive view of the landscape. Contour map of the project area can aid in giving information on the highest and the lowest point on the terrain. This is important in road construction and location of other facilities like storage tanks for water distribution.

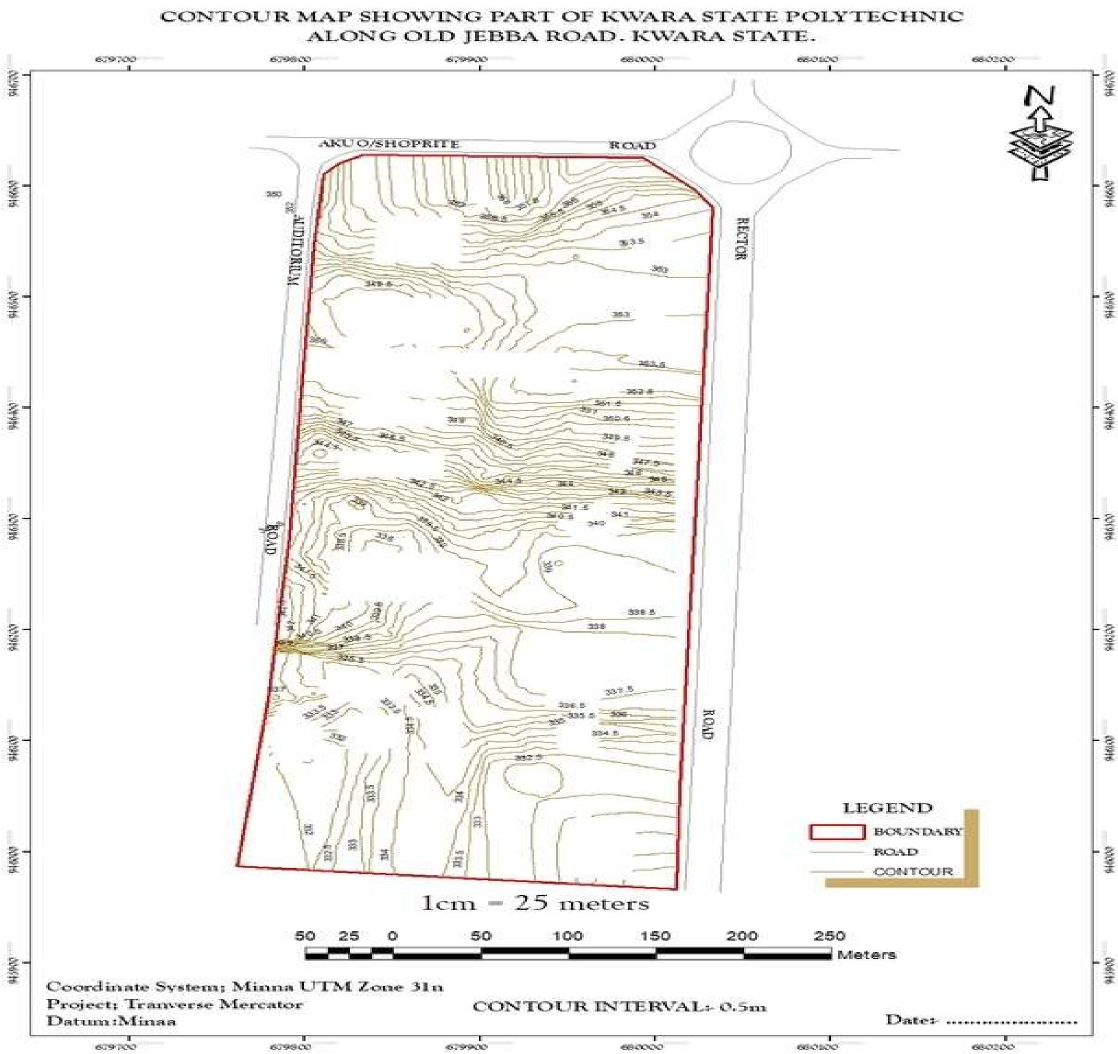

Figure 4.2.2.4: CONTOUR MAP OF THE PROJECT AREA.

v. **FLOW DIRECTION MAP**:

This is used to determine the direction of flow of water within the project area. It also indicates the magnitude and erosive force water passing through an area.

