# FACILITY MANAGEMENT USING GIS APPROACH OF PART OF KWARA STATE POLYTECHIC MORO LOCAL GOVERNMENT ILORIN KWARA STATE


BY

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*HND/23/SGI/FT/0017*


**BEING A RESEARCH SUBMITTED TO THE DEPARTMENT OF SURVEYING AND GEO INFORMATICS, INSTITUTE OF ENVIROMET STUDIES (I.E.S), KWARA STATE POLYTECHNIC, ILORIN, KWARA STATE**

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## CERTIFICATION

This is to certify that this final year research project titled **FACILITY MANAGEMENT OF PART OF KWARA STATE POLYTECHNIC MORO LOCAL GOVERNMENT ILORIN KWARA STATE USING GIS APPROACH"**, meets the regulations governing the award of the degree of Higher National Diploma (HND) in Surveying and Geo-informatics Kwara State Polytechnic Ilorin, and is approved for its contribution to knowledge.

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**(Supervisor)** **Signature&Date**

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**Surv. I.I Abimbola.** ________________ **(Head of Department)** **Signature&Date**

**External Supervisor.** _________________
**Signature&Date**

# DEDICATION

I dedicate this work to God almighty, that author and finisher of faith for His love and mercy, which has brought me this far and to my father **Mr. Akinsola,** thank you for all you do before and during this program.

**ACKNOWLEDGEMENT**

I reserve my thanks to God almighty for sparing my life and providing me with wisdom to initiate this project.

Special thanks goes to my father, **Mr. Akinsola kayode O.** I honestly can't thank you enough, may the lord preserve you to enjoy the fruit of your labor (Amen). To my brothers **Akinsola Ayodeji O. and Akinsola Samuel O.** Thank you for solving my emergency needs. Na man una be. To my step mum, thanks for doing your best. To my younger siblings, **Akinsola Hannah oluwatosin** and **Akinsola . Samson,** thank you guys for being an encouragement

My appreciation also goes to my supervisor **Surv. Awoleye R.S.** of department of Geo-infomatics for Kwara State Polytechnic Ilorin. and Head of Department **Surv II Abimbola**, and also, a special thanks and appreciation goes to my lecturers in the department in person of **Surv. Ayuba Abdulsalam**, **Surv. Asonibare R.O Surv. A.G Aremu, Surv. B.F Diran, Surv. Williams kazeem** and **Surv. Kabir Babatunde** for their training and encouragement that I received. May God reward you all. Again, I wish to also express my gratitude to my course mate whose spend their time money and energy on directing me on how to run my project work.

Last but not least, I want to thank me for believing in me, I want to thank me for doing all these hard work, I want to thank me for having no days off, I want to thank me for never quitting, I want to thank me for always being a giver and trying to give more than I receive, I want to thank me for trying to do more right than wrong, I want to thank me for just being me at all times

## *Abstract*

*GIS based Facility Management Systems (FMS) offer several advantages over thetraditional analogue model and/or Computer-Aided Design (CAD)-based systems. For instance, they can integrate a campus location and facility management (building, floor and room location) into one package. The integration simplifies the querying of such data. The Kwara State Polytechnic ilorin mode of manual space inventory does not provide for querying the available data for the purpose of quick decision making; neither does it provide for a structured storage system. The objective of this study is therefore to develop, using an existing GIS tool kit, a method of setting up a typical geo-database for organising digital data so as to facilitate infonnation management, its visualization and illustration. In this project, a GIS database for the building of the Kwara State Polytechnic Ilorin has been created. As a result of time constraint, it was not possible to have a GIS database for every building of the College. From the U-Block database, one is able to extract information on space, such as the amount space available, the department to which some space is assigned, or even the maximum number of students a room can accommodate (stations) by integrating the different building plans, the attribute tables and the room pictures, it is possible to easily manipulate the data and display different views of the rooms, based on usage and assignment to departments. On the basis of this success of the U-Block database, it is recommended that a geodatabase for the entire school be established. Such an intranet-based system should permit the linking of the various building floor plans, facilities data and the general base map layers, which should then be accessed through some standard browser for visualization and reporting of space utilization across the entire school.*

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# CHAPTER ONE

# INTRODUCTION

## 1.1 Background of the Study

Often organizations such as government departments, municipalities, and universities have responsibilities over several constructed facilities like buildings, roads, railways and sewage lines, water, power and telephone lines, parks as well as other equipment necessary for the maintenance of the facilities. To manage such facilities often involves the linkage of a property asset management database to some form of large-scale digital map. Before the advent of the computer technology, the utility industry always relied on hardcopy maps to manage such facilities. However, with time, physical maps deteriorate, get lost or are misfiled. Where available, similar records are kept at different departments - (thus creating a waste of storage space); accessibility to data becomes insecure or impossible altogether. These shortcomings call for new tools and strategies, to not only drive down management costs, but also to improve on space management (Meyers, 1999).In any development and expansion of an institution's constructed facilities makes management of the same difficult. The development and subsequent expansion of the institution's constructed facilities has aggravates the difficulties of managing them. With the Facilities Management Systems (FMS) which are capable of handling the massive data being generated from these facilities. The data may be about the facilities themselves or the people and processes involved. These FMS are generally integrated with some form of Geographic Information Systems (GIS) queries. The integration is important to the facilities management application where the idea is to place spatial and attribute data in the hands of those who make decisions about how a utility can be maximized at minimum costs.

## 1.2 Statement of the Problem

Most institutions still relies on the old system of organizing, retrieving and updating hardcopy facility drawings, where available. There is no coordinated system for storing, accessing and updating the available documents related to the physical infrastructure of the institution.However, an analogue storage system cannot be recommended for the institution for the fact that the storage space required is enormous and updating the maps requires re-drawing the entire document. Lack of a centralized graphic database as well as computerized inventories of the institution, maintenance and operations to the extent that even space utilization is a nightmare. Therefore this study will be of great help to this institution in terms of utilization, maintenance and decision making will be improved.

### 1.3. Aim

The aim of this study is to develop, using an existing GIS tool kit, a method of setting up a typical geo-database for organizing digital data so as to facilitate information management, visualization and illustration, decision-making and project organization in the process of Facilities Management. The study helps in developing an integrated GIS database system of part of theKwara State Polytechnic ilorin which will enable the institution's management to have effective methods of resource utilization (such as space management) at the institution.

#### 1.3.1 Objective

**Reconnaissance**: is the most important of the series of survey. It is a rapid rough survey conducted to examine the territory through which the alignment line has to pass.

**Data Aquistion**: Geometric data acquisitions form the most important aspect of spatial data base creation. Geometric data base was acquired by land surveying method with the use of total station (Robustic) and its accessories.

**Data Processing**: The geometric data obtained on the field as a result of field observation were downloaded. It is the process where all the data acquired on the field were transferred from the memory unit of the Differential GPS with the help of downloading cable and software were downloaded into computer for further processing.

**Information Presentation:** This is the stage were coordinates are import and plot using software to generate maps.

**1.4 Significance of the Project**

The successful design and implementation of such a GIS database management system will provide answers to such questions as: which GIS-based tools are available for Facility Management?

1. What can these tools do?
2. What developments can be expected in the future?
3. How can GIS techniques be involved in the process of facilities management?
4. What are the benefits and limitations of a GIS database for facility management?
5. How can a typical database for facility management be constructed?

The end product of this project is therefore a geo-database for facilities management for the part of the Kwara State Polytechnic Ilorin. The database is built to illustrate the current capabilities of GIS based tools.

**1.5 Scope**

The data and information required for this project study is scattered at different buildings within the school premises. It is therefore required that all this be assembled together and then combined with data directly collected from the field. To achieve this, the scope of the project covered the following operations:

i. Capturing the locational and attribute data for the buildings for the purposes of geo-referencing the floor plans and by extension, rooms;

ii. Designing and creating a database using a combination of Access, A review GIS, ArcGIS and Excel software.

The objectives of the project are therefore to:

i. Identify the service utilities such as: Bulbs, Power sockets, Water taps etc. within the institution, to sustain the proper management of the facilities of the institution. These utilities can then be monitored and reported on frequently for performance improvement.

ii. Employ the selected service utilities in a G1S environment and test the capability of the system to create reports.

iii. Select appropriate GIS-based tools

iv. Create a GIS conceptual database schema for facilities management

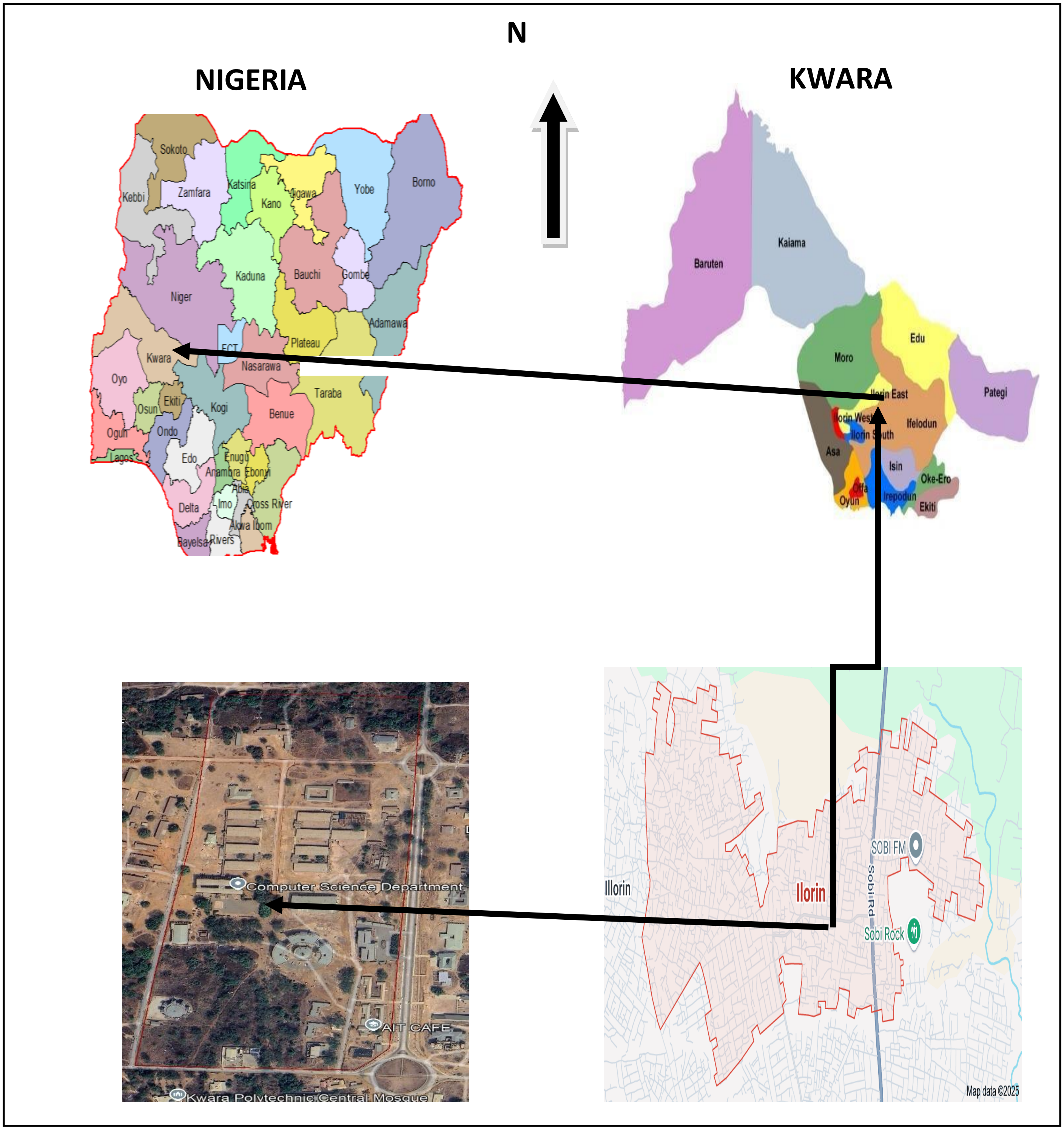
### 1.5.1 Personnel Involved

**Table 1.1: Personnel**

| | | |
|---|---|---|
| Akinsola Victoria Oluwabunmi | HND/23/SGI/FT/0017 | Author |
| Dauda Aishat Adebukola | HND/23/SGI/FT/0015 | Member |
| Abioye Azeez Opeyemi | HND/23/SGI/FT/0023 | Member |
| Salawu Kehinde Naomi | HND/23/SGI/FT/0016 | Member |
| Ibrahim Irewumi Fatimat | HND/23/SGI/FT/0018 | Member |
| Soliu Fatai Olusina | HND/23/SGI/FT/0020 | Member |
| Oni Isaac Ayodele | HND/23/SGI/FT/0025 | Member |

### 1.5.2 Study Area

Part of Kwara State Polytechnic Moro Local Government, Ilorin Kwara State. It covers about a total area of 26.29 hectares with geographical coordinate between 008°33'28"N to 008°33'38.05"N and longitude 004°38'11"E, to 004°38'19"E respectively.




IBASS

ILORIN

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1.0. A Facility

A facility is a building or place that provides a particular service or is used for a particular industry. It may be a space or an office or suite of offices; a floor or group of floors within a building; a single building or a group of buildings or structures, which may be in an urban setting or freestanding in a suburban or rural setting. The structures or buildings may be a part of a complex or office park or campus. A facility can also be thought of as a support service or physical resource of an institution which his key to the institution's business, for example, bulbs and water taps therefore, include such structures as grocery stores, auto shops, sports complexes, jails, office buildings, hospitals, hotels, retail establishments, roads, pipelines and all other revenue-generating or government institutions (Kenneth, 1995)). Kwara State Polytechnic Ilorin fits in the category of government institutions.

## 2.1.1. Definition of Facilities Management

Facilities management (also referred to as Asset management) encompasses all activities related to keeping a complex set-up of structures, people and processes operating. In an institution such as the Kwara State Polytechnic Ilori, the purpose of the facilities management would be to maintain proper operations of its buildings as physical resources. Facilities management could therefore be considered as a general term for the management of the space and assets contained within buildings and structures (Alexander, 2004). Here assets refer to floor areas, room areas, vertical penetrations such as lift shafts, and stairwells, as well as people or employees.

Due to the complexity of facilities and their characteristics, an integrating system that brings together both the spatial and the non-spatial data is required. Such a Facilities Management System (FMS) would then be said to cover the planning, control and management of buildings for optimum utilization of real estate, infrastructure, and maintenance. FMS would therefore be utilized, for instance, when one needs to know how many rooms there are on a floor of a building or how many desks and chairs there are in those rooms. Facilities Management Systems also help in determining the number of stations in a room. 'Number of stations' is an expression that identifies the capacity of a room for selected room-use categories. The concept of stations is an important one for classrooms, laboratories and other similar spaces, since it can help in determining the number of occupants a particular space (room) is designed to accommodate. This information is vital for comparing the designed capacity to the actual utilization or in assigning or scheduling the space.

The term ‘facilities management’ (FM) has been the subject of much debates inceits conception. Leaman (1992) suggests that ‘‘facilities management brings together knowledge from design and knowledge from management in the context of buildings in everyday use’’. He continues, remarking on the apparent differences between designers and modern day facilities managers. ‘‘The management (FM and Property Management) disciplines—which are less well defined as disciplines, but include maintenance, administration and financial management end to be much more short term, often day-to-day, in outlook. They deal with shorter timescales, the project deadline, the end-of-year financial statement, the quarterly report, the immediate crisis’’ .In opposition to this short-term position, Thompson (1990) argued for a more strategic view of the discipline, arguing that ‘‘real facilities management is not about construction, real estate, building operations maintenance, or office services. It is about facility planning—where building design meets business objectives’’.

A recent definition of FM places less emphasis on the built asset, focusing instead on the role of service provision in a support capacity. The European CEN definition of facility management is expressed as: ‘the integration of processes within an organization to maintain and develop the agreed services which support and improve the effectiveness of its primary activities’ (CEN EN 15221-1).

This definition makes no explicit reference to building operation. In so doing, it appears to bypass the role of the built environment in determining service out-comes. Moreover, it does not attempt to acknowledge the requisite skills of the property professional in meeting these outcomes. Perhaps the definition that has had the greatest longevity is that of the inter-national facilities management association (IFMA): ‘Facility management is a profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, process, and technology’ (Inter-national Facility Management Association

### 2.1.2. Developments in Facilities mapping and Management

Modem methods of managing facilities involve the application of integrating technologies such as GIS to bring together resources and activities to support decision-making in an organization (Wyatt, 2003). Management of facilities consists of such activities as inventory, inspection and maintenance, with more emphasis on graphical detail or precision. This shortcoming of dealing with only graphics has however been mitigated by the introduction of automated mapping technology which generally, utilizes limited database management systems (DBMS) technology (Barret, 2003) to relate tabular data to mapped area, for production of statistical or choropleth maps. The problems of handling data manually (either as maps or as tables), necessitated the introduction of Automated Mapping (AM) and Facilities Management (FM).