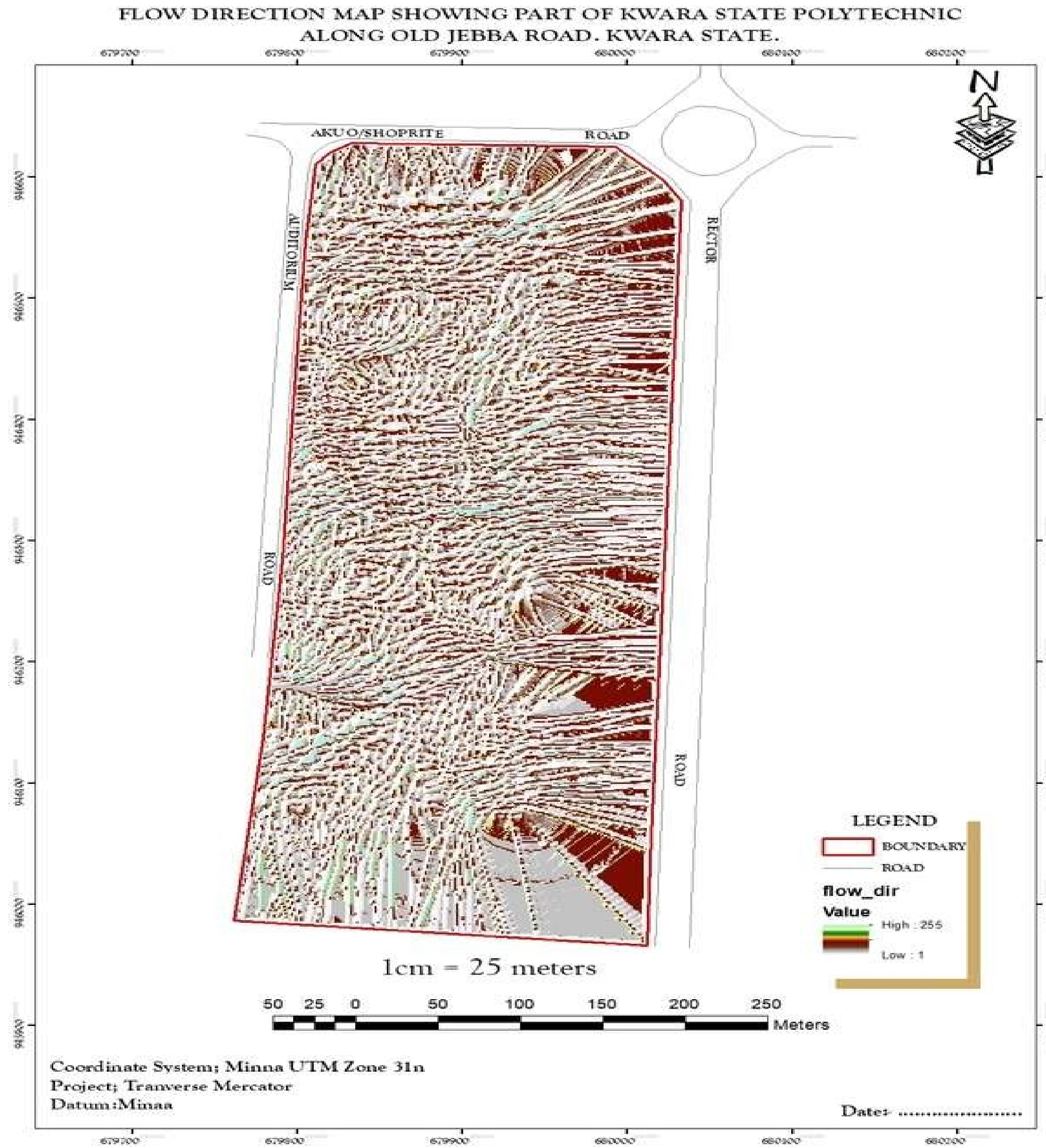

Figure 4.2.2.5 FLOW_DIRECTION MAP OF THE PROJECT AREA

vi. **DIGITAL SURFACE MODEL MAP:**

A DSM (Digital Surface Model) map, or Digital Surface Model, represents the elevation of the Earth's surface including all objects on it, such as buildings, vegetation, and other structures. Unlike a DTM (Digital Terrain Model), which only includes the bare-earth surface, a DSM incorporates both natural and man-made features. DSMs are useful for various applications, including urban planning, infrastructure design, and 3D visualization. They are often derived from aerial or satellite imagery, LiDAR data, or photogrammetry techniques. This shows the reality of the terrain of the project area.