This was the realization that there was need to relate computerized tabular data with a data layer containing the local geography, e.g. rooms and specialized utility information such as telephone posts, bulbs and power sockets (Montgomery, 1993). During 1960s, 1970s and 1980s, special AM systems that could help organizations manage their facilities based on Database Management Systems (DBMS) technologies were developed. The combination of the functionalities in AM, FM and GIS result in an AM/FM/GIS system which moves facilities management beyond mapping to analysis and management of not only space, but the utility network as whole. It is necessary to note that facilities management is simply a specific GIS application that deals with utility facilities (Fig. 2.1).

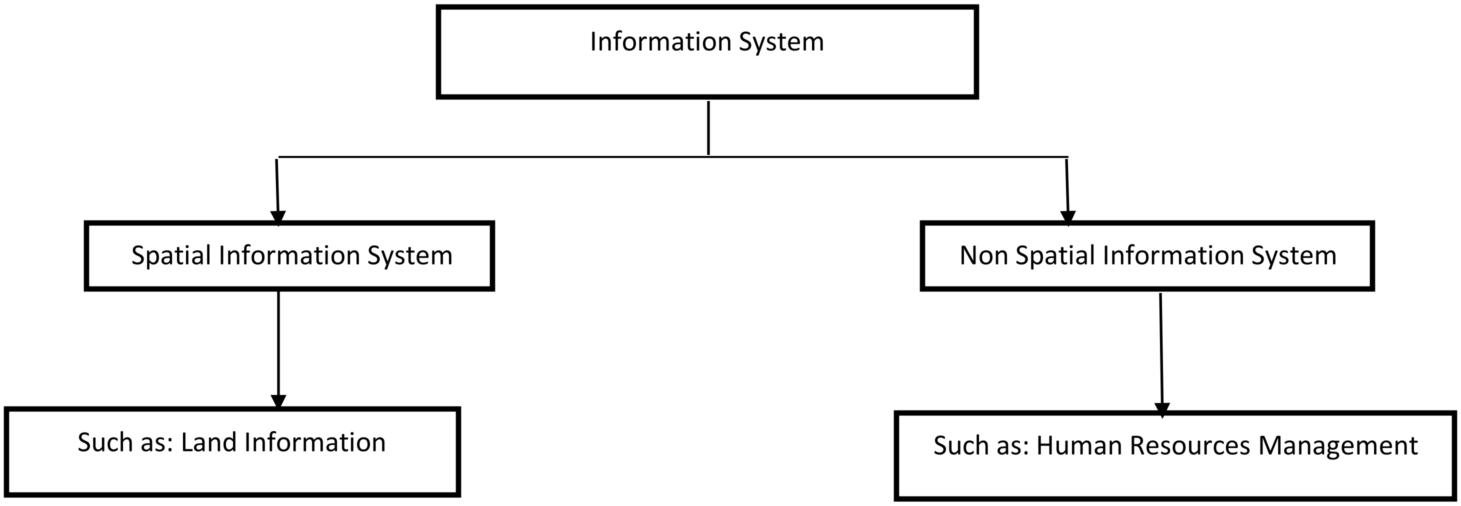



Figure 2.1 (Information System)

The concept of sustainable buildings continues to attract international attention in the wake of growing environmental demands. Much of the focus has been on the accommodation of sustainable principles in building design and the incorporation of retrofit solutions in the subsequent building life cycle. A fixation with technological remedies can, however, overlook the fundamental role of the facilities management team in ensuring the continued rectification and improvement of a building's performance. The idea of a sustainable building should not be one ofa 'product' but a 'process' subject to continuous improvement throughout its life. Much has been discussed about the failure of many 'sustainable' buildings to realize their energy saving potential. This failure in performance may arise at handover or may be evident over time as a general deterioration in performance. In this chapter, we consider 'sustainable buildings' as just that buildings that achieve high levels of performance, not just from day one, but throughout the building's life.

To achieve this, facilities management (FM) plays an indispensable part, tackling the complexities of people, process, and place. In this chapter, we consider the type of sustainable technology that can be used to leverage energy savings. The chapter discusses the vital importance of decision-making cycles that reflect the life of the building and the systems within it. The layered concept of building systems and the associated concepts of passive and active systems highlight the staged involvement of the facilities management team. The discipline of facilities management is a relatively new, yet largely mis-understood profession. At the heart of this role is the capacity to integrate. In theface of increasingly complex building systems, a greater diversity of user involvement and an aversion for operational risk, facilities management must attempt to resolve conflicts and identify synergies. It is perhaps no coincidence that the Portuguese word 'facilidade' or the Spanish word 'facilidad' the translation of 'facilities'—means 'ease' or 'easiness'. The idea of 'ease-of-use' is fundamental to the facilities management role. Yet, in the context of sustainability, with the headstrong desire to embrace new technology, the management challenge of making solutions accessible and appropriate is often overlooked.

The emergence of facilities management tells us something of its modern day role in supporting sustainability issues. The unprecedented need for integration in facilities today can be traced to the advent of two developments in the 1970s. The first of these was the introduction of computers and IT equipment in the office environment, which in turn presented challenges in relation to wiring, lighting ,acoustics, and territoriality. The second of these developments was the innovation of systems furniture or ''cubicles''. While attempting to provide a technological 'fix' to the IT challenge, cubicles presented new questions of their own: not least of which was who would take responsibility for procuring and managing such environments? The need for an integrating professional led to the development of the professional association 'International Facility Management Association' in1981 that has since spawned other professional associations worldwide.306 E. Finch and X. Zhang

### 2.1.3 Energy Operation and Management

It is useful at this point to consider the economic impact of FM and maintenance management. Yiu (2007) laments on the tendency to focus on design improvements as a means of improving the environmental, and hence economic return of buildings: ''Most studies focus on new designs that encourage more efficient use of natural resources, deliver pollution free and ecologically supportive urban landscape. When economic development is addressed, most focus on the increase of property value by these new designs. Unfortunately, there is very little discussion on the contribution of maintenance of existing buildings to sustainable development and those exceptions focus on environmental issues only'' Yiu (2007). In his study of the Hong Kong residential market (using sensitivity analysis), it was suggested that a 10 % reduction of housing depreciation could yield a 14 %increase in gross domestic product (GDP) in a decade, while costing only about2.3 % of GDP. Such figures resonate in other parts of the global property market and reinforce the argument that FM has a key role to play in sustainability target sand in delivering real financial returns.

### 2.1.4 Active Versus Passive Solutions to Building Operation

Sustainable technologies can be categorized under two broad headings: active and passive design. Passive design refers to building design solutions which do not require mechanical equipment for heating, cooling, ventilation, or day lighting. Their environmental performance is instead, determined by the characteristics of the building envelope (orientation, air permeability, exterior walls, doors, windows, and roofing), which in turn determine solar loss and gain. By careful specification of these design parameters, energy consumption and lifetime costs can be significantly reduced. The alternative, active design, refers to the use of artificial, mechanical, or electrical sustainable technology to control, heat, cool, or light a space (supporting air conditioning, lighting, vertical transportation, pumps, and fans among others) (Kibert 2008). A recent report published by Mikler et al.(2008) has itemized the major passive sustainable elements that influence energy consumption.

## 2.2.0. Geographic Information Systems (GIS)

### 2.2.1. Definition of GIS

Depending on different perspectives and also on an individual’s view, GIS may have different meanings; some people see it as a branch of information technology; others see it as a computer-aided mapping and cartographic application, while others see it as a set of spatial-analytical tools, a type of database system or simply another field of study (Lo,2002).

In this project, GIS definition is adopted as a collection of computer hardware, software, data, procedures and personnel that functions as an automated system for the capture, storage, update, retrieval, manipulation, analysis, management and display of all forms of geographically referenced information. Unlike other related technologies, such as Autocad, which are designed primarily for electronic drafting, GIS is designed as a mapping as well as a management tool. This characteristic is what makes GIS an appropriate technology for integrating (Fig. 2.2) and managing information about institutions such as the kwara state Polytechnic, Ilorin


Figure 2.2 GIS: An Integrating Technology

### 2.2.2. GIS Data and Concepts

In developing a GIS database for Facilities Management, preparation of GIS data layers is a pre-requisite. GIS data layer development is a process of digitally creating real world features (e.g., buildings, building floors, roads, water areas). The layers can be created from digitizing off hardcopy maps, converting Computer Aided Design (CAD) data into GIS formats, or from using remotely sensed data (aerial photographs, satellite imagery) to extract and create new GIS data sets. GIS data concerning facilities change quite often, for instance blowing of bulbs, change of offices and others. Tracking, documenting and reporting of these changes, therefore becomes an everyday reality for many organizations. To optimize these functions, GIS technology has been utilized.

### 2.2.3. GIS Applications

The use of GIS in the public sector has increased over the last couple of decades. More recently, GIS has been used in a variety of fields such as crime prevention, health care, urban re-planning, environmental policy as well as traffic control (Valcik,2003). As a practical tool for improving work processes, the GIS technology has many possibilities of application; for instance, rather than physically walk to a building to determine what type of light bulb needs replacement, this information can easily be accessed from a database.

### GIS Applications in Educational Institutions

Educational institutions have adopted GIS for various purposes:

- Campus Planning and Infrastructure Management: GIS aids in mapping campus utilities, optimizing space usage, and enhancing safety protocols.
- Resource Allocation: Through spatial analysis, institutions can allocate resources effectively, ensuring equitable distribution across departments.
- Maintenance Scheduling: GIS facilitates the scheduling of maintenance activities by identifying areas requiring attention based on spatial data.

For instance, a study at Ahmadu Bello University, Zaria, utilized GIS to assess the condition of staff housing units, revealing that one-third were in poor condition and highlighting the need for proper management.

### GIS-Based Facility Location Planning in Nigeria

In Nigeria, GIS has been instrumental in facility location planning, especially in rural areas. A study in Ogun State applied a GIS-based Spatial Decision Support System to evaluate the efficiency and equity of public health facility locations, demonstrating significant improvements in access and service delivery. These methodologies can be adapted for educational facility management to optimize resource distribution.

### Digitalization and Industry 4.0 in Facility Management

The integration of digital technologies, including GIS, Building Information Modeling (BIM), and the Internet of Things (IoT), has transformed FM practices. These tools facilitate real-time monitoring, predictive maintenance, and data-driven decision-making. A literature review highlights the role of these technologies in enhancing FM performance measurement and sustainability.

### Participatory GIS in Facility Management

Participatory GIS (PGIS) involves stakeholders in the mapping and decision-making processes, ensuring that local knowledge and needs are incorporated. This approach is particularly effective in community-based resource management and can be applied in educational settings to engage students and staff in FM initiatives.

**Case Studies Relevant to the Study Area**

- **Ahmadu Bello University, Zaria**

The development of a GIS-based facility management system for staff housing units at Ahmadu Bello University highlighted the importance of spatial data in assessing infrastructure conditions and planning maintenance activities.

- **Ogun State Health Facilities**

The application of a GIS-based Spatial Decision Support System in Ogun State demonstrated how spatial analysis could improve the efficiency and equity of public facility locations, a methodology applicable to educational institutions.

The integration of GIS into facility management offers significant benefits, including improved decision-making, efficient resource allocation, and enhanced maintenance planning. However, challenges such as lack of awareness, limited infrastructure, and data quality issues must be addressed to realize these benefits fully. Case studies from Nigerian institutions provide valuable insights into the practical applications and potential of GIS in FM.

## 2.3.0. Geographic Information Systems Technology in Facilities Management.

### 2.3.1. Information Technology in Facilities Management

Facilities Management (FM) has become a focus of attention for both the academics and the practitioners (Atkin, 2005). The former view it as a rapidly developing field that offers, among others, rich sources of data that can be used to explain or develop theories about how buildings and other constructed facilities are managed. The latter regard it as an opportunity for business or as a means for controlling operational costs, depending on whether there is a primary interest in providing FM services or in processing them. GIS is only one of the many information technologies (IT) that have transformed the ways geographic data have been used to conduct research and contribute to society.

### 2.3.2. The Process of Facilities Management

Facilities Management is not a one-time event, but a continuous process. Events like office moves, floor maintenance and re-modelling of a facility occur regularly .The basic materials within the process of facilities management are maps of the facilities and other physical characteristics of the local environment. Through the characterization of these maps at different stages, it becomes easy to visualize the various management processes. Facility management is therefore, all about planning and managing the various events which constitute the life cycle of a facility. It encompasses distinct but linked stages (life cycle): Concept, Development, Implementation, Operations and Maintenance, and Renewal or Termination.

During the conceptual stage, the idea of a facility is articulated and the planning and design of the project started (Dhruv,2006). This stage includes activities of preliminary Research and Development (R&D) which consists of verification of needs and requirements; assessment of technical feasibility, costs, benefits and risks; development of conceptual design; exploration of funding partnership, and definition of conceptual ( as opposed to final cost) schedule and performance goals. Under the development stage, project planning and design are completed and a proposal submitted, after which the project moves to the Implementation stage, where the project plan is executed. Implementation entails construction and/or acquisition, system integration, commissioning, testing, acceptance, transition to operation and management of these efforts.

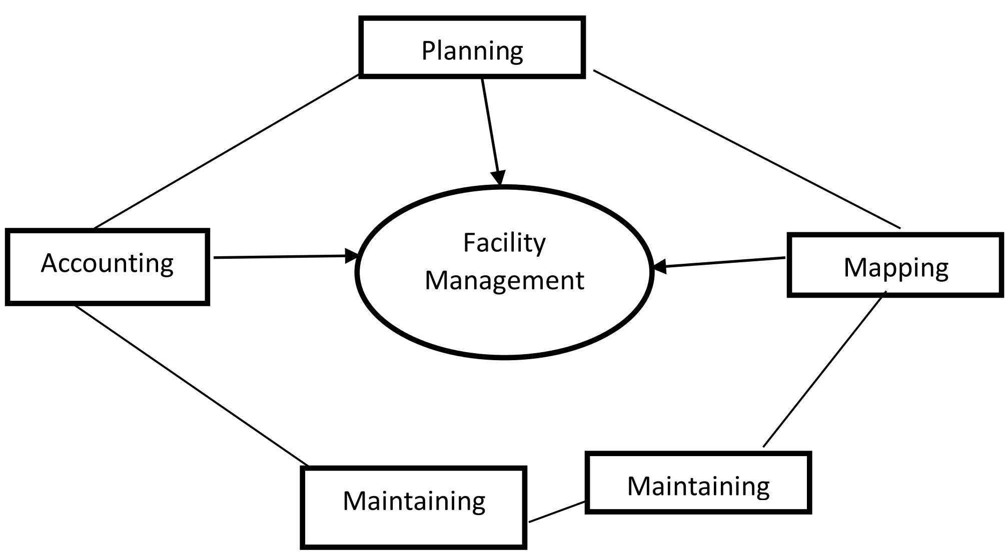



***Figure 2.3: Process of Facility Management***

The fourth stage, Operations and Maintenance on which this project is anchored, means the use of the facility for its intended purpose. At this level, often referred to as micro level facility management, is the maintenance and operations planning. As shown in Fig. 2.3, this is the stage at which five important processes take center-stage: planning, managing, maintaining, rationalizing and accounting for all the services associated to a facility, while at the same time trying to reduce the associated costs (Robeel,2006). For an educational institution, the O&M stage includes work required to support and conduct all forms of educational activities so as to ensure that the facility operates efficiently and cost-effectively. Like any other project, a facility has a time lifespan. The O&M stage also acts as a feedback stage, so that at the last stage, Renewal or Termination, decisions regarding continued support of the facility are made. Facility Management will be used to determine whether the facility will be renewed, upgraded or terminated.

### 2.3.3. GIS Technologies in the Process of Facilities Management

A variety of technologies and information sources are involved in the process of Facilities Management. The use of GIS in the public sector has increased over the last couple of years. A GIS utilizes automated mapping and DBMS technology to relate data to digital maps and to allow for the creation, storage, maintenance retrieval, analysis, and the display of the various geographic and tabular information in question. As already indicated, the power of GIS technology is in its ability to integrate database operations with visualization and analysis offered by a digital map interface. In FM, the technology is effectively used to manage such records as a built drawings, parcel information, utility data and facility use data. This ensures that such critical records receive effective protection from deterioration can be used in the process of FM, as explained in the following sections.