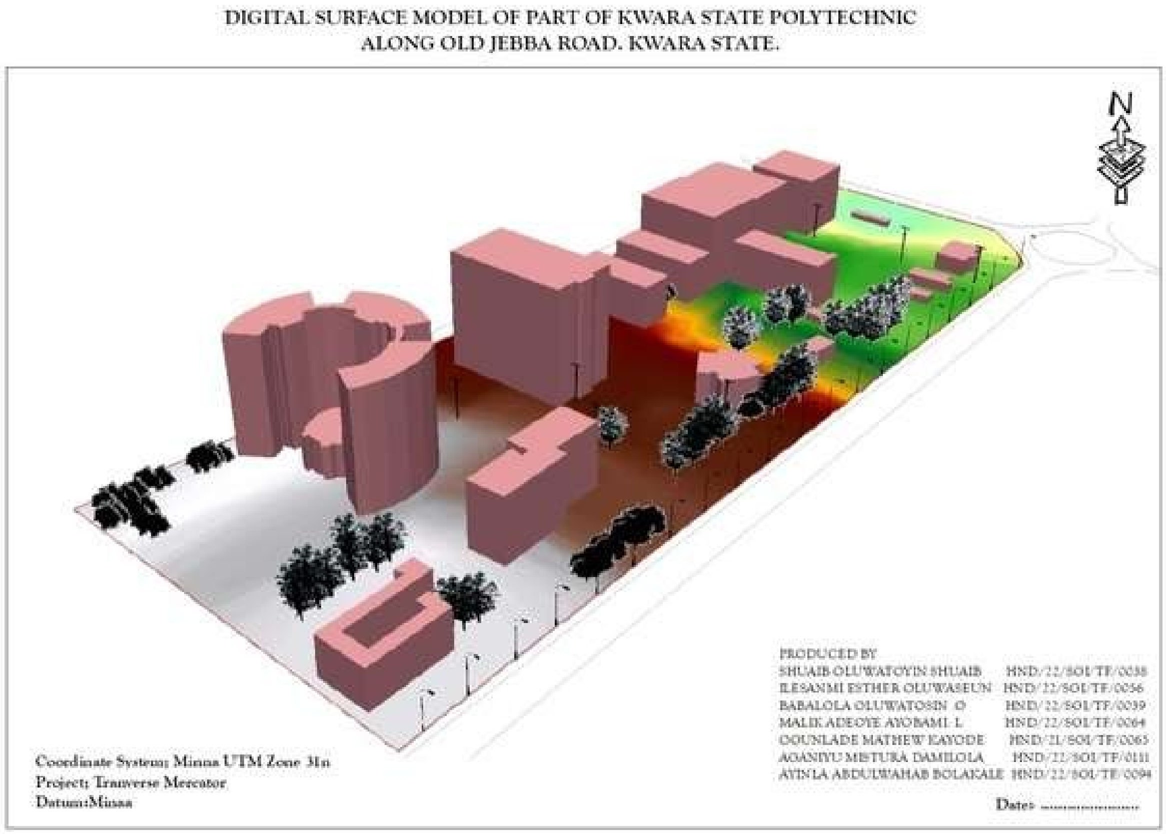

Figure 4.2.2.6: DIGITAL SURFACE MAP OF THE PROJECT AREA

4.3 RESULT ANALYSIS

From the below pie chart, it is inferred that large percentage is serving academic function.The DSM project commenced with the utilization of a Total station referenced to control station within kwara state polytechnic to capture 3D data of the project area. The captured data were then processed using software, employing photogrammetry techniques to generate a high-precision DSM and create a detailed 3D model. Subsequently, ArcGIS and ArcScene software was employed to visualize and analyze the DSM data, facilitating spatial analysis and information presentation both in 2D and 3D respectively.

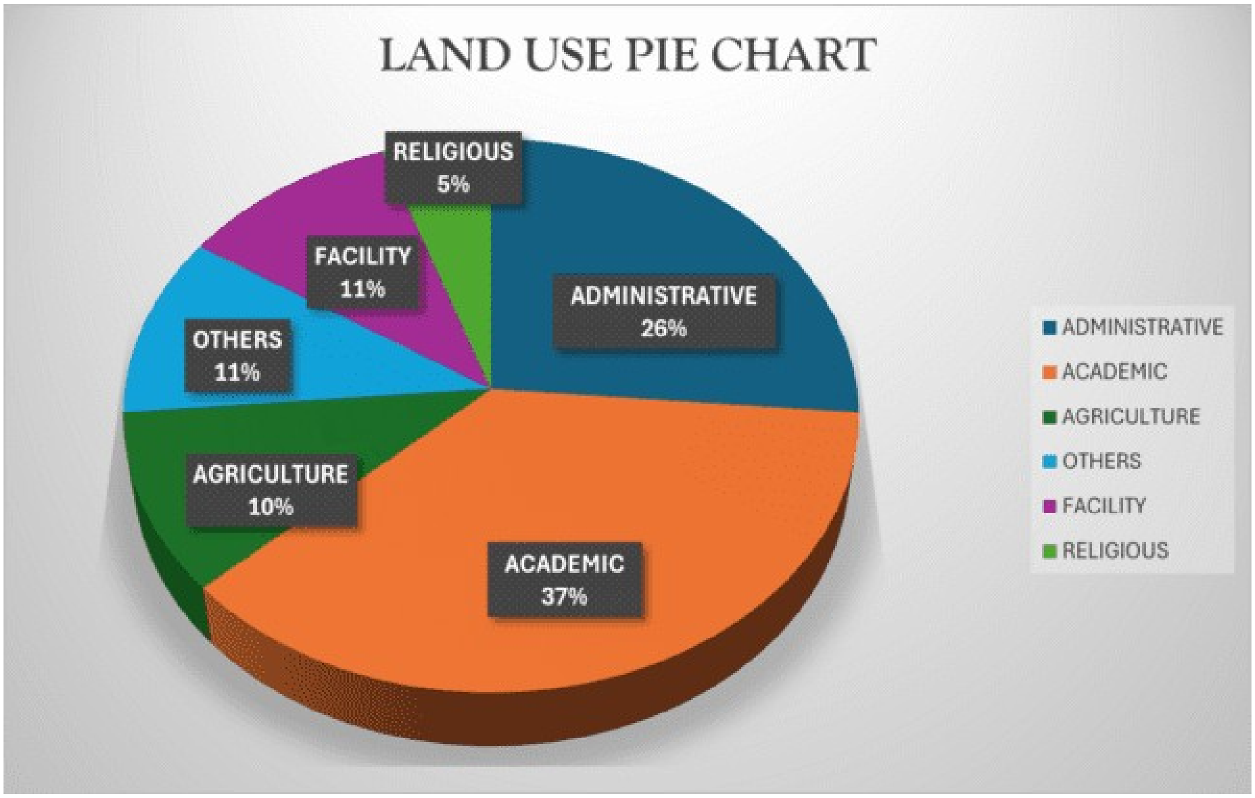

Figure 4.2.2.7: LAND USE PIE CHART

4.4 APPLICATION OF PROJECT

i. Generally DSM is applicable in urban development modeling.