### 2.3.4. Spatial Representation

The goal of data representation in GIS is to provide spatial characterization of thematic 'layers' at desired scales and level of detail (Karl, 2006). The representation is usually an abstraction of reality, for instance, a point representing a city or a line representing a highway. Visualization of such geographic information can be done using a variety of techniques (Lo, 2002). The commonest five of these techniques are 2D plots, 3D plots, 2D planimetric view, 3D perspective view and animation. The techniques are used in different combinations depending on the objectives of the application and the types of the data being visualized. Representation of geographic features are usually represented in a GIS as spatial features with x, y and sometimes, with z and t (time) coordinates. As already indicated above, spatial features could be points, lines or polygons. In GIS, digital objects are used to represent entities in the real world while computational procedures represent real world processes.

#### 2.3.5. Three Dimensional Representation

3D representation is an expression commonly used to define the ability of making a virtual world, using 3D computer models so to give people a feeling of reality in the imaginary (virtual) world. In the traditional design process, designers always use perspective renders to express their design and planning ideas (Teicholz,2001). The components of the three dimensions of the real world that are so visualized are the spatial (variation in place), temporal (variation in time) and thematic (variation in characteristics).

#### 2.3.6. Web-Mapping System.

An organization with widely spatially scattered assets and facilities requires means and ways of viewing them on maps so as to keep track of any changes. For instance, a large manufacturing firm running different equipment at, say, five sites across a country needs to determine which assets are more than five years old so that they can forecast for the next year’s equipment purchase or maintenance budget (MyungHee et al, 2000). Using web-based application such as Online Spatial Information System (OSIS), any authorized staff member can access and query asset and facilities information using an intuitive graphical presentation system based on such packages as Autodesk Map Guide and presented in a standard web browser. The foregoing powerful spatial representation and visualization capability permits new ways of looking at, assets, civil or geospatial information. Such views can be applied to:

Space Management; Utility Tracking; Parking Analysis; Construction Planning; Emergence Preparedness, or any number of other areas, limited only by the quality and quantity of the information in the database.

### 2.4 Facility Management Techniques Using Internet GIS and Decision Support System

Thanks to the development of GIS Technique, modern society is fast developing that much easier predictions on real world can be possible by database needed to solve many problems-from human-facing big ones such as society, economy, culture, environment to small ones like gas pipe, electricity pipe, water supply pipe, sewerage pipe management or school facilities.

Since previous facilities management system was based on managing original map and attribute data separately, it's been very inefficient. In addition, despite the need of sorting and preserving the design map and data of construction, there're not enough space and good management, which has led to the loss of data, also making it hard to manage facilities effectively. Because of the separate management and network of previous data, it was inevitable to do the same work and wait for a long time before doing the job.

This was a considerably ineffective system timely or economically. Previous study did only process and print data, which was meaningless. It was necessary that supporting-information for decision making could analyze, unify, and prim previous data graphically so that it helps decision makers understand every situations and then take an action. Also, although space-analysis and calculation supported these processing of information, standard of accuracy was not clear and supported just simple level printing. So there wasn't any statistical space analysis. And not only mangers but also users of facilities felt uncomfortable and tended to wonder. The reasons and details whenever using them.

However, previous manager-inclined system tried to improve this and meet user's needs only to fail. The goal of this research is to establish the base of information unit by sharing information with relation organization, being scientific of facility management, and build network system to prevent investment of construction descriptive method which depends on experience or intuition, so that we intend to give consistent and precise regulation as far as possible. In the research observed in information sharing aspect, it used the internet in printing final system, and realized raster Web GIS and 2-Tier structured model from internet GIS technical tendency. As the campus is large and complicated with facilities containing enormous man-power, material and formless property, so this research is intended to suggest the need of GIS in decision-making, supporting and managing function of all facilities in campus.

### 2.4.1 Internet GIS

Internet is a global network of computers connected through communication devices to one another. It is a means for GIS users to exchange GIS data, conduct GIS analysis and present GIS output. Therefore, Internet GIS is a special GIS tool that uses Internet as a means to access and transmit remote data, conduct analysis and make GIS presentation.

At first, Internet and GIS advanced in independent fields. GIS installed and independent systems and addition devices with database established in local, whereas, Internet publicized multimedia-centered Internet information service thanks to the rapid growth of network which is an instrument of information-communication. So far the publication of WEB has shown the possibility that high costs aren't necessary for data process while sharing the data previously established in the active areas of SIG. It is realizing GIS in dispersion environment through network. Internet GIS is a system to exchange space data through Internet and to analyze, process the space data by a remote control. Internet GIS has been developed separately in data format and under client/server environment. Information-supply in data format is divided into raster and vector data again.

Information supply of raster data is a sever-centered service making client display mainly, that of vector data which not only servers but also clients are able to process geo-space data. This means proper apart division is possible in both sides. Since normal browsers like Netscape or Explorer don't support geo-spatial data, vector browser is needed which supports formats of vector data. The main function of way of data offer under the client/server environment is to store, manage geo-spatial data, and provide service. Multi-user process, display of geo-spatial data, and user interface are also possible. The concept of client/server involves splitting an application into tasks between the server and client. A client/server application has three components: a client, a server, and a network (Hall, 1994). Each of them is supported by specific software and hardware.

The client sends a request to the server, which processes the request and returns the result to the client, the client then manipulates the data and/or results and presents to the user. The connections between the client and server are established according to a communication protocol such as a TCP/IP. Internet GIS applies the client/server concept in performing GIS analysis tasks. It breaks down the task into server side and client side. The client can request for data, analysis tools or modules from the server. The server either performs the job itself and sends the results back to the client through the network, or sends the data and analysis tools to the client for use on the client side.

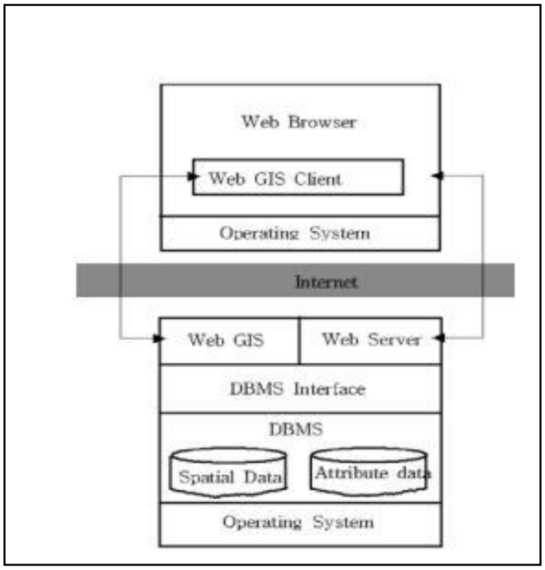



***Figure: 2.4 Concept of internet GIS***

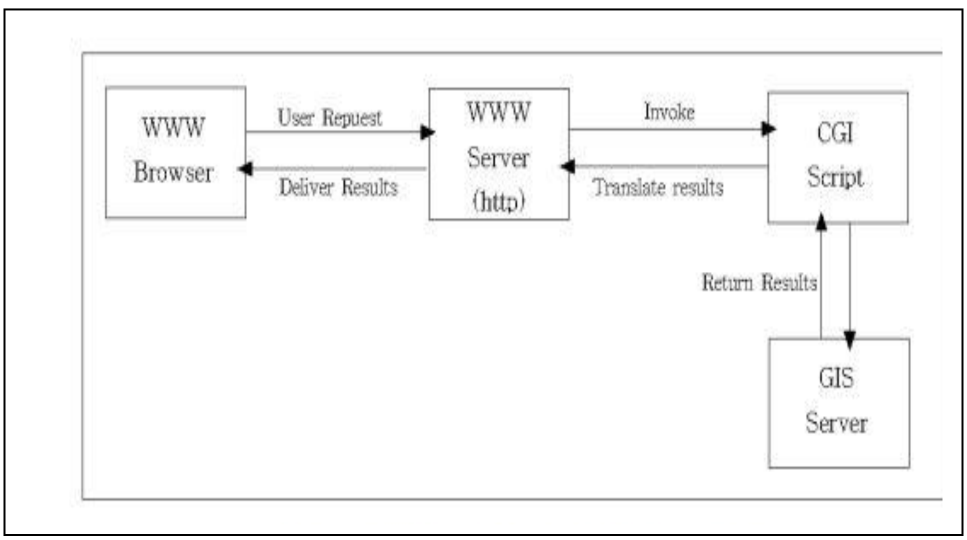



***Figure: 2.4.1 Work process of CGI Based Internet GIS***

## 2.5 Challenges in Implementing GIS for FM

As we all know GIS connects data from different sources, such as map tiles, satellite imagery and databases, to analyse and visualise spatial information. It processes geographic data to create maps, identify patterns and make informed decisions.

Implementing this system can be a complex process, fraught with technical challenges that can impact the successful implementation and use of spatial data and analysis tools. These difficulties arise from the nature of GIS technology and its integration into existing workflows and organizational structures. The multidisciplinary character of GIS requires collaboration between different departments and stakeholders, further complicating the implementation process. In addition, spatial data combined with evolving technological advances, adds another layer of complexity, so careful planning and ongoing evaluation are essential to overcome challenges and ensure the successful adoption and use of GIS.

### 2.5.1 GIS implementation challenges

Despite technological leaps, modern GIS practitioners still face significant obstacles that resemble, in some respects, the issues of the past. While improvements in cloud computing, open-source software, and affordable data storage have reduced the technical challenges, many organisational and data-related barriers remain or have evolved in complexity:

**Key contemporary issues include:**

- **Data Accessibility:** Despite the availability of open-source platforms and global repositories, many spatial datasets remain difficult to access or restricted by licensing agreements. For instance, while platforms like the Global Biodiversity Information Facility (GBIF) and Open Street Map provide accessible global datasets, specialized environmental, socio-economic, or infrastructure data often remain behind pay walls or administrative hurdles. The World Bank and the United Nations have repeatedly emphasized the importance of open data policies for sustainable development, yet progress is uneven globally (World Bank, 2021).
- **Data and Platforms Usability:** Data usability is defined as "the degree to which something is able or fit to be used" (Oxford English Dictionary). In software engineering, usability is a quality attribute that assesses how easy user interfaces are to use, defined by

five quality components: learn ability, efficiency, memorability, errors, and satisfaction. Even when data is accessible, issues with metadata, inconsistent formats, and varying spatial and temporal resolutions persist. Without high-quality, well-documented data, analysts must spend considerable time cleaning and harmonizing information rather than conducting meaningful analyses. A systematic literature review by Kurniawan et al. (2023) highlights the critical need for usability evaluations in GIS to develop more user-friendly applications. The study emphasizes that usability issues, such as poor metadata and inconsistent data formats, significantly hinder the efficiency of GIS projects by leading to fragmented data landscapes. This fragmentation makes it challenging for users to integrate datasets from various sources, thereby hindering large-scale analyses and comparisons. Furthermore, the authors argue that improved user guidance and more intuitive design are essential for enhancing data usability, particularly for novice users.

- **Data Validation:** Ensuring data accuracy and completeness is a key challenge in GIS Implementation. Diverse and incompatible data collection protocols among agencies and institutions can create inconsistencies that ultimately undermine trust in GIS outputs (Koldasbayeva et al., 2023). In the environmental and biodiversity sectors, globally validated datasets can be rare due to varied and sometimes incompatible data collection methods, resulting in methodological discrepancies that deter decision-makers (U.S. Environmental Protection Agency, 2024). Moreover, differences in resolution, standards, and the absence of standardised validation protocols across regions can further exacerbate these issues.
- **Capacity Gaps:** Governments, NGOs, and private-sector organisations, particularly in regions with limited resources, often lack the human capital and training needed to implement GIS effectively. The lack of trained professionals means that many organisations struggle to fully leverage GIS capabilities, which can impede data collection, analysis, and decision-making processes. Academic studies highlight that the gap in GIS capacity is not just about the number of trained individuals but also about the depth of their training and the availability of continuous professional development. For instance, a study by Murthy and Kishore (2018) emphasises the need for comprehensive training programs to build a robust geospatial workforce capable of meeting the demands of modern GIS applications. Similarly, Dakis (2016) points out that the absence of

institutional support and infrastructure further exacerbates these capacity gaps, making it difficult for organisations to sustain GIS initiatives. Moreover, the disparity in GIS capacity is often more pronounced in developing regions, where educational and training opportunities are limited. This creates a significant barrier to the effective use of GIS in addressing local and regional challenges. The need for targeted capacity-building interventions is critical to bridge these gaps and ensure that all regions can benefit from the advancements in GIS technology.

- **Organisational Inertia and Policy Gaps:** A state-of-the-art GIS system cannot deliver results if organisational culture resists change, fails to incentivise data sharing, or lacks clear policies guiding GIS integration into strategic planning. These institutional barriers, noted decades ago, remain pertinent today (Göçmen & Ventura, 2010; Skidmore, 2017).

# CHAPTER THREE

## 3.0 METHODOLOGY

This are the methods and procedure employed in executing the project both in office and on the field. The method adopted for this project was based on the principle of surveying which was working from whole to part, aimed at acquiring reliable and accurate data needed for the computation and presentation of information in form of a plan.

The procedure adopted in carrying out the project followed a pattern in which one step leads to another. For easy execution and for the aim and objectives of the project to be realized, it was planned as under listed;

i. Reconnaissance survey.
iii. Data acquisition.
iii. Data downloading and processing.
iv. Data analysis.
v. Information presentation.

## 3.1. RECONNAISSANCE

This is a very important aspect of surveying that involves planning and preliminary inspection of the area before the commencement of the actual data acquisition of the project site, this was done for the purpose of planning on how to execute the project, fixing stations, locating controls, etc. Its importance prior to the actual survey operation, it cannot be underestimated as it enables the Surveyor to have a clear view of the project area so as to give the best method to carry out the task. The two phases of reconnaissance are;

i. Office planning

ii. Field reconnaissance

### 3.1.1. OFFICE PLANNING

This involved the office work carried out before the actual field work. This aspect involved the compilation and study of the available information about the project site as this helped in yielding result within the expected accuracy. It comprises of the following;

i. Understanding the purpose of the survey from the project instruction.

ii. Obtaining the specification for the accuracy required leading to the choice of a suitable scale.

iii. Deciding the method to be employed for the measurements.

iv. The kind of instruments to be used in executing the project.

### 3.1.2. FIELD RECONNAISSANCE

The field reconnaissance was done after the office planning. It involved a visitation to the project site by all the group members to have a pre-requisite knowledge of how it looks like and how the field operations would be carried out. At the end of the visit, a sketch diagram known as “recce diagram” showing the physical appearance of the project site was drawn.

To sum it up, the reconnaissance facilitated the planning and execution of the actual survey as it was taking into consideration, the possible problems that are likely to be encountered, how such problems can be overcome or reduced to the barest minimum.

The diagram below shows the drawn recce diagram.

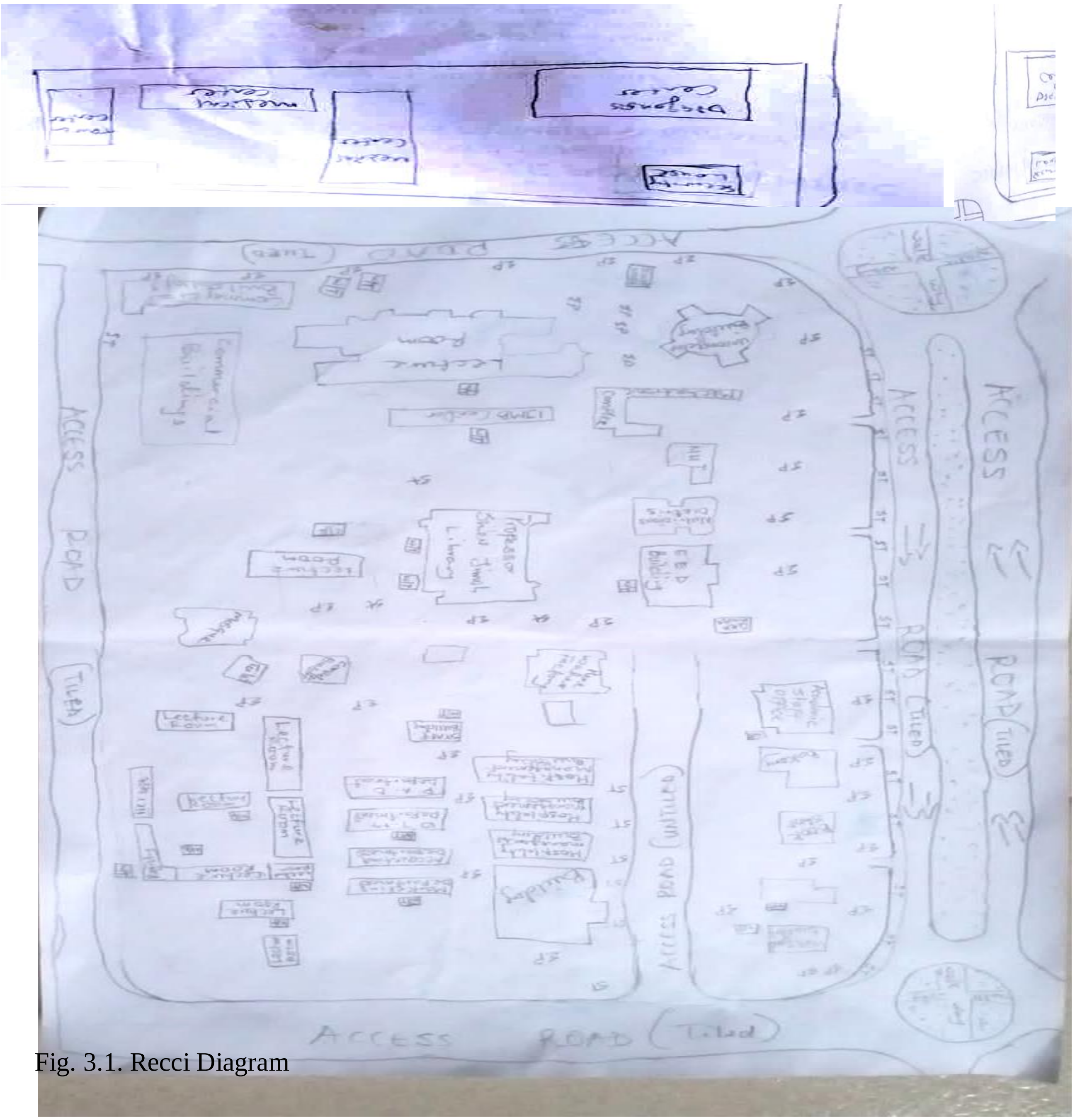



Fig. 3.1. Recci Diagram

## 3.2. BOUNDARY SELECTION AND MONUMENTATION

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

A total number of Nine (9) beacons were emplaced and prefixed with identification mark "PIL" where "PIL" represent property beacon, Pillar. The beacons were capped and numbered from Pil.1 to Pil.9 as obtained from the department of surveying, Kwara State Polytechnic, Ilorin and they were numbered in a clockwise direction with stencil.