ii. It enhanced visualization and communication of such data not only in maps modeling but also in mobile digital devices for quick navigation and assessment.

iii. To create a sustainable and favourable living environment.

iv. Positioning and monitoring of physical features, structures and engineering works on, above or below the surface of the earth to protect properties or investment.

v. The feasibility studies through the use of line of sight analysis provide visibility between two points. This is good for network distribution in telecommunication.

vi. The profile graph is good road construction which will provide the cross section of the topography from which rivers, streams and depression can be shown. Points require bridges, culverts and filling can be known from the profile graph.

vii. The vector map shows the direction of rivers, streams and depression which helps in road construction.

viii. The aspect map shows the direction of the surface faces. It is used to determine how much sun a hill received and the information can be used to put building where they will get enough sun also used to find where different crop will do best and also the Converging/diverging flow; soil water properties.

ix. The aspect map shows the suitable place for plane landing i.e. the flat terrain area and also solar illumination which can affect the diversity of life i.e. Vegetation and soil studies; glaciology.

x. The result from the analysis can be help in managing the land resources of the project area. With the DSM, adequate information has been provided for proper decision making on the school land. Proper allocation various land use can now be done without difficulty in the decision making process.

xi. The slope map which is used to find low- slope for potential construction site and high slope that may be vulnerable to erosion or landslide.

xii. Also, the slope map shows slope length which is important topographical parameters for soil erosion analysis and traditional soil erosion studied

xiii. Contour map of the project area can aid in giving information on the highest point on the terrain as well as the lowest. This is important in Road construction and location of other facilities like storage tank for water distribution.

CHAPTER FIVE

5.0 PROJECT COSTING, SUMMARY, PROBLEM ENCOUNTERED, POSSIBLE SOLUTION, RECOMMENDATION AND CONCLUSION

5.1 PROJECT COSTING

Table 5.1: Shows the worked out cost of the project

PREPARATION	RATE/DAY	NO. OF DAYS	UNIT COST(N)	AMOUNT (N)
RECONNAISSANCE				
DAYS				
Senior Surveyor	10,000	1	10,000	10,000
Technical Officer	5,000	1	40,000	40,000
Skilled Labour	5,000	1	5,000	5,000
Transportation	20,000	1	20,000	20,000
Basic Equipment (hand held GPS, Field book e.t.c)	5,000	1	5,000	5,000
SUB TOTAL				**₦80,000**

DETAILING AND SPOT HEIGHTING DAYS

ITEM	RATE/DAY	NO. OF DAYS	UNIT COST(N)	AMOUNT (N)
Senior Surveyor	10,000	4	40,000	40,000
Technical Officer	5,000	4	20,000 × 8	160,000
Basic Equipment (Total station, Reflector)	20,000	4	80,000	80,000
Transportation	5,000	4	20,000	20,000
SUB TOTAL				₦300,000

DATA PROCESSING DAYS

ITEM	RATE/DAY	NO. OF DAYS	UNIT COST(N)	AMOUNT (N)
Principal Surveyor	10,000	5	50,000	50,000
Surveyor	8,000	5	40,000	40,000
Assistant Technical Officer	5,000	5	25,000	25,000
Computer Accessories(Printer, Internet, Generator, Fuelling etc	15,000	5	75,000	75,000
SUB TOTAL				**₦190,000**

INFORMATION PRESENTATION

ITEM	RATE/DAY	NO. OF DAYS	UNIT COST(N)	AMOUNT (N)
Senior Surveyor	10,000	1	10,000	10,000
Technical Officer (CAD)	8,000	1	8,000	8,000
Standard Set (Computer, Plotter, Generator etc.)	15,000	1	15,000	15,000
SUB TOTAL				**₦33,000**

TECHNICAL REPORT

ITEM	RATE/DAY	NO. OF DAYS	UNIT COST(N)	AMOUNT (N)
Chief Surveyor	30,000	1	30,000	30,000
Surveyors	20,000	1	20,000 × 2	40,000
SUB TOTAL				**₦70,000**

PROJECT COST SUMMARY

COST BREAKDOWN TABLE

ITEM	DESCRIPTION	AMOUNT (₦)
SUM OF THE PROJECT	Base Project Cost	₦678,000
MOBILIZATION/DEMOBILIZATION	(10% of the project)	₦67,600
CONTINGENCY	(5% of the project)	₦33,800
V.A.T	(7.5% of the project)	₦50,700
ACCOMMODATION	(1.5% of the project)	₦10,140
GRAND TOTAL	**Final Project Cost**	**₦838,240**

5.2 SUMMARY

To accurately determine the shape, size, and precise location of the site extensive office planning and on-site visitation were conducted. As part of the preparation process, a reconnaissance diagram was produced, providing valuable insights for informed decision-making.

Controls were searched for and checked using a South Total Station instrument, enabling the systematic traversal and observation of various points, including detailed features such as roads. The observed coordinates were diligently recorded in the field book and also saved in the memory of the total station for future reference.

The recorded coordinates were utilized to plot the boundary points and preparation of other necessary plans with accuracy. This information served as the foundation for creating a comprehensive plan and generating a detailed report, both of which were diligently prepared and printed.