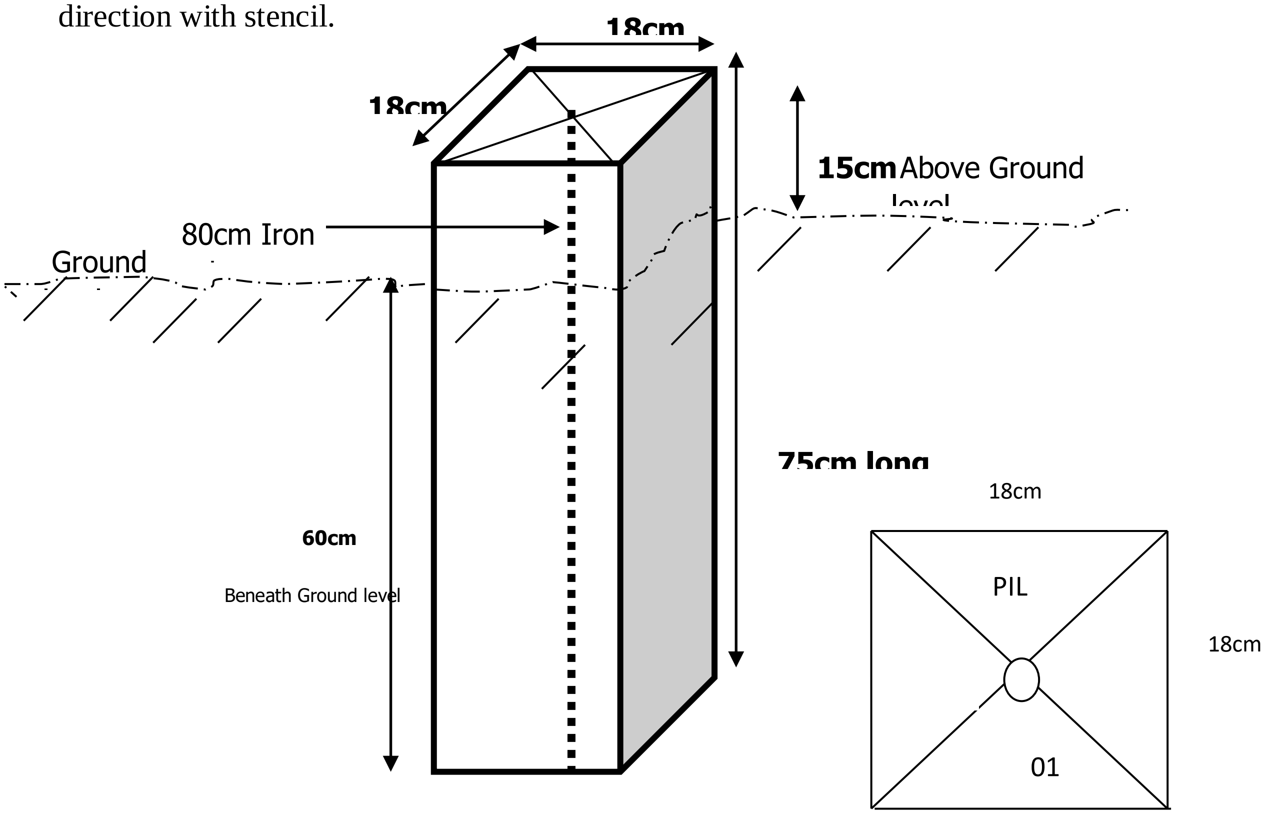


**Figure 1.9: Pre- cast property beacon**

## 3.3 EQUIPMENT SELECTION

The various equipment used for the acquiring of data and successful completion of this project were selected and was grouped in to two categories. They are;

### 3.3.1 Hardware

| | Hardware | Numbers |
|---|---|---|
| i. | Total Station (South NTS-350R) with its accessories. | 1 No. |
| ii. | Tripod stand | 1 No. |
| iii. | Tracking Rod / Reflector | 2 No. |
| v. | Tape of 30m | 1 No. |
| vi | Cutlass | 2 No. |
| vii | Handed GPS (Garmin 72SC) | 1 No. |
| viii | Total Station Batteries | 2 No. |
| ix. | Laptop computer | 1 No. |
| x | HP DeskJet | 1 No. |

### 3.3.2. SOFTWARE USED

The software used for the project includes;

i. ArcMap 10.3.

ii. Microsoft Excel

iii. Microsoft word

iv. NotePad

## 3.4 TEST OF INSTRUMENT

### 3.4.1 SOUTH (NTS-350R) TOTAL STATION TEST

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

### 3.4.2 PLATE LEVEL TEST

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

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

### 3.5.3 HORIZONTAL COLLIMATION TEST

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

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

### 3.5.4 VERTICAL INDEX ERROR TEST

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

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

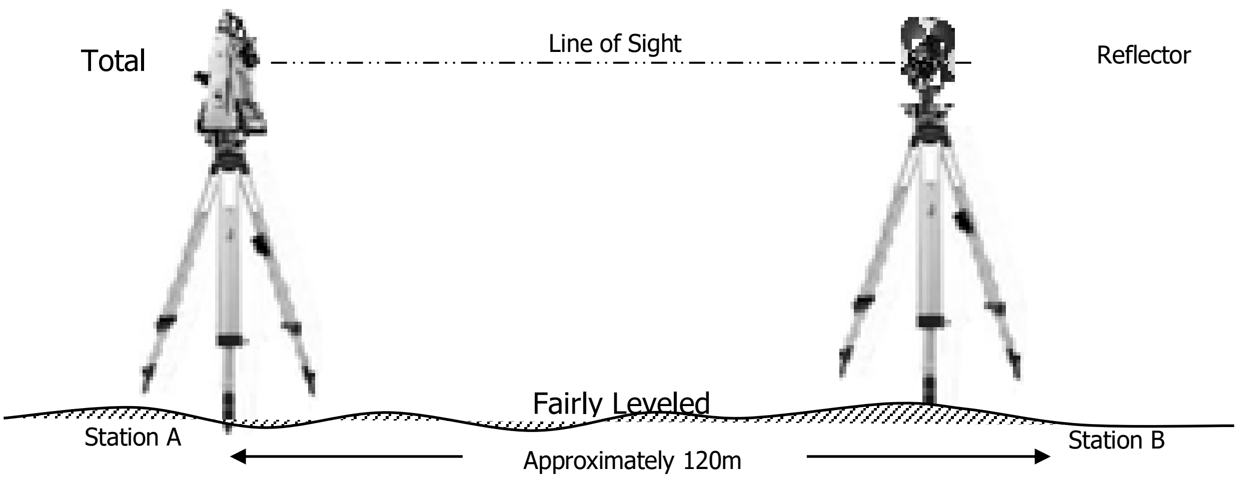



***Figure 1.6. : Instrument set-up for horizontal collimation test and vertical index test***

### 3.5.5 ANALYSIS OF COLLIMATION AND VERTICAL INDEX DATA

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

**Table 1.2: Horizontal and Vertical Collimation Test Reading**

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

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

= [(180º 00’ 02’ - 180º 00’ 00’’) /2]

= 00º 00’ 02’’/2

= 00° 00’ 01’’

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

= [(360º 00’ 01’’ - 360º 00’ 00’’)/2]

= 00º 00’ 01’’/2

= 00° 00’ 01’’

**Table 1.3: Comparison of Old and New Values.**

| HORIZONTAL COLLIMATION | OLD | NEW |
|---|---|---|
| | + 00º 00’ 02’’ | +00º 00’ 01’’ |
| VERTICAL INDEX | +00º 00’ 00’’ | + 00’ 00’ 01’’ |

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

## 3.6. DATA ACQUISITION

### 3.6.1 OBSERVATION PROCEDURE

Geometric data was acquired using South (NTS-350R) Total Station. Total Station is an integrated system combining Electronic Theodolite and Electromagnetic distance measuring device. It is an instrument with inbuilt software for selected programs, which made it possible to compute data. The system also includes storing unit which serves as the survey field book.

This task was achieved through the following procedures;

1. The instrument South (NTS-350R) was set up on a known station (KWPT733) and the bubble was centred and levelled.

2. The instrument was switched on and menu button was pressed to display the programs on the total station.
3. ***Data collect*** menu on the total station was selected to key in necessary information needed for commencement of the job. In the appeared dialogue box is Occp. Stn., Backsight and Fss. / SS
4. The information of the known station (KWPT734)was keyed into the Total Station under the ***Data Collect*** sub-menu (***Occp. Stn.)*** by opening a new file and naming the job. The station parameter N,E,H and height of instrument was entered in its appropriate space.
5. The second option was selected, which is the ***Backsight***, a submenu under the ***Data Collect***. Here the information of the target position N,E,H and height of reflector was keyed into the Total Station. After this was achieved, ***Measure*** button was pressed for orientation and to compute the bearing, distance and N,E,H of the target position. The result was compared with the given coordinates, when the difference between the given and the observed was seen to be minimal, a centimetre difference, ***OK*** button was pressed.
6. After the orientation. ***FS / SS*** menu was selected, which is a submenu under ***Data Collect*** and ***ALL*** button which captures and stores data automatically was pressed and observation to both natural and man-made features within the perimeter were fixed. A subsidiary traverse was run close to the interested feature and the above step was repeated at every point created until all the features were covered.

### 3.6.2 IN-SITU CHECK OF SURVEY CONTROL USED

The position of the control pillars used was checked before any other observation can be carried on. The check was done on control pillars (KWPT.733, KWPT.734 and KWPT.735). I set-up the Total Station instrument, centred and levelled it on KWPT.733 and the values control were keyed into the Total Station. The target position KWPT.734 was sighted and tracked and the result (Bearing, Distance, N, E, and H) was displayed as and checked finally recorded. The reflector was then positioned on KWPT.735 and was sighted and tracked and the results were also recorded and compared with given value of the pillar.

The result of the observed coordinates of pillar KWPT.733 was compared with the given coordinates. By specification the deviation in the distance and angle must not exceed 0.30m and 30'' respectively. The summary of the computation between the given coordinates and observed is shown in the table below.

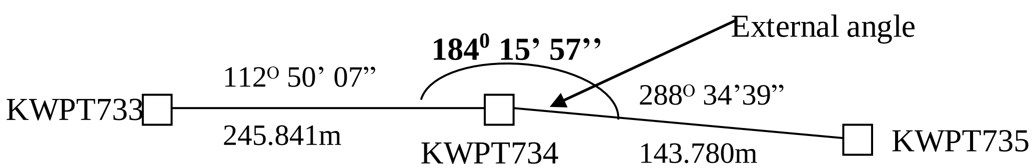



*Fig. 1.6 Shows the computed check angle and check distance as obtained from the control pillars.*

**Table 3.1: Result of the computed survey control check from given coordinate.**

| FROM STN | BEARING | DIST. (m) | DN | DE | NORTHING (m) | EASTING (m) | TO STN |
|---|---|---|---|---|---|---|---|
| | | | | | 946553.567 | 680054.213 | KWPT733 |
| KWPT733 | 182° 32'08" | 182.734 | -182.555 | -8.084 | 946371.012 | 680046.129 | KWPT734 |
| KWPT734 | 182° 05'27" | 493.386 | -493.058 | -18.001 | 945877.954 | 680028.128 | KWPT735 |

Source:Author, 2025.

The result was used to obtain the inclusive angle between KWPT733, KWPT734 and KWPT735 by finding the difference between the bearings of two lines.

KWPT734 ➙ KWPT733 => $002^0$ 32’ 08’’

KWPT734 ➙ KWPT735 => $182^O$ 05’27”

Therefore ($182^O$ 05’27” - $002^0$ 32’ 08’’)

Check angle ⇨ **$179^0$ 33’ 19’’**

**Table 3.2: Result of the computed survey control check from given coordinate.**

| FROM STN | BEARING | DIST. (m) | DN | DE | NORTHING (m) | EASTING (m) | TO STN |
|---|---|---|---|---|---|---|---|
| | | | | | 946553.567 | 680054.213 | KWPT733 |
| KWPT733 | $182^O$ 32’14” | 182.728 | -182.555 | -8.089 | 946371.012 | 680046.129 | KWPT734 |
| KWPT734 | $182^O$ 05’26” | 493.390 | -493.058 | -17.998 | 945877.954 | 680028.128 | KWPT735 |

Source:Author, 2025.

The result was used to obtain the inclusive angle between KWPT733, KWPT734 and KWPT735 by finding the difference between the bearings of two lines.

KWPT734 ➙ KWPT733 => $002^0$ 32’ 14’’

KWPT734 ➙ KWPT735 => $182^O$ 05’26”

Therefore ($182^O$ 05’26” - $002^0$ 32’ 14’’)

Check angle ⇨ **$179^0$ 33’ 12’’**

The difference between the Observed checked angle and the computed check angle

= (**$179^0$ 33’ 19’’**- **$179^0$ 33’ 12’’**) = **$00^0$ 00’ 07’’**

### 3.6.3 PERIMETER SURVEY

A perimeter survey covering the entire area was ran using the three Survey control pillars found to in-situ and the area covered by the survey was 26.808 Hectares.

### 3.6.4 OBSERVATION PROCEDURE

The Total Station was setup on kwpt734 and all the necessary temporary adjustment were done like centring, levelling and parallax removal. Then instrument was switched on and the parameters of the instrument station (Station I.D, Height of instrument and the N,E,H coordinate) were keyed in. The reference control point kwpt733 was then bisected and the parameters (back station I.D, Height of reflector over the target station, and the N,E,H coordinate) were also keyed in. After this process, the measured button was pressed and orientation is set. Foresight was made to kwpt735, which was my forward station and the reflector was bisected and tracked to measure the N,E,H value of the point, all the obtained coordinates N,E,H were checked and found correct before proceed to next measurement. The instrument was then moved to kwpt735 as my new instrument station values were keyed in and back sight to kwpt734 was used as my reference station. The same process was repeated from one boundary station to the next pillar from kwpt735 to Pil.1. In this manner, the traverse was ran through the boundary beacons and finally closed back on Kwpt734. A closed loop traverse was carried out and all field data were later downloaded and processed. The data was later downloaded as show on the appendix table.

### 3.6.5 DETAILING SURVEY

Comprehensive details Survey of all natural and man-made features along the survey line were carried out. Ray method with the total station was used for the detailing. Subsidiary points were established around the project area to allow features that cannot be pick from the boundary points be picked easily. The X, Y and Z coordinates, angles (vertical and horizontal) and distance to the point to be detailed were measured.

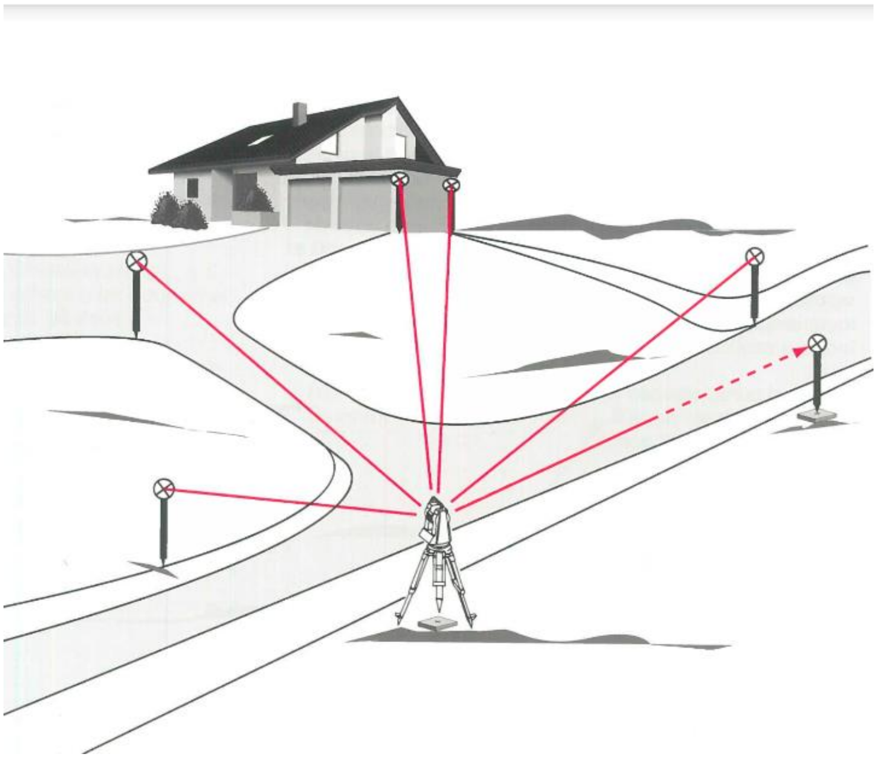


Fig. 1.8 Show the observation process of using total station.

### 3.6.6 PROCEDURES OF OPERATING SOUTH (NTS-350R) TOTAL STATION

The following steps were taken when operating South (NTS-350R) Total Station.

1. The tripod was set-up on the occupied station and the shoes of the tripod legs were adequately marched down to ensure that it grips the ground firmly.
2. The Total Station was mounted on the tripod and clamped adequately and the necessary adjustment was carried out to achieve centering and levelling of the instrument, the foot screws were used.
3. The instrument was then switched on and **MENU** button was pressed to display list of all programs resident on the Total Station.

4. **DATA COLLECT** was selected by pressing **1** on the key pad. Then the **MEAS. & COORD.File** dialogue box appears prompted me to name the job, I created the job by the name KWARAPOLY. **[F3]** was pressed to change the Numeric button to Alpha so as to key in my desired file name, and when this was done; **[F4]** was pressed to accept.
5. After achieving step 4, the **DATA COLLECT** dialogue box appear with the following sub-menu (*Occp. Pt., Backsight and Fs/ss*). Then I pressed on the key pad and to lunch **OCCP. PT.** on the name FEDPOFFA_TOPO. dialogue box. Here all the parameters (*Occp. Pt. ID, P code, Inst. Ht, N, E, N*) for occupy station was keyed into the Total station and **[F3]** button (**REC.**) was pressed and then **[F4]** button (**YES**) to accept these parameters in the occupy point environment. i.e. Occupy point, Pt-I.D, Pcode, Instrument Height H.I. Values.
6. The **DATA COLLECT** dialogue box re-appears when step 5 was completed and **2** was pressed on the keypad to activate **BACKSIGHT** sub-menu. In the appeared dialogue box, all the parameters (*BKP. PT. ID, P code, R. Ht. And N, E, H*) for backsight station was keyed in and **[F3]** (**MEAS**) button was pressed for orientation by sighting at the target station and bisecting it. By doing this, the orientation is set and the Total Station is ready for the coordination of new points. i.e
7. 489spt,679717.405,946223.476,318.638
8. 490confe,679724.363,946216.6,318.346
9. 491spt,679712.324,946222.709,318.634
10. 492spt,679700.275,946222.701,318.734
11. 493conf,679695.032,946217.477,318.649

7. After achieving step 6, the **DATA COLLECT** dialogue box reappears again and **3** was pressed on the keypad to lunch the **FS/SS** dialogue box. **F4** (**ALL**) button was then pressed to make observations to points of interest. As soon as this **[F4]** button was pressed, the Total Station automatically measures, records and stores the data into the internal memory of the instrument. This setting is peculiar to Kolida (KTS-462) Total Station. Where

   F.S means Fore sight

   Meas mean Measure

   N mean Northing Coordinate

   E mean Easting Coordinate

   H mean Height of Station

## CHAPTER FOUR

## 4.0. DATA PROCESSING AND RESULT ANALYSIS

### 4.1. DATA PROCESSING

All the data acquired from the field are required to be processed. It is this processing that makes the acquired data meaningful. The processed data is then used for map production.

After downloading the data into the computer system, the data is converted from document to excel form and save as .csv format (facility management.csv). Then the ArcMap was launched and the necessary parameters are set up, after setting the parameters the saved data file was imported.

### 4.2 DATA DOWNLOADING

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

* The South (NTS 350R) Total Station was connected to computer before switching "ON" the computer and total station.
* The computer was switched "ON" and allowed to complete the booting operation.
* The Total Station was switched "ON"
* On the Total Station "MENU" key was pressed to open the program page
* F3 key was pressed to select "Memory Manager".

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

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

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

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

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

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

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

## 4.2 COMPUTATION OF SURVEY DATA

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

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

1) Averaging of multiple angles and distances observations;

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

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

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

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

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

7) Computing coordinates of surveyed points from horizontal angle and horizontal distance components (supplemented with keyboard input of coordinates for the occupied station, and a reference azimuth). Furthermore, the microprocessors of total station perform

traverse computations and simultaneously calculate and store station coordinates and elevation.

## 4.2. PROCESSING IN ARCMAP 10.3

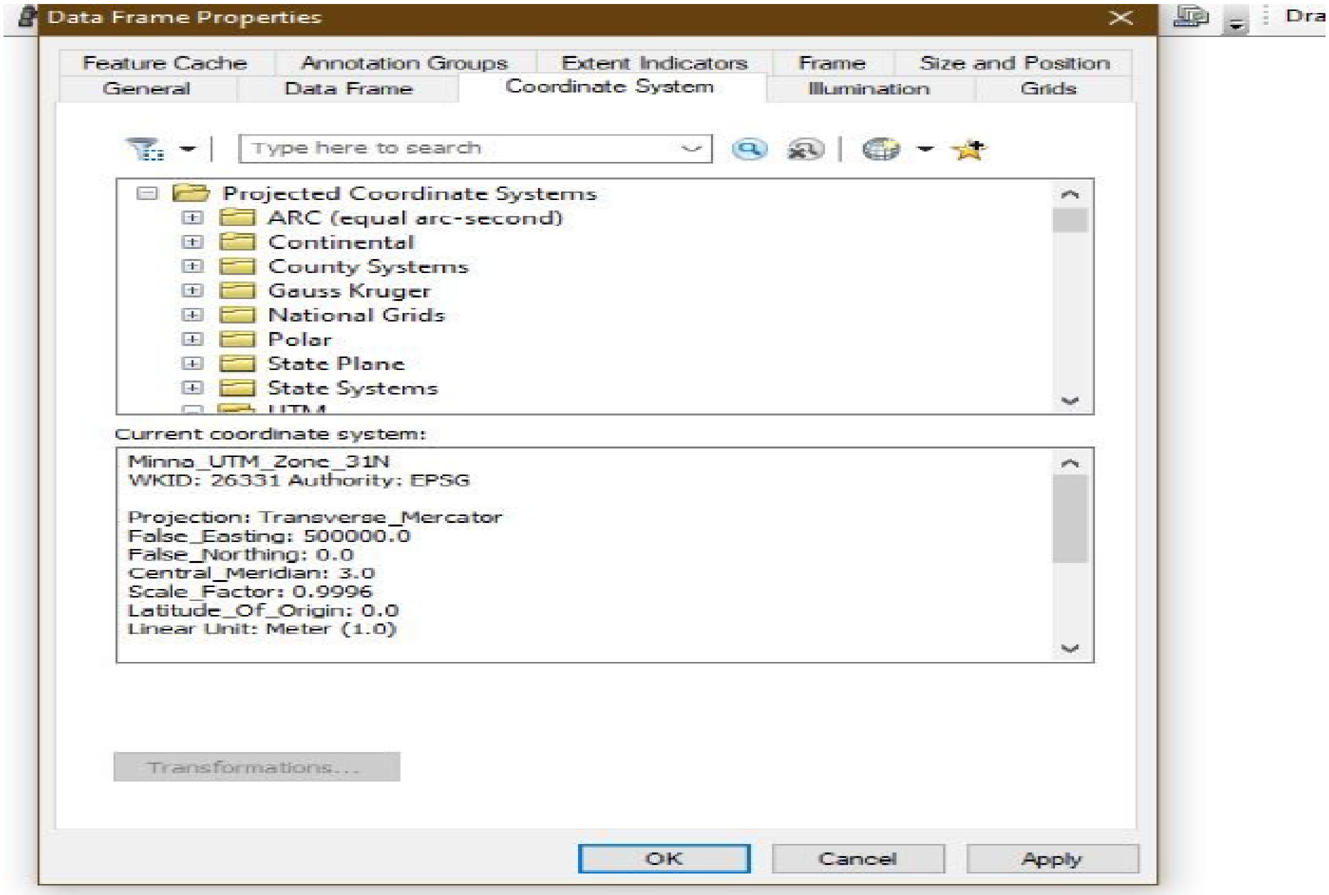
After acquiring the data from the field, it is then processed using the arcmap 10.3 software to produce a digital map of the project area. The following are the steps involved;

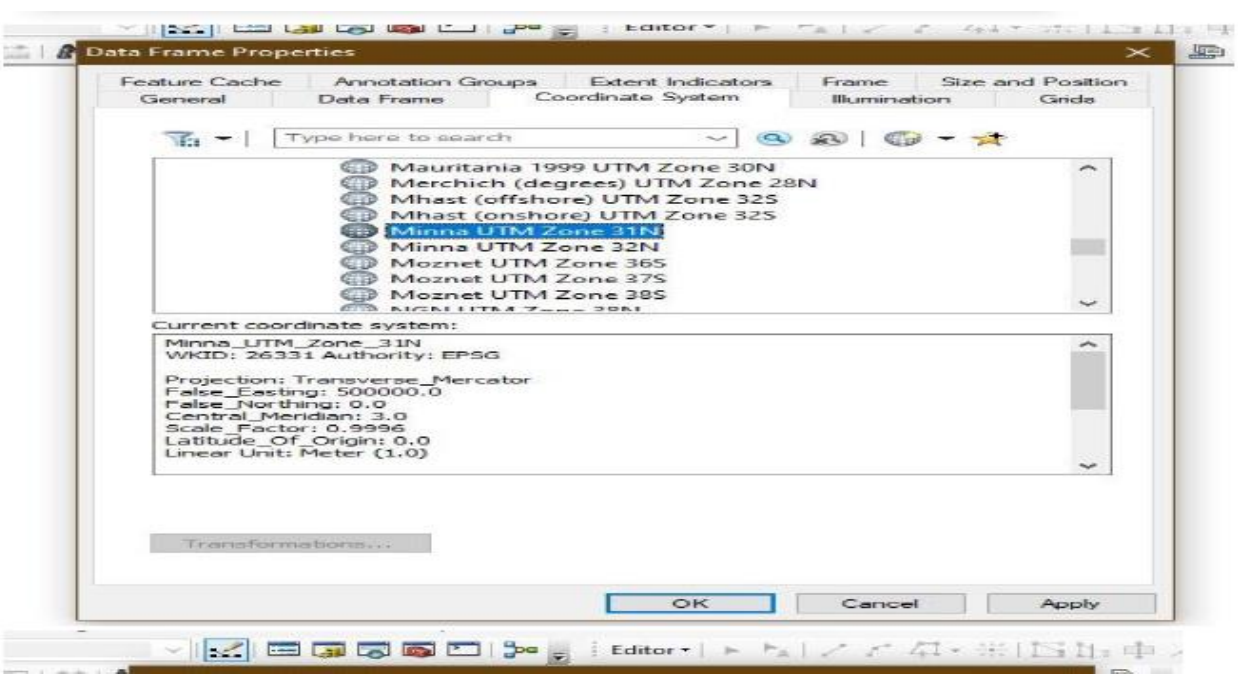
- **Unit settings**: - this is the setting up of the primary units for the drawing. In ArcMap 10.3 the following steps described below are the procedure to set up the primary unit.

STEPS

* Double click on the ArcMap10.3 icon on the desktop (allow the software to lunch).
* Then click on cancel button (to open new fresh ArcMap10.3).
* Right click on the ArcMap10.3 window and select Data Frame Properties, then the Data.
* Frame Properties dialog box appear.
* Then select Coordinates System from the list and go to Projected Coordinate Systems and select UTM.
* On the drop down select Africa and the drop down to select Minna Zone 31(as the Datum Reference).
* Then click Apply and then select ok (the dialog box disappears).

Note: the scale box under the processing Menu will be on.


Data Frame Properties
Feature Cache
Annotation Groups
Extent Indicators
Frame
Size and Position
General
Data Frame
Coordinate System
Illumination
Grids
Type here to search
Projected Coordinate Systems
ARC (equal arc-second)
Continental
County Systems
Gauss Kruger
National Grids
Polar
State Plane
State Systems
Current coordinate system:
Minna_UTM_Zone_31N
WKID: 26331 Authority: EPSG
Projection: Transverse_Mercator
False_Easting: 500000.0
False_Northing: 0.0
Central_Meridian: 3.0
Scale_Factor: 0.9996
Latitude_Of_Origin: 0.0
Linear Unit: Meter (1.0)
Transformations...
OK
Cancel
Apply


Data Frame Properties
Feature Cache
Annotation Groups
Extent Indicators
Frame
Size and Position
General
Data Frame
Coordinate System
Illumination
Grids
Type here to search
Mauritania 1999 UTM Zone 30N
Merchich (degrees) UTM Zone 28N
Mhast (offshore) UTM Zone 32S
Mhast (onshore) UTM Zone 32S
Minna UTM Zone 31N
Minna UTM Zone 32N
Moznet UTM Zone 36S
Moznet UTM Zone 37S
Moznet UTM Zone 38S
Current coordinate system:
Minna_UTM_Zone_31N
WKID: 26331 Authority: EPSG
Projection: Transverse_Mercator
False_Easting: 500000.0
False_Northing: 0.0
Central_Meridian: 3.0
Scale_Factor: 0.9996
Latitude_Of_Origin: 0.0
Linear Unit: Meter (1.0)
Transformations...
OK
Cancel
Apply
Editor

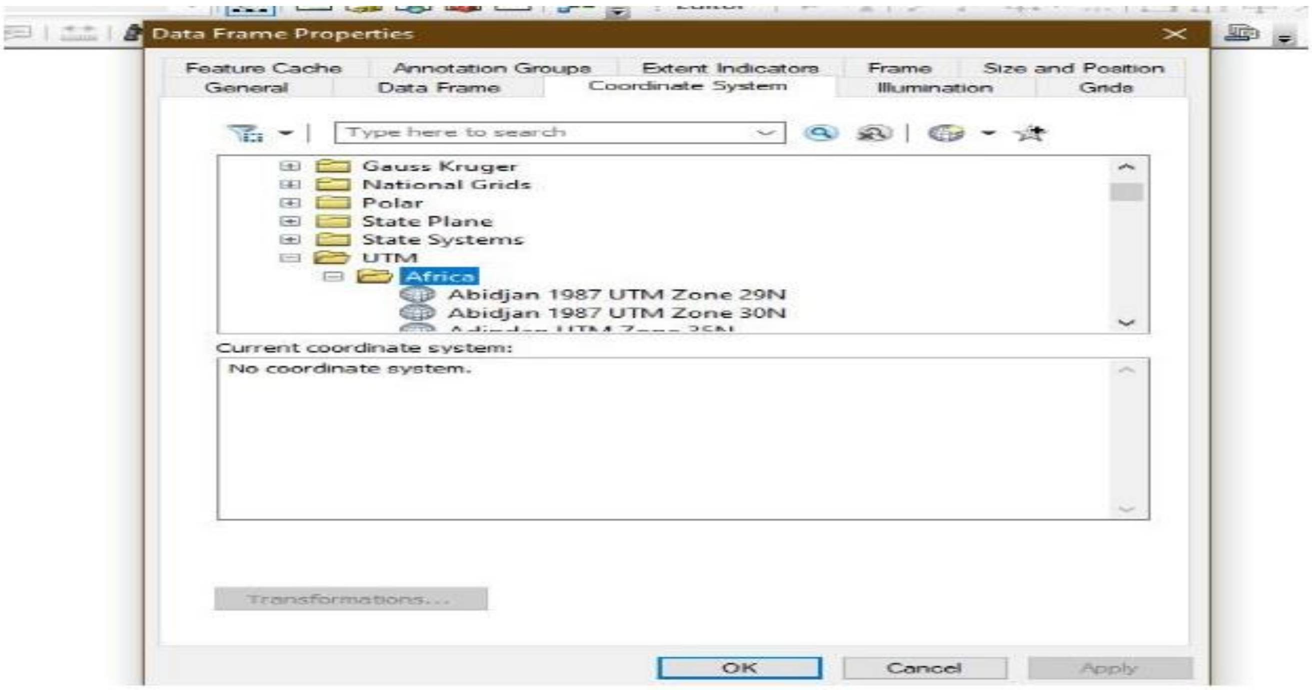



Fig 4.1. setting of units on ArcMap

✓ **Adding data**: - after setting up the primary units, then the data can be added to the

ArcMap10.3, at this stage there two options of data to be add to the ArcMap10.3 i.e. Vector data or Raster data. The practical comprises of Vector data procedures is as follows.