5.3 Problem Encountered

1. Limited Access to Equipment: Limited access to Total Station equipment and other surveying instruments, which delayed data collection.

2. Technical Issues: Technical problems with software and equipment, such as data import errors.
3. Data Quality Issues: Ensuring data accuracy and quality, particularly with limited experience in data collection and processing.
4. Time Management: Managing time effectively to complete the project within the given timeframe, balancing data collection, processing, and analysis.
5. Software Challenges: Difficulty in using DSM software, for us with limited experience in geospatial analysis.

5.4 Possible Solution

Addressing the challenges encountered required careful planning, collaboration with supervisor, seeking assistance from geospatial analysisexperts, and leveraging available resources effectively. By overcoming these challenges, the project was able to carried out successfully and able to gain valuable skills in DMS and geospatial analysis.

5.5 RECOMMENDATION

During the course of carrying out this project a lot of new things were learned which will make me recommend that this type of project should be carry out as practical as well for the student to have a profound knowledge on it. A better learning environment with digital equipment should be available for the students as well.

5.6 CONCLUSION

In conclusion, all necessary observational procedures and precaution were taken into consideration during the project execution. The field work was carried out in line with fundamental principles of surveying and instructions from the supervisor the aim of the project which was to produce a 3D plan, perimeter and detailed plan, 3D wireframe and Contour plan was perfectly and timely achieved in better accuracies.

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COORDINATE LIST

Detail	E	N	ELEVATION
	679549.147	940622.115	349.661
	679571.054	940634.161	349.647
	679592.961	940646.207	349.647
	679614.867	940658.253	357.133
	679636.911	940670.039	4330
	679659.764	940680.158	349.661
	679683.38	940688.339	349.661
	679707.585	940674.572	349.647
	679731.947	940700.18	349.661
	679,756	940705.789	349.661
	679780.673	940711.397	349.647
	679805.036	947717.006	349.647
	679829.399	940722.614	357.133
	679853.761	940728.223	349.635
	679878.124	940733.831	350.567
	679902.468	940739.52	349.731
	679926.406	940746.703	350.484
	679949.664	940755.852	350.233
	679972.079	940766.906	350.012
	679993.497	940779.788	349.347
	680013.768	940794.407	349.402
	680032.752	940810.663	349.661
	680050.318	940808.441	349.661
	680067.208	940846.873	349.647

680084.097	940865.305	349.647
680100.986	940883.738	357.133
680177.876	940902.17	349.635
680134.765	940920.602	350.567
680151.654	940939.034	349.731
680168.544	940957.467	350.484
680185.433	940975.899	350.233
680202.323	940994.331	350.012
680219.212	941012.764	349.347
680236.101	941031.196	349.402
680252.991	941049.628	349.661
680269.88	941068.06	349.661
680286.77	941086.493	349.647
680303.996	941104.607	349.647
680322.097	941121.847	357.133
680341.038	941138.161	349.635
680360.77	941153.507	350.567
680381.244	941167.848	349.731
680402.41	941181.148	350.484
680424.213	941193.373	350.233
680446.601	941204.494	350.012
680469.485	941214.558	349.347
680492.472	941224.39	349.402
680595.455	941234.233	349.661
680538.44	941244.055	349.661
680561.426	941253.888	349.647
680584.411	941263.72	349.647

680677.396	941273.552	357.133
680630.382	941283.385	349.635
680653.367	941293.271	350.567
680676.352	941303.05	349.731
680699.337	941312.882	350.484
680722.323	941322.547	350.233
680745.308	941342.379	350.012
680768.296	941352.212	349.347
680791.279	941362.044	349.402
680814.264	941371.877	349.661
680837.249	941381.779	349.661
680869.234	941391.542	349.647
680883.22	941401.374	349.647
680906.205	941411.206	357.133
680929.19	941421.039	349.635
680952.175	941430.871	350.567
680975.161	941440.774	349.731
680998.146	941450.334	350.484
681021.216	941459.483	350.233
681044.482	941468.576	350.012
681067.77	941477.669	349.347
681091.057	941486.761	349.402
681114.345	941495.854	356.33
681160.921	941504.947	333.336
681184.209	941514.039	350.561
681207.496	941523.132	350.528
681230.784	941532.225	349.57

681254.072	941541.318	349.314
681277.36	941550.411	336.852
681300.248	941559.503	336.426
681323.935	941568.596	336.839
681347.223	941577.689	336.841
681370.511	941586.782	346.601
681393.799	941595.874	335.186
681417.087	941604.967	346.322
681440.374	941614.06	346.327
681463.662	941623.153	346.33
681486.95	961632.245	335.276
681510.238	941641.338	335.358
681533.526	941650.431	335.304
676356.26	938198.37	335.258
676368.289	938195.409	356.33
636364.319	938192.449	333.336
676368.348	938189.448	350.561
676372.377	938186.528	350.528
676376.407	938183.568	349.57
676380.436	938180.607	349.314
676384.465	938177.647	336.852
676388.495	938174.686	336.426
676392.524	938171.726	336.839
676396.553	938168.765	336.841
676400.583	938165.805	346.601
676404.612	938160.847	335.186
676408.648	938159.892	346.322