Adding Vector data.

STEPS

* Select File from the Menu, the go to Add data and the drop down show the following:
* elect Add XY data (then Add XY data Dialog box appear).
* Then click on the Folder icon to navigate to the store files.

* After navigate to the folder where the data was stored, select the required folders saved with name (facility management), and

* Click on add data and it will go back to the add XY data.

* Then select the necessary field to the data e.g. column of easting for X and column of northing for Y and column of Z field for Height.

* Then click ok and the point will display on the window.

* Go to table of content on the left corner of the window and right click on the layer of the point key.

* Then select label feature and the names of the features will be labeled according to how the data was saved during capturing.

oi

| FID | Shape * | Field1 | Field2 | Field3 | Field4 |
|---|---|---|---|---|---|
| 0 | Point ZM | Pt1 | 680431.278 | 946530.245 | 366.462 |
| 1 | Point ZM | Pt2 | 680423.49 | 946537.066 | 366.592 |
| 2 | Point ZM | Pt3 | 680405.861 | 946540.917 | 366.205 |
| 3 | Point ZM | bld1 | 680335.907 | 946508.052 | 363.167 |
| 4 | Point ZM | bld2 | 680323.604 | 946508.533 | 362.816 |
| 5 | Point ZM | bld3 | 680397.588 | 946439.822 | 361.285 |
| 6 | Point ZM | bld4 | 680398.419 | 946400.54 | 359.278 |
| 7 | Point ZM | bld5 | 680371.214 | 946419.246 | 359.862 |
| 8 | Point ZM | bld6 | 680370.046 | 946416.774 | 359.646 |
| 9 | Point ZM | bld7 | 680372.612 | 946415.52 | 359.752 |
| 10 | Point ZM | bld8 | 680373.825 | 946418.409 | 359.946 |
| 11 | Point ZM | bld9 | 680388.785 | 946400.723 | 359.197 |
| 12 | Point ZM | bld10 | 680388.817 | 946398.894 | 359.214 |
| 13 | Point ZM | bld11 | 680388.177 | 946370.007 | 357.607 |
| 14 | Point ZM | bld12 | 680395.897 | 946369.698 | 357.659 |
| 15 | Point ZM | bld13 | 680396.716 | 946398.915 | 359.346 |
| 16 | Point ZM | Wt1 | 680400.932 | 946390.148 | 358.819 |
| 17 | Point ZM | Wt2 | 680401.038 | 946391.765 | 359.005 |
| 18 | Point ZM | Wt3 | 680399.547 | 946392.041 | 359.006 |
| 19 | Point ZM | Wt4 | 680399.242 | 946390.296 | 358.899 |
| 20 | Point ZM | bld14 | 680378.008 | 946350.756 | 355.82 |
| 21 | Point ZM | bld15 | 680378.09 | 946340.86 | 355.375 |
| 22 | Point ZM | bld16 | 680329.062 | 946341.57 | 355.141 |
| 23 | Point ZM | bld17 | 680329.014 | 946351.505 | 355.215 |
| 24 | Point ZM | bld18 | 680314.143 | 946344.905 | 354.669 |
| 25 | Point ZM | bld19 | 680304.169 | 946345.049 | 354.589 |
| 26 | Point ZM | bld20 | 680314.491 | 946388.55 | 357.428 |
| 27 | Point ZM | bld21 | 680315.374 | 946390.854 | 358.28 |
| 28 | Point ZM | bld22 | 680329.247 | 946399.6 | 358.166 |
| 29 | Point ZM | bld23 | 680329.188 | 946389.877 | 357.351 |
| 30 | Point ZM | bld24 | 680373.394 | 946389.306 | 357.961 |
| 31 | Point ZM | bld25 | 680373.545 | 946399.131 | 358.77 |
| 32 | Point ZM | Wt5 | 680331.464 | 946403.645 | 358.652 |
| 33 | Point ZM | Wt6 | 680331.343 | 946402.316 | 358.685 |
| 34 | Point ZM | Wt7 | 680332.996 | 946402.064 | 358.748 |
| 35 | Point ZM | Wt8 | 680333.052 | 946403.638 | 358.624 |
| 36 | Point ZM | bld26 | 680304.134 | 946433.235 | 359.839 |
| 37 | Point ZM | bld27 | 680304.221 | 946435.56 | 359.222 |
| 38 | Point ZM | bld28 | 680304.336 | 946442.769 | 359.52 |
| 39 | Point ZM | Wt9 | 680309.801 | 946444.07 | 359.792 |
| 40 | Point ZM | Wt10 | 680309.769 | 946445.4 | 359.623 |

1 (0 out of 503 Selected)

Fig 4.2. Adding of data

Electric poles

Table

ELECTRIC_POLES

| OBJECTID * | SHAPE * | NAME |
|---|---|---|
| 1 | Point | E.P |
| 2 | Point | E.P |
| 3 | Point | E.P |
| 4 | Point | E.P |
| 5 | Point | E.P |
| 6 | Point | E.P |
| 7 | Point | E.P |
| 8 | Point | E.P |
| 9 | Point | E.P |
| 10 | Point | E.P |
| 11 | Point | E.P |
| 12 | Point | E.P |
| 13 | Point | E.P |
| 14 | Point | E.P |
| 15 | Point | E.P |
| 16 | Point | E.P |
| 17 | Point | E.P |
| 18 | Point | E.P |
| 19 | Point | E.P |

19 (1 out of 19 Selected)

ELECTRIC_POLES

Building

BUILDING

| OBJECT | SHAPE * | SHAPE_Length | SHAPE_Area | BLD_NAME | BLD_PURP | BLD_COND | BLD_YR_CONS |
|---|---|---|---|---|---|---|---|
| 24 | Polygon | 197.25 | 2419.43 | JAMB HALL | EXAM | GOOD | 5/5/2001 |
| 25 | Polygon | 144.08 | 1265.85 | ACCESS BANK | FINACIAL | GOOD | 3/2/1994 |
| 26 | Polygon | 115.11 | 811.16 | DIAGONY CENTRE | HOSPITAL | GOOD | 5/9/1989 |
| 30 | Polygon | 5.64 | 1.95 | TOILET | REST ROOM | FAIR | 6/7/2006 |
| 33 | Polygon | 84.49 | 255.34 | MEDICAL-C | HOSPITAL | GOOD | 3/4/1985 |
| 35 | Polygon | 118.63 | 417.64 | MEDICAKL-A | HOSPITAL | GOOD | 3/2/1994 |
| 36 | Polygon | 64.04 | 252.98 | COMMERCIAL BA | FINACIAL | GOOD | 5/9/1989 |
| 38 | Polygon | 97.18 | 169 | ADMISSION OFFI | ADMIN | FAIR | 3/2/1994 |
| 39 | Polygon | 35.65 | 48.48 | ADMISSION OFFI | ADMIN | FAIR | 3/6/2002 |
| 40 | Polygon | 59.47 | 182.5 | ADMISSION OFFI | ADMIN | FAIR | 6/7/2006 |
| 41 | Polygon | 52.56 | 170.36 | ADMIN BLOCK-B | ADMIN | GOOD | 3/2/1994 |
| 42 | Polygon | 118.55 | 334.99 | ADMIN BLOCK-A | ADMIN | GOOD | 3/6/2002 |
| 43 | Polygon | 147.67 | 416.58 | ADMIN BLOCK-C | ADMIN | GOOD | 3/2/1994 |
| 49 | Polygon | 139.57 | 949.15 | CHEMISTRY-LAB- | LECTURE | FAIR | 3/6/2002 |
| 50 | Polygon | 139.57 | 949.15 | CHEMISTRY-LAB- | LECTURE | FAIR | 3/2/1994 |
| 51 | Polygon | 139.57 | 949.15 | BIOLOGY LAB | LECTURE | GOOD | 5/9/1989 |
| 52 | Polygon | 139.57 | 949.15 | GEOGRAPHY LAB | LECTURE | FAIR | 3/2/1994 |
| 53 | Polygon | 232.45 | 1757.64 | BILOLGY LAB-B | LECTURE | FAIR | 3/4/1985 |
| 54 | Polygon | 5.44 | 1.82 | TIOLET | REST ROOM | FAIR | 6/7/2006 |
| 55 | Polygon | 167.74 | 1389 | SIWES UNIT | ADMIN | GOOD | 3/6/2002 |
| 56 | Polygon | 334.99 | 1905.9 | I.O.T COMPLEX | LECT/OFFI | GOOD | 5/5/2001 |
| 57 | Polygon | 113.01 | 470.08 | ESTAB-A | ADMIN | FAIR | 5/9/1989 |
| 58 | Polygon | 113.01 | 470.08 | ESTAB-B | ADMIN | FAIR | 3/2/1994 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible].T.F | LECTURE | FAIR | 5/5/2001 |
| 60 | Polygon | 183.75 | 1357.81 | ADMIN BLOCK | ADMIN | GOOD | 8/6/1998 |

1 (7 out of 41 Selected)

BUILDING

**✓ Layer creation or data base creation**

STEPS

* Go to catalog on the right corner of the window.

* Navigate to the folder and right click on the folder.

* Then select new and click on file geo-database.

* Then right click on the file geo-database and select new then click on the new feature to create a new dataset.

* Type the name of the dataset and click next to select the unit as done during the primary unit setting, then click next twice and click finish.

* Then the new feature dataset will appear under the file geodatabase.

* 	Finally, right click on the new feature dataset and select new then select the feature class.

* The new feature class box appears (type in the layer name e.g. Road and copy it into the Alias box.

* 	Then select the feature type, e.g. line for road, polygon for building and point for electric poles.

* 	Then click next twice and click finish.

* Then the layer created will appear on the table of content.

* The same processes are repeated to create another layer.

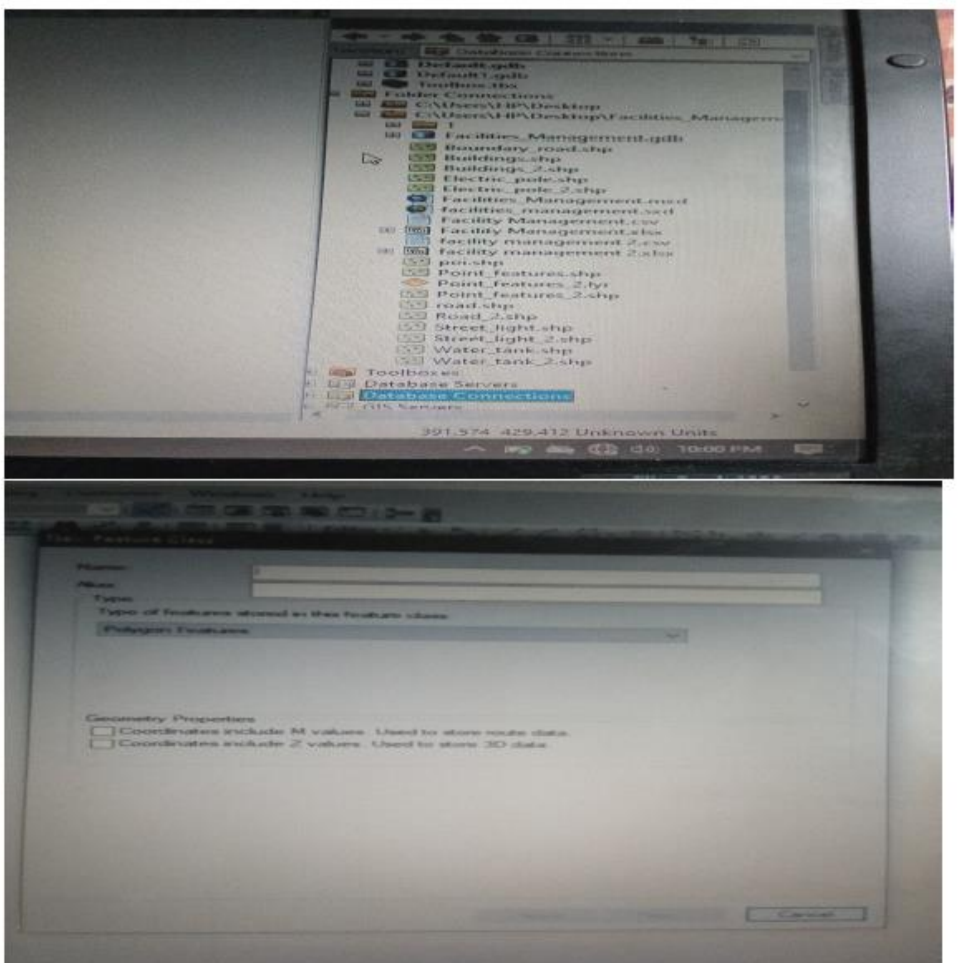



Fig 4.3. New dataset creation

✓ **Digitizing**: - the digitizing process is involved the tracing out the necessary features, as captured on the field to form the map feature.

STEPS

* Go to Editor, then click on starting editing.

* Then a create feature box appear, then select on the feature to digitize e.g. road, building, e.t.c.

* Then click on the window and trace out the feature outlines and double click when get to the end of the entity.

* Repeat the process above for all the features to be digitize and all will be saved in the data base table.

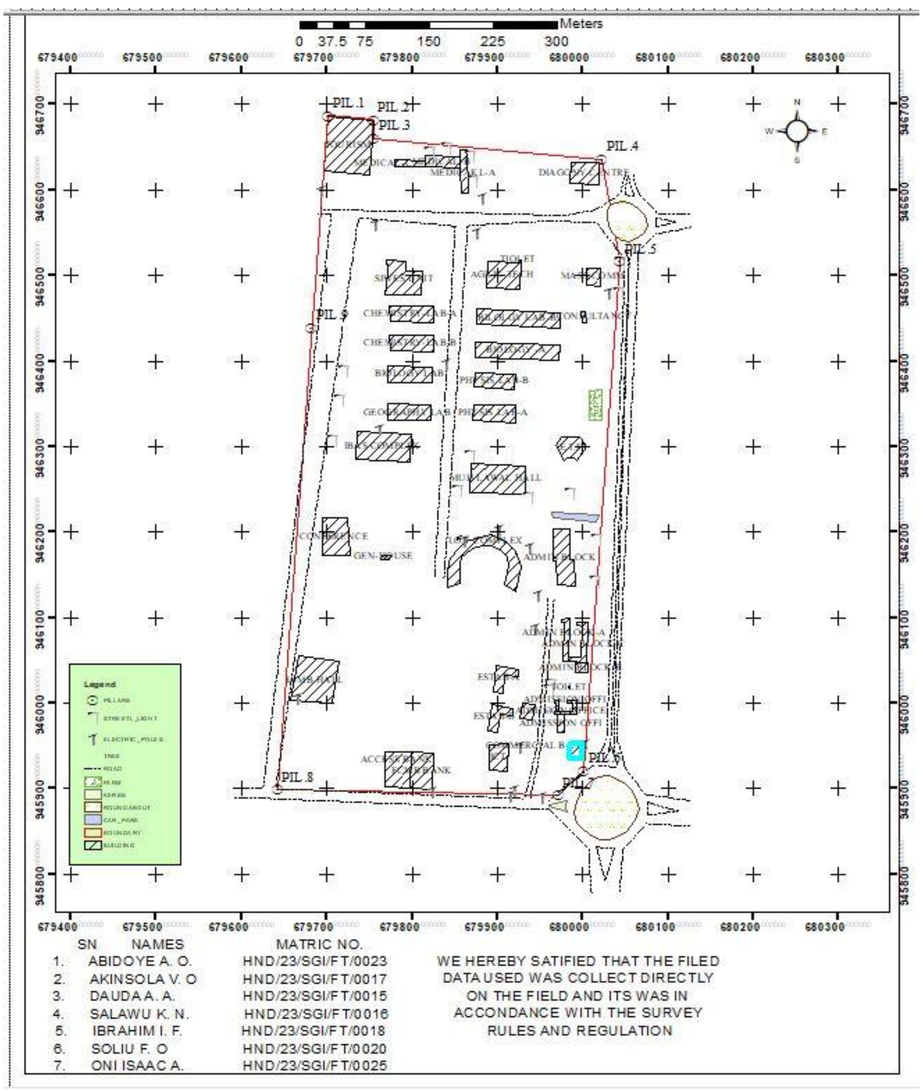



Fig 4.4. Digitizing on ArcMap

✓ **Database Creation**: - this is the process of populating the database.