676412.698	938156.961	346.327
676416.763	938154.049	346.33
676420.842	938151.158	335.276
676424.936	938148.287	335.358
676429.044	938145.437	335.304
676433.158	938142.596	335.258
676437.272	938139.754	356.33
676441.386	938136.913	333.336
676445.5	938134.071	350.561
676449.615	938131.229	350.528
676453.729	938128.388	349.57
676457.843	938125.546	349.314
676461.957	938122.705	336.852
676466.071	938119.863	336.426
676470.185	938117.022	336.839
676474.299	938114.18	336.841
676478.415	938111.341	346.601
676482.538	938108.541	335.186
676486.49	938105.7	346.322
676490.808	938102.89	346.327
679494.943	938100.08	346.33
676499.079	938097.271	335.276
676503.215	938094.461	335.358
676507.351	938091.651	335.304
676511.487	938088.841	335.258
675515.622	938086.031	356.33
676519.758	938083.222	333.336

676523.894	938080.412	350.561
676528.03	938077.602	350.528
676532.166	938074.792	349.57
676536.302	938071.982	349.314
676540.437	938069.173	336.852
676544.573	938066.363	336.426
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676552.845	938060.743	336.841
676556.981	938057.934	346.601
676561.117	938055.124	335.186
676565.252	938052.314	346.322
676569.388	938049.504	346.327
676573.524	938046.694	346.33
676577.66	938042.885	335.276
676581.796	938041.075	335.358
676585.932	938038.265	335.304
676590.067	938035.455	335.258
676594.205	938032.647	335.354
676598.354	938029.857	335.526
676602.517	938027.088	346.038
676606.694	938024.34	346.075
676610.884	938021.612	346.127
676615.086	938019.902	335.887
676619.289	938016.194	335.276
676623.492	938013.486	335.358
676627.695	938010.778	335.304
676631.898	938008.069	335.258

676636.101	938005.361	335.354
676640.302	938002.649	335.526
676644.48	937999.903	346.038
676648.63	937997.114	346.075
676652.759	937994.294	346.127
676656.887	937991.472	335.887
676661.014	937988.65	348.773
676665.142	937985.829	349.333
676669.269	937983.006	349.333
676673.397	937980.185	348.33
676677.525	937977.363	335.354
676681.652	937974.541	335.354
676685.78	937971.719	335.526
676689.907	937968.897	346.038
676694.035	937966.075	346.075
676698.162	937963.253	346.127
676702.29	937960.431	335.887
676706.417	937957.609	335.276
676710.545	937951.965	335.358
676714.672	937949.143	335.304
676718.8	937946.321	335.258
676722.927	937943.521	335.354
676727.069	937940.818	335.526
676731.276	937938.221	346.038
676735.548	937935.732	346.075
676739.885	937933.345	346.127
676744.278	937930.981	335.887

	676748.684	937928.616	348.773
	676753.089	937926.252	349.333
	676757.495	937923.888	349.333
	676761.901	937921.524	348.33
	676766.307	937919.16	335.354
	676770.713	937919.16	349.661
	676775.118	937916.196	349.661
	676779.524	937914.432	349.647
	676783.93	937912.068	349.647
	676788.336	937909.103	357.133
	679950.479	946498.189	349.661
	679950.491	946498.191	349.661
	679950.504	946498.018	349.647
	679950.518	946498.081	349.647
	679934.511	946685.294	357.133
	679950.555	946498.085	349.635
	679767.154	946487.096	350.567
	679889.863	946495.087	349.731
	679908.552	946495.934	350.484
	679922.324	946485.237	350.233
	679938.369	946482.334	350.012
YB	679942.726	946447.667	349.347
YB	679951.616	946494.93	349.402
muu	679954.166	946493.685	356.33
zsu	680052.252	946663.441	333.336
Pl	679877.555	946362.24	350.561
kp704cp	679790.101	946612.117	350.528

Rd1	679797.106	946608.52	349.57
Rd1	679798.963	946607.102	349.314
PL1	679951.493	946504.835	336.852
PL2	679778.794	946218.243	336.426
PL3	679773.011	946212.525	336.839
Rd2	679776.97	946218.623	336.841
Rd2	679776.992	946218.657	346.601
Rd2	679874.136	946428.193	335.186
	679884.297	946419.018	346.322
	679874.159	946428.114	346.327
	679935.313	946390.241	346.33
	679761.812	946401.236	335.276
IOT	679767.23	946400.507	335.358
IOT	679766.877	946397.766	335.304
IOT	679767.39	946393.899	335.258
IOT	679768.185	946392.132	335.354
IOT	679780.852	946390.63	335.526
Ep	679787.141	946389.368	346.038
Ep	679796.626	946383.742	346.075
IOT	679795.987	946382.484	346.127
IOT	679802.37	946376.284	335.887
IOT	679797.038	946362.095	335.276
IOT	679798.791	946356.995	335.358
IOT	679799.368	946350.984	335.304
IOT	679811.452	946351.109	335.258
IOT	679809.795	946338.021	335.354
IOT	679808.56	946332.144	335.526