STEPS

* Left click on the TOC on the layer to populate the table and then click on the open attribute table.

* The table appears.

* Then go to add field and the add field box appear.

* Set up the necessary information.

* And click ok, then the new field will be added to the table.

## 4.3. PREPARATION OF 3D MAP USING ARCSCENE

The 3D image was done on ArcScene using the created DEM, the created DEM was added to ArcScene and extruded with the heights gotten on the field. Extrusion incorporates the height of these features in their representation to give them 3D look and were made to float on DEM to have a true land representation. The created DEM was also added to ArcScene, the height of the buildings gotten from the field were added to the already created height field in the attribute table of each of the facility shape file in ArcMap. ArcScene was launched and all the shape files were added, from the table of content each shape file was right clicked on to access the property dialog box, from the property dialog box the shape files were extruded to give them 3D look and were made to float on the DEM to have a full 3D visualization.

* Open the ArcScene software and set necessary parameters.

* Go to arc tool box, click on spatial analytic tools.

* Then click on interpolation and then click IDW (Inverted Distance Way).

* Then it is going to generate 3D dimension value and set Z value point and press ok.

Note: - The IDW can be used to create contour and slope. But we are dealing with slope.

To creates slope, click on surface from interpolation and press slope and input raster(IDW) and press ok. The same procedure for contour also.

To set parameters for necessary facilities needed,

a. Select (IDW).

b. Go to source, click on property and press the base height.

c. Then click floating on a custom surface and press extrusion.

d. Click apply then ok.

## 4.4. PLAN PRODUCTION

The ultimate aim of the project is to produce a digital map (Facilities management plan) of the part of kwara state polytechnic. After processing the acquired data using the appropriate software, a digital map of the project area was produced. Thus, the aim of the project was achieved.

### 4.4.1. DIGITAL MAP

A digital map is the representation of cartographic features in a form that allows the value of their attributes to be stored, manipulated, and out-put by a computer system. A digital map is a data base or file that becomes a map when a GIS produces a hardcopy or screen display output.

Finally, a hardcopy of the digital map of the project area was printed.

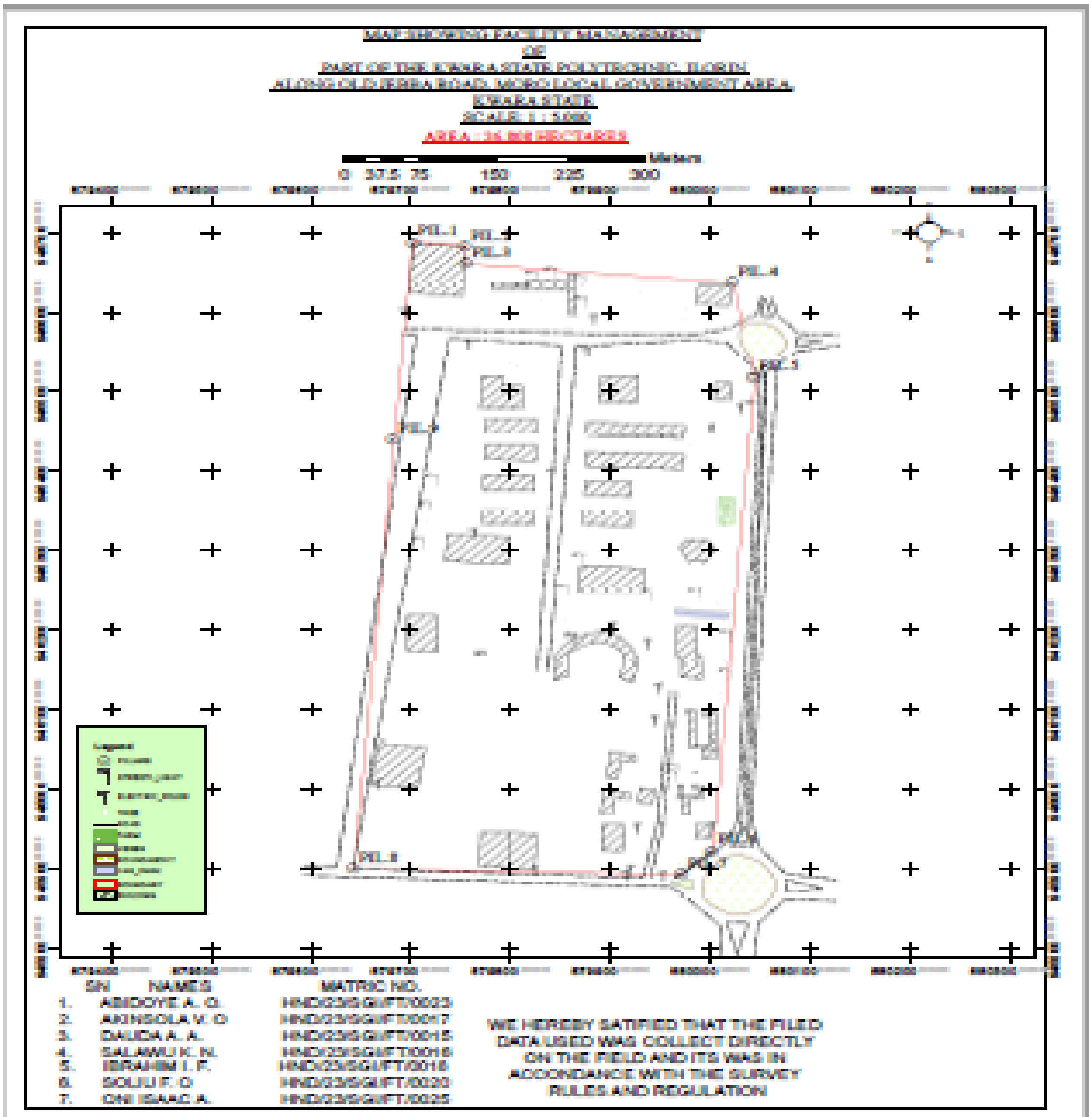



Fig 4.7. Facility Management map

## 4.5. RESULT ANALYSIS

The facility management project commenced with the usage of a South (NTS-350R) referenced to Kwara State CORS station to capture the data of the project area. The captured data were then processed using software (ArcMap 10.3, ArcScene), employing photogrammetry technique to generate a high precision DSM and create a detailed 3D model.

ARCGIS software was employed to visualize and analyze the DSM data, facilitating spatial analysis and information Presentation.

The following maps were produced and their usefulness was stated,

## 4.6. QUERIES ANALYSIS

Queries analysis in GIS involve extracting information from spatial datasets by posing specific questions and then analyzing the data to gain insights or make decisions.

Queries involves selecting features based on attributes or spatial relationship, while analysis may include tasks like spatial overlay, proximity analysis, spatial statistics or modeling.

### 4.6.1. SINGLE CRITERIA QUERY

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

**QUERY ANALYSIS (selection by attribute)**

**Query question: "T**o query for the building that construction year is less than or equal to 1990."

Analysis Name: Database extraction

Analysis Type: Single criteria analysis

Syntax: "BLD_YR_CONS>=1990.

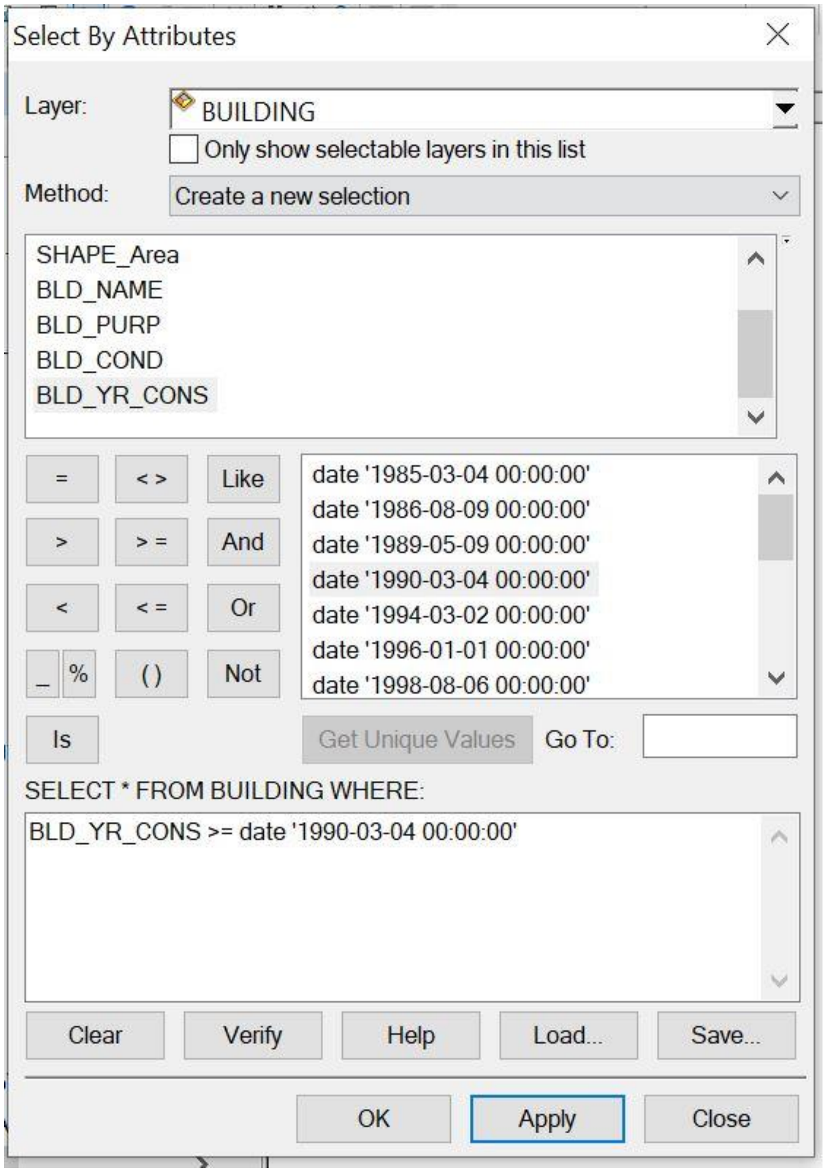
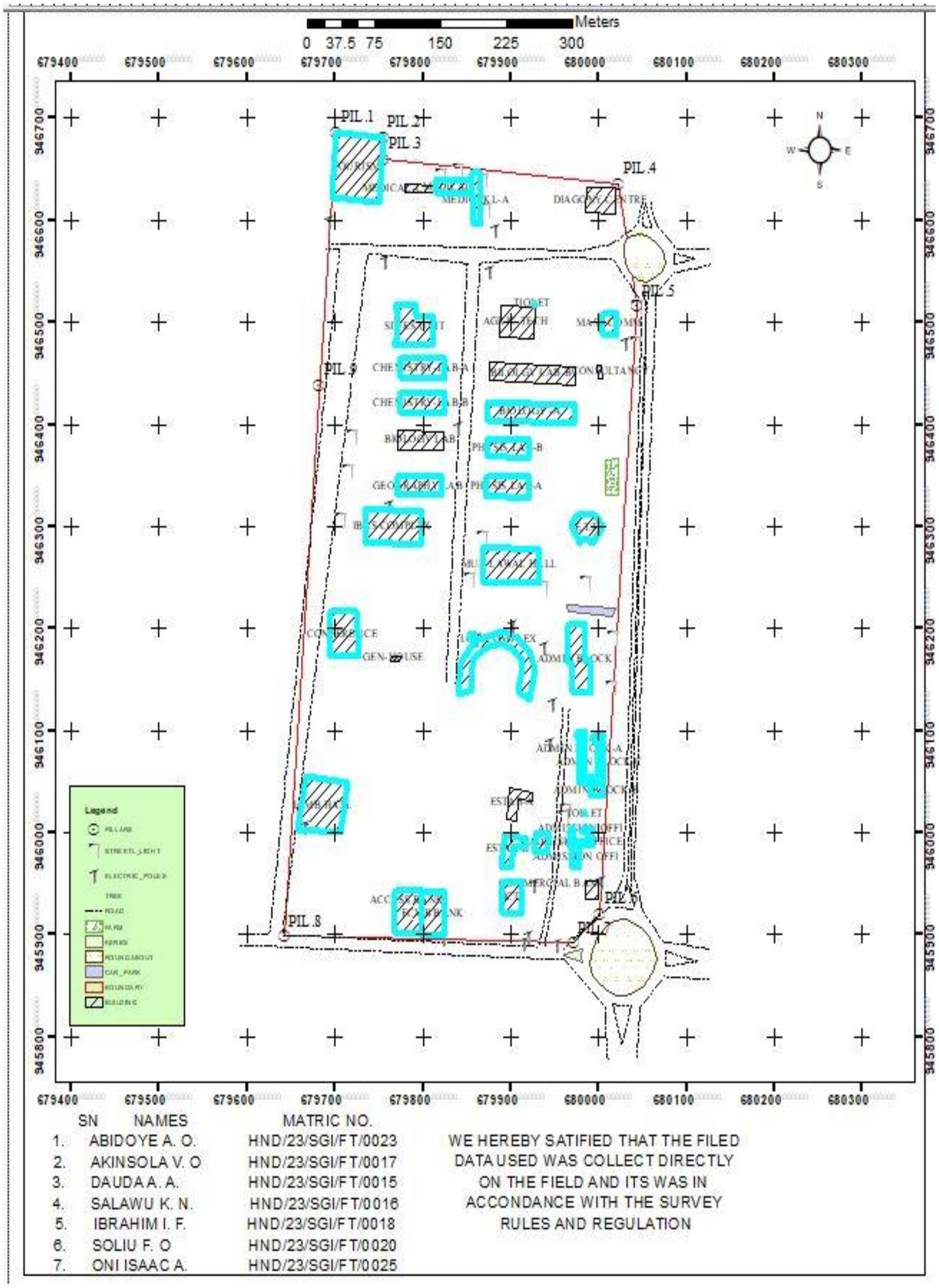



Fig. 4.12. single criteria query

**Answer to query 1.**



Table

BUILDING

| OBJECT | SHAPE * | SHAPE_Length | SHAPE_Area | BLD_NAME | BLD_PURP | BLD_COND | BLD_YR_CONS |
|---|---|---|---|---|---|---|---|
| 2 | Polygon | 234.96 | 3421.35 | TOURISM | TOURIST CE | GOOD | 10/15/2020 |
| 3 | Polygon | 136.5 | 1099.67 | FCMB BANK | FINACIAL | GOOD | 2/3/2020 |
| 4 | Polygon | 106.03 | 679.91 | ICT | COMMUNIC | GOOD | 4/6/2009 |
| 5 | Polygon | 64.56 | 258.75 | ADMISION OFFIC | ADMIN CEN | GOOD | 1/1/1996 |
| 6 | Polygon | 16.59 | 15.05 | TOILET | REST ROOM | FAIR | 4/7/2023 |
| 7 | Polygon | 193.92 | 2112.9 | MUH LAWAL HAL | EVENT HAL | GOOD | 3/6/2020 |
| 8 | Polygon | 137.2 | 933.32 | PHYSIS LAB-A | LECTURE | FAIR | 3/4/1990 |
| 9 | Polygon | 130.61 | 837.71 | PHYSIS LAB-B | LECTURE | GOOD | 3/4/1990 |
| 10 | Polygon | 232.45 | 1757.64 | BIOLOGY -A | LECTURE | GOOD | 3/4/1990 |
| 12 | Polygon | 35.85 | 63.49 | CONSULTANCY | BUSINESS | FAIR | 8/9/1986 |
| 13 | Polygon | 73.65 | 332.79 | MASS COMM | LECT/OFFI | FAIR | 6/7/2006 |
| 14 | Polygon | 109.57 | 562.37 | MEDICAL-B | HOSPITAL | GOOD | 5/5/2001 |
| 15 | Polygon | 29.25 | 47.67 | GEN-HOUSE | ELECTRICA | FAIR | 5/9/1989 |
| 16 | Polygon | 149.33 | 1341.5 | CONFERENCE | HALL | GOOD | 6/7/2006 |
| 17 | Polygon | 192.7 | 2078.75 | IBAS COMPLEX | LECT/OFFI | GOOG | 3/2/1994 |
| 19 | Polygon | 139.04 | 1195.51 | AGRIC-TECH | LECT/OFFI | GOOD | 3/4/1985 |
| 24 | Polygon | 197.25 | 2419.43 | JAMB HALL | EXAM | GOOD | 5/5/2001 |
| 25 | Polygon | 144.08 | 1265.85 | ACCESS BANK | FINACIAL | GOOD | 3/2/1994 |
| 26 | Polygon | 115.11 | 811.16 | DIAGONY CENTRE | HOSPITAL | GOOD | 5/9/1989 |
| 30 | Polygon | 5.64 | 1.95 | TOILET | REST ROOM | FAIR | 6/7/2006 |
| 33 | Polygon | 84.49 | 255.34 | MEDICAL-C | HOSPITAL | GOOD | 3/4/1985 |
| 35 | Polygon | 118.63 | 417.64 | MEDICAKL-A | HOSPITAL | GOOD | 3/2/1994 |
| 36 | Polygon | 64.04 | 252.98 | COMMERCIAL BA | FINACIAL | GOOD | 5/9/1989 |
| 38 | Polygon | 97.18 | 169 | ADMISSION OFFI | ADMIN | FAIR | 3/2/1994 |
| 39 | Polygon | 35.65 | 48.48 | ADMISSION OFFI | ADMIN | FAIR | 3/6/2002 |