IOT	679856.7	946402.607	346.038
IOT	679865.099	946413.267	346.075
AUD	679868.065	946417.833	346.127
AUD	679874.472	946430.042	335.887
AUD	679821.234	946466.003	348.773
AUD	679796.705	946483.775	349.333
RD1	679802.487	946480.038	349.333
RD1	679824.499	946474.962	348.33
STL	679992.15	946412.203	335.354
ACC	679928.325	946404.352	335.526
ACC	679947.108	946413.144	346.038
ACC	679966.022	946430.1	346.075
TREE	679954.869	946416.095	346.127
TREE	679951.942	946418.633	335.887
TREE	679946.089	946403.635	348.773
	679955.07	946420.288	349.333
	679970.027	946416.214	349.333
	679949.719	946391.003	348.33
EP	679953.97	946390.006	335.354
	679940.811	946369.187	335.526
	679926.79	946376.368	346.038
	679917.705	946382.196	346.075
	679921.791	946399.618	346.127
	679902.133	946412.212	335.887
	679886.129	946422.819	348.773
	679880.055	946408.541	349.333
	679894.626	946399.673	349.333

	679908.308	946390.299	348.33
	67896.923	946375.722	335.887
	679981.384	946376.767	348.773
STL	679878.204	946367.443	349.333
WT	679875.94	946369.131	349.333
WT	679876.93	946371.023	348.33
WT	679879.252	946369.096	335.276
WT	679881.127	946385.816	335.358
	679869.276	946393.585	335.304
	679903.999	946366.986	335.258
MSQ	679916.947	946363.527	335.354
MSQ	679910.932	946354.601	335.526
MSQ	679900.085	946357.584	346.038
MSQ	679912.022	943330.948	346.075
CARP	679908.229	946326.306	346.127
CARP	679872.245	946368.601	335.887
CARP	679868.541	946364.229	335.276
CARP	679863.66	946350.6	335.358
RECTOR	679879.993	946341.304	335.304
RECTOR	679868.976	946925.282	335.258
RECTOR	679873.052	946312.293	335.354
RECTOR	679866.974	946302.191	335.526
RECTOR	679842.011	946372.685	346.038
RECTOR	679842.007	946372.683	346.075
	679844.923	946386.445	346.127
	679830.916	946371.166	335.887
	679818.994	946358.6	348.773

	679805.906	946377.496	349.333
	679809.597	946383.496	349.333
	679816.535	946393.23	348.33
EP	6798626.452	946405.202	347.586
	679808.254	946421.525	335.276
	679799.138	946408.163	335.358
	679791.397	946395.303	335.304
	679773.316	946398.098	335.258
	679767.303	946409.27	335.354
	679770.338	946414.894	335.526
TREE	679782.687	946419.253	346.038
	679795.94	946435.294	346.075
	679802.913	946438.451	346.127
	679790.889	946448.778	350.752
STL	679790.165	946418.168	349.338
EP	679809.615	946383.514	348.733
EP	679822.886	946353.509	349.029
	679828.814	946348.826	349.377
	679840.564	946345.286	349.179
EP	679850.537	946338.807	348.3302
	679916.014	946412.481	353.37
	676917.035	946433.207	353.3308
ACC	679936.018	946460.231	355.228
ACC	679969.032	946503.296	356.711
WIREFENCE	679959.048	946497.993	356.208
	679944.204	946506.013	355.33
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	679928.906	946485.964	348.733
	679939.243	946476.365	349.029
	679929.081	946460.821	349.377
	679914.112	946468.615	349.179
	679904.141	946472.315	348.3302
	679887.739	946444.47	353.37
	679899.748	946438.196	353.3308
	679913.373	946434.103	355.228
	679844.744	946322.441	356.711
	679835.358	946308.958	356.208
	679820.262	946317.617	355.33
	679811.268	946322.831	350.752
	679792.405	946308.835	349.338
	679810.85	946298.029	348.733
	679823.981	946295.136	349.029
	679808.038	946293.822	349.377
EP	679804.218	943278.115	349.179
	679800.779	946273.668	348.3302
TREE	679791.67	946264.05	344.233
TREE	679803.187	946266.737	335.15
RD3	679812.433	946259.653	335.231
RD3	679813.059	946259.106	335.011
AUD	679822.607	946253.774	335.272
AUD	679791.984	946234.386	333.705
RD3	679786.581	946232.487	333.033
RD3	689758.276	946229.73	342.651

EP	679757.229	946231.852	342.609
	679776.672	946852.809	344.233
	679776.674	946282.812	335.15
PL5	679776.684	946282.8	335.231
PL5	679729.76	946217.895	335.011
IOT	679724.982	946202.784	335.272
IOT	679720.122	946191.069	333.705
IOT	679727.667	946189.137	333.033
IOT	679731.729	946185.142	342.651
IOT	679732.753	946173.222	342.609
IOT	679731.566	946156.504	344.233
IOT	679736.458	946160.546	335.15
IOT	679748.502	946150.008	335.231
IOT	679763.547	946135.015	335.011
IOT	679765.932	946123.941	335.272
IOT	679755.728	946154.631	333.705
IOTCAR	679761.208	946165.795	333.033
IOTCAR	673761.328	946181.224	342.651
IOTCAR	679759.198	946190.102	342.609
IOTCAR	679756.778	946198.261	344.233
IOTCAR	679748.325	946209.728	335.15
IOTCAR	679738.387	946216.575	335.231
IOTCAR	679729.133	946193.58	335.011
IOTCAR	679791.431	946273.704	335.272
PL5	679780.157	946220.381	333.705
PL4	679842.028	946222.811	333.033
AUD	6798280275	946219.97	347.857

RD	6798270872	946217.076	347.829	
RD	679701.552	946284.126	350.326	
PL6	679711.47	946286.216	350.3303	
	679726.233	946282.318	350.207	
	679749.786	946279.757	350.309	
	679766.964	946277.688	350.763	
	679778.44	946275.937	350.732	
	679916.412	946440.847	353.3304	
	679967.317	946502.488	351.3305	
LAB	679953.447	946495.441	352.013	
LAB	679932.711	946484.612	347.857	
LAB	679918.429	946477.254	347.829	
LAB	679896.597	946519.121	350.326	
LAB	679894.309	946524.58	350.3303	
	679887.459	946513.309	350.207	
	679877.034	946506.23	350.309	
	679866.745	946499.249	350.763	
	679877.531	946479.312	350.732	
	679890.763	946484.201	353.3304	
	679903.82	946489.798	351.3305	
	679914.965	946471.205	352.013	
	679899.523	946464.72	347.857	
STREETLIGHT		679888.742	946459.561	347.829
	679893.393	946446.288	350.326	
	679893.348	946446.299	350.3303	
	679905.506	9464510413	350.207	
	679920.122	946454.749	350.309	

	679889.219	946537.761	350.763
	679878.716	946559.804	350.732
LAB	697842.259	946566.147	353.3304
LAB	679841.218	946557.973	351.3305
LAB	679841.226	956557.965	352.013
	679841.179	946547.3	351.641
	679859.662	946543.615	350.33
	679863.356	946555.265	350.265
	679880.926	946552.61	349.3308
	679881.131	946539.771	350.088
	679894.893	946550.513	349.313
	679929.131	946546.304	348.562
	679910.9	946533.748	348.833
	679922.266	946531.412	348.533
	679923.969	946538.261	347.3301
	679925.312	946544.538	348.529
	679920.956	946549.028	347.3301
	679937.632	946530.579	347.28
	679942.359	946540.665	350.33
	679961.886	946536.949	350.265
	679954.955	946533.448	349.3308
	676899.008	946540.596	350.088
	679595.563	926077.774	349.313
	679584.498	926096.94	348.562
	679610.828	926041.662	348.833
	679530.083	926071.317	348.533
	680136.869	946468.048	347.3301

PL1	680118.501	946563.078	348.529
PL2	680162.982	946533.033	347.3301
	680143.539	946535.543	347.28
	680135.188	946537.814	350.33
	680129.161	946540.4	350.265
	680122.031	946540.418	349.3308
	680124128	946534.5	350.088
	680135.503	946524.907	349.313
	680126.966	946526.341	348.562
BLD	680117.808	946509.489	348.833
BLD	680099.807	946519.512	348.533
BLD	680087221	946500.313	347.3301
BLD	680112.801	946482.968	348.529
BLD	680108.689	946476.814	330.611
BLD	680121.514	946477.457	330.533
	6801127.184	946485.028	330.153
	680130.068	946491.122	330.333
	680139.799	946482.89	330.115
	680138.212	946490.96	330.633
	680144.614	946499.432	331.325
	680137.673	946509.715	331.3308
	680148.336	946516.23	332.375
	680119.823	946500.707	330.782
	680107.316	946507.273	330.3308
	680090.498	946515.917	330.611
	680087.674	946510.725	330.533
	680102.204	946503.742	330.153

680118.045	946493.463	330.333
680117.252	946475.535	330.115
680111.624	946463.279	330.633
680103.628	946455.397	331.325
680090.966	946444.463	331.3308
680083.202	946449.399	332.375
680073.893	946456.352	330.782
680079.016	946462.359	330.3308
680083.982	946469.515	330.611
680090.234	946464.677	330.533
680072.27	946470.994	330.153
680065.653	946471.062	330.333
680089.305	946429.839	330.115
680080.898	946436.514	330.633
680074.493	946442.448	331.325
680067.942	946444.048	331.3308
680060.661	946444.139	332.375
680057.18	946437.511	330.782
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680060.373	946426.062	330.783
680066.994	946421.446	330.88
680074.955	946416.657	330.03
680080.257	946413.373	330.26
680075.453	946407.571	330.3308
680067.385	496404.576	330.575
680060.997	946409.008	330.313
980055.631	946412.843	330.276

	680049.554	946408.475	330.3308
	680043.739	956401.831	330.577
	680051.182	946398.539	330.72
	680057.742	946394.685	330.855
	680052.102	946389.309	330.57

	680034.027	946378.19	330.378
BLD	680039.434	946385.919	330.379
BLD	680029.451	946392.61	330.33
BLD	680064.95	946449.304	330.116
BLD	680072.991	946462.481	330.178
BLD	680060.274	946470.863	330.3306
BLD	680026.388	946279.188	330.553
CP1	680026388	946279.188	330.553
CP1	687969.31	946303.241	330.035
CP1	679967.787	946291.188	330.722
CP2	679915.507	945264.285	330.035
PT4	679938.317	946279.995	330.722
BLD	679960.805	946294.594	330.429
BLD	679944.446	946328.264	330.3306
BLD	679957.896	946322.486	330.859
	679965.619	946311.485	330.622
	679970.16	946304.965	330.05
	679940.921	946298.082	330.256
	679970.341	946298.082	330.731