1 (32 out of 41 Selected)

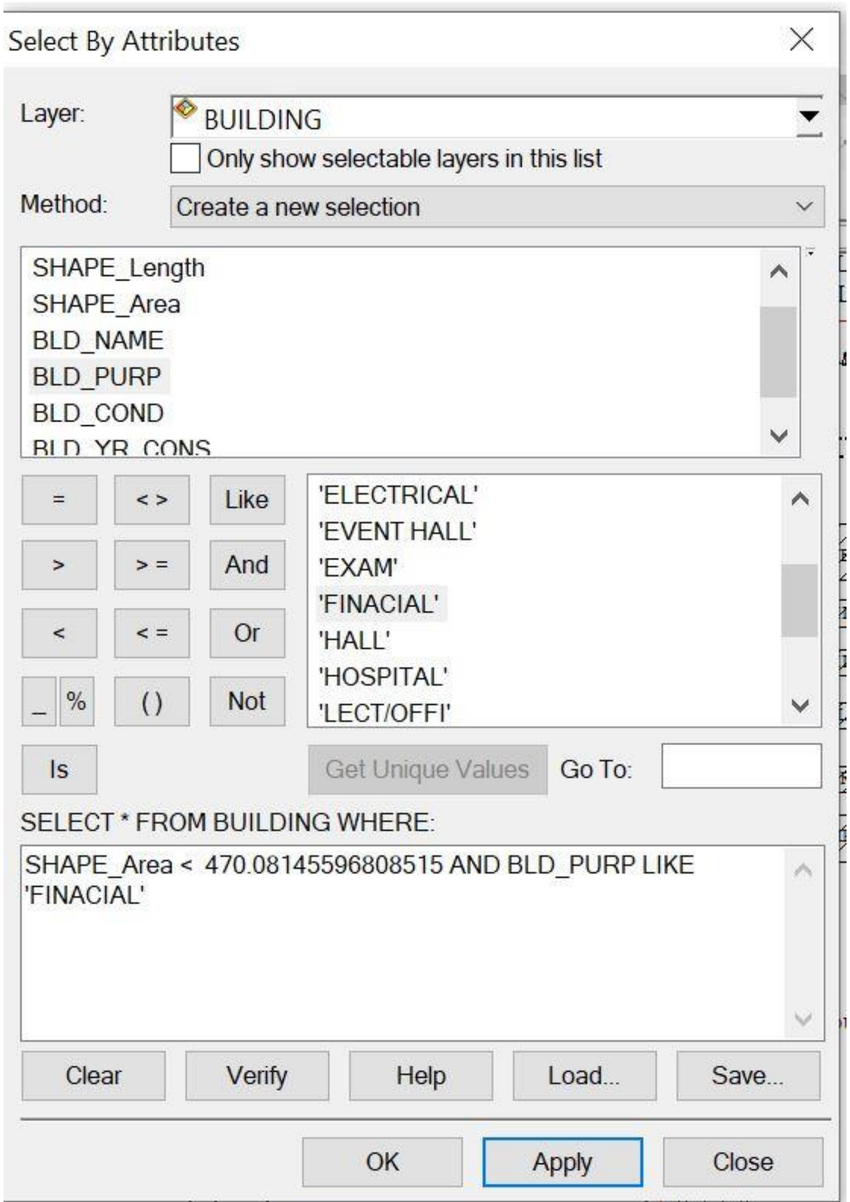
BUILDING

**Query question: "T**o query for the building that has an area less than 470.08 meters square and their purpose is used for financial

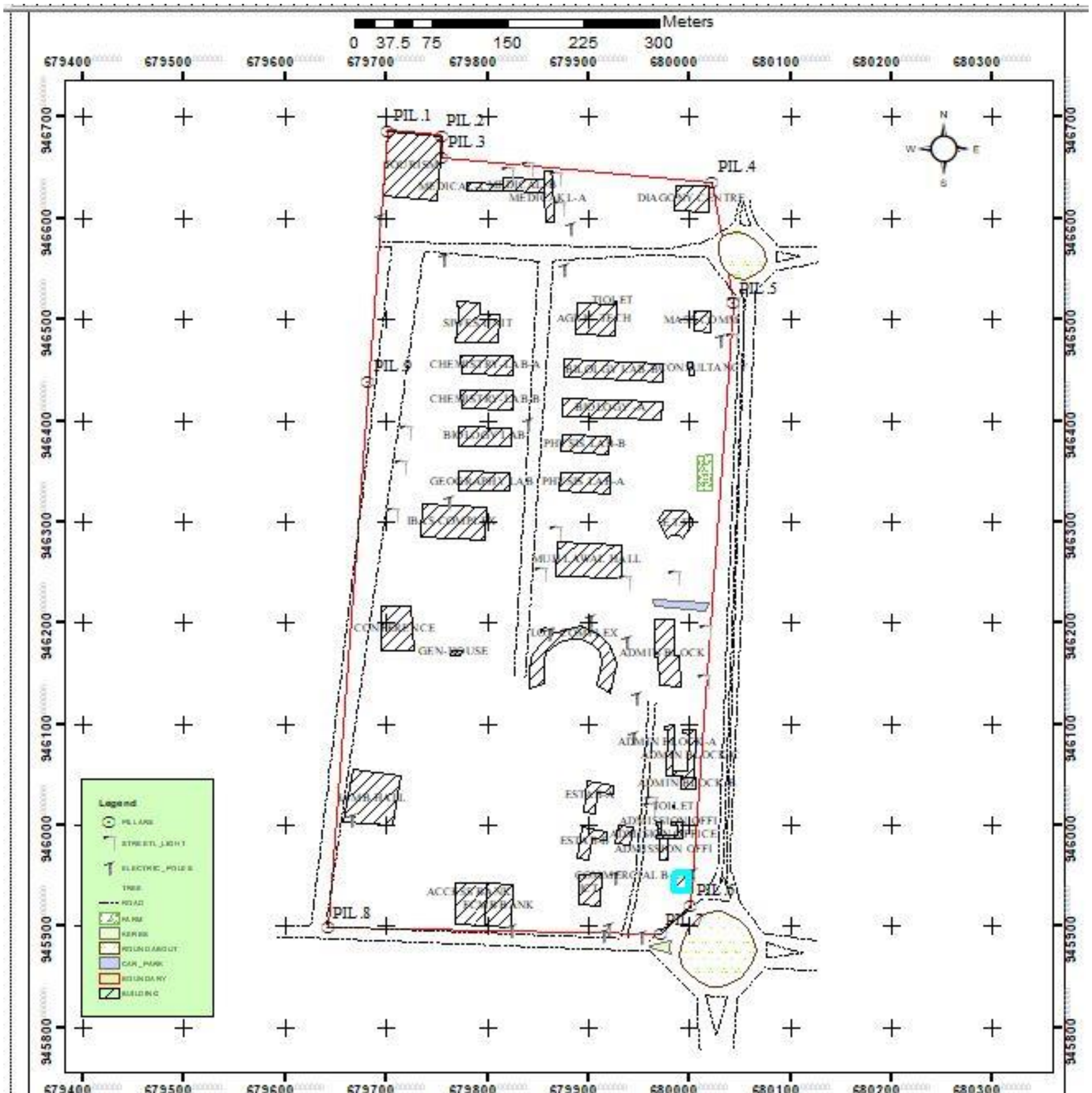
Analysis Name: Database extraction

Analysis Type: Double criterion analysis

Syntax: "SHAPE_AREA<470.08AND BLD_PURP".




Answer to the query II.




| SN | NAMES | MATRIC NO. |
|---|---|---|
| 1. | ABIDOYE A. O. | HND/23/SGI/FT/0023 |
| 2. | AKINSOLA V. O | HND/23/SGI/FT/0017 |
| 3. | DAUDA A. A. | HND/23/SGI/FT/0015 |
| 4. | SALAWU K. N. | HND/23/SGI/FT/0016 |
| 5. | IBRAHIM I. F. | HND/23/SGI/FT/0018 |
| 6. | SOLIU F. O | HND/23/SGI/FT/0020 |
| 7. | ONI ISAAC A. | HND/23/SGI/FT/0025 |

WE HEREBY SATIFIED THAT THE FILED DATA USED WAS COLLECT DIRECTLY ON THE FIELD AND ITS WAS IN ACCONDANCE WITH THE SURVEY RULES AND REGULATION

Table

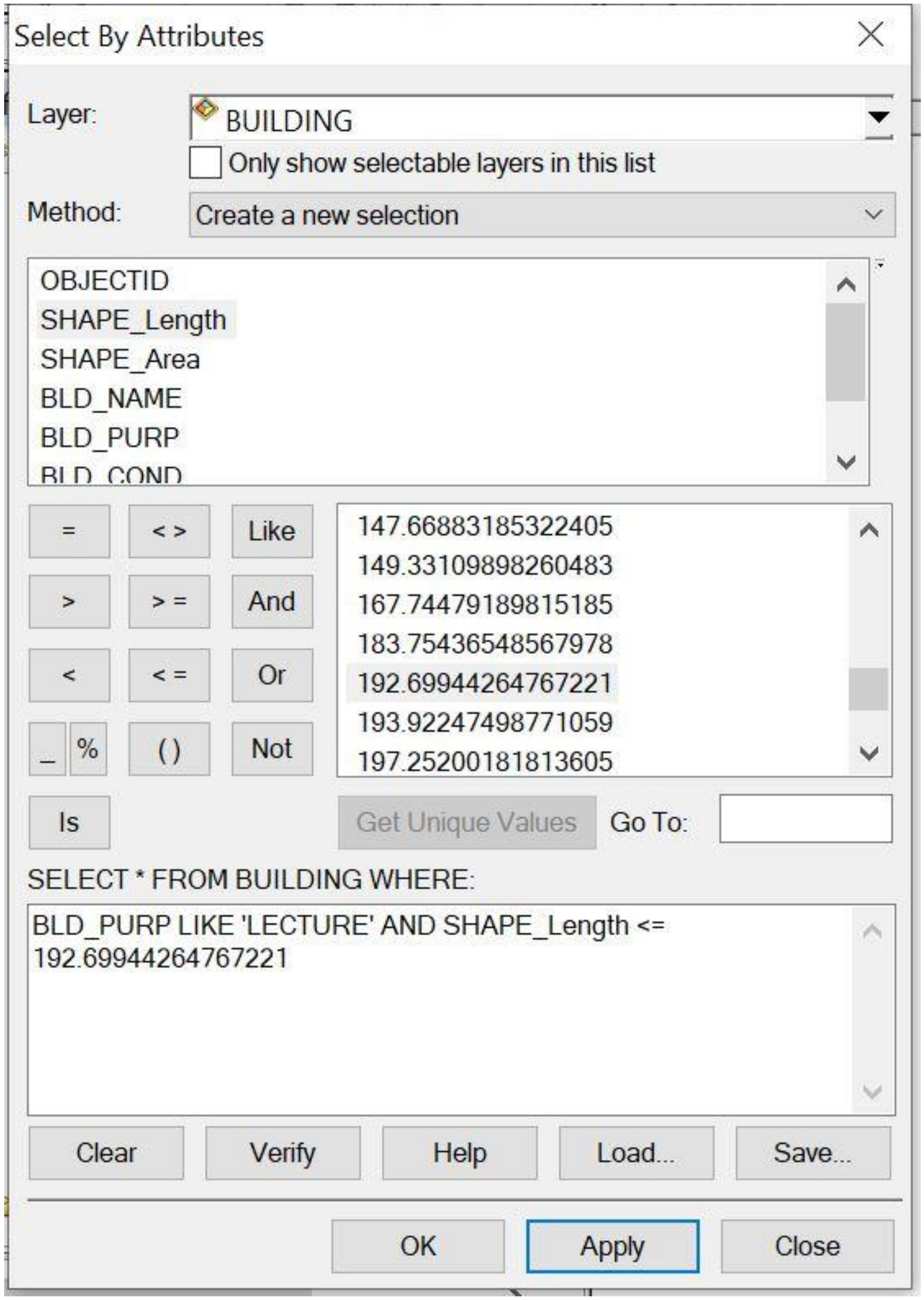
BUILDING

| OBJECT | SHAPE * | SHAPE_Length | SHAPE_Area | BLD_NAME | BLD_PURP | BLD_COND | BLD_YR_CONS |
|---|---|---|---|---|---|---|---|
| 2 | Polygon | 234.96 | 3421.35 | TOURISM | TOURIST CE | GOOD | 10/15/2020 |
| 3 | Polygon | 136.5 | 1099.67 | FCMB BANK | FINACIAL | GOOD | 2/3/2020 |
| 4 | Polygon | 106.03 | 679.91 | ICT | COMMUNIC | GOOD | 4/6/2009 |
| 5 | Polygon | 64.56 | 258.75 | ADMISION OFFIC | ADMIN CEN | GOOD | 1/1/1996 |
| 6 | Polygon | 16.59 | 15.05 | TOILET | REST ROOM | FAIR | 4/7/2023 |
| 7 | Polygon | 193.92 | 2112.9 | MUH LAWAL HAL | EVENT HAL | GOOD | 3/6/2020 |
| 8 | Polygon | 137.2 | 933.32 | PHYSIS LAB-A | LECTURE | FAIR | 3/4/1990 |
| 9 | Polygon | 130.61 | 837.71 | PHYSIS LAB-B | LECTURE | GOOD | 3/4/1990 |
| 10 | Polygon | 232.45 | 1757.64 | BIOLOGY -A | LECTURE | GOOD | 3/4/1990 |
| 12 | Polygon | 35.85 | 63.49 | CONSULTANCY | BUSINESS | FAIR | 8/9/1986 |
| 13 | Polygon | 73.65 | 332.79 | MASS COMM | LECT/OFFI | FAIR | 6/7/2006 |
| 14 | Polygon | 109.57 | 562.37 | MEDICAL-B | HOSPITAL | GOOD | 5/5/2001 |
| 15 | Polygon | 29.25 | 47.67 | GEN-HOUSE | ELECTRICA | FAIR | 5/9/1989 |
| 16 | Polygon | 149.33 | 1341.5 | CONFERENCE | HALL | GOOD | 6/7/2006 |
| 17 | Polygon | 192.7 | 2078.75 | IBAS COMPLEX | LECT/OFFI | GOOG | 3/2/1994 |
| 19 | Polygon | 139.04 | 1195.51 | AGRIC-TECH | LECT/OFFI | GOOD | 3/4/1985 |
| 24 | Polygon | 197.25 | 2419.43 | JAMB HALL | EXAM | GOOD | 5/5/2001 |
| 25 | Polygon | 144.08 | 1265.85 | ACCESS BANK | FINACIAL | GOOD | 3/2/1994 |
| 26 | Polygon | 115.11 | 811.16 | DIAGONY CENTRE | HOSPITAL | GOOD | 5/9/1989 |
| 30 | Polygon | 5.64 | 1.95 | TOILET | REST ROOM | FAIR | 6/7/2006 |
| 33 | Polygon | 84.49 | 255.34 | MEDICAL-C | HOSPITAL | GOOD | 3/4/1985 |
| 35 | Polygon | 118.63 | 417.64 | MEDICAKL-A | HOSPITAL | GOOD | 3/2/1994 |
| 36 | Polygon | 64.04 | 252.98 | COMMERCIAL BA | FINACIAL | GOOD | 5/9/1989 |
| 38 | Polygon | 97.18 | 169 | ADMISSION OFFI | ADMIN | FAIR | 3/2/1994 |
| 39 | Polygon | 35.65 | 48.48 | ADMISSION OFFI | ADMIN | FAIR | 3/6/2002 |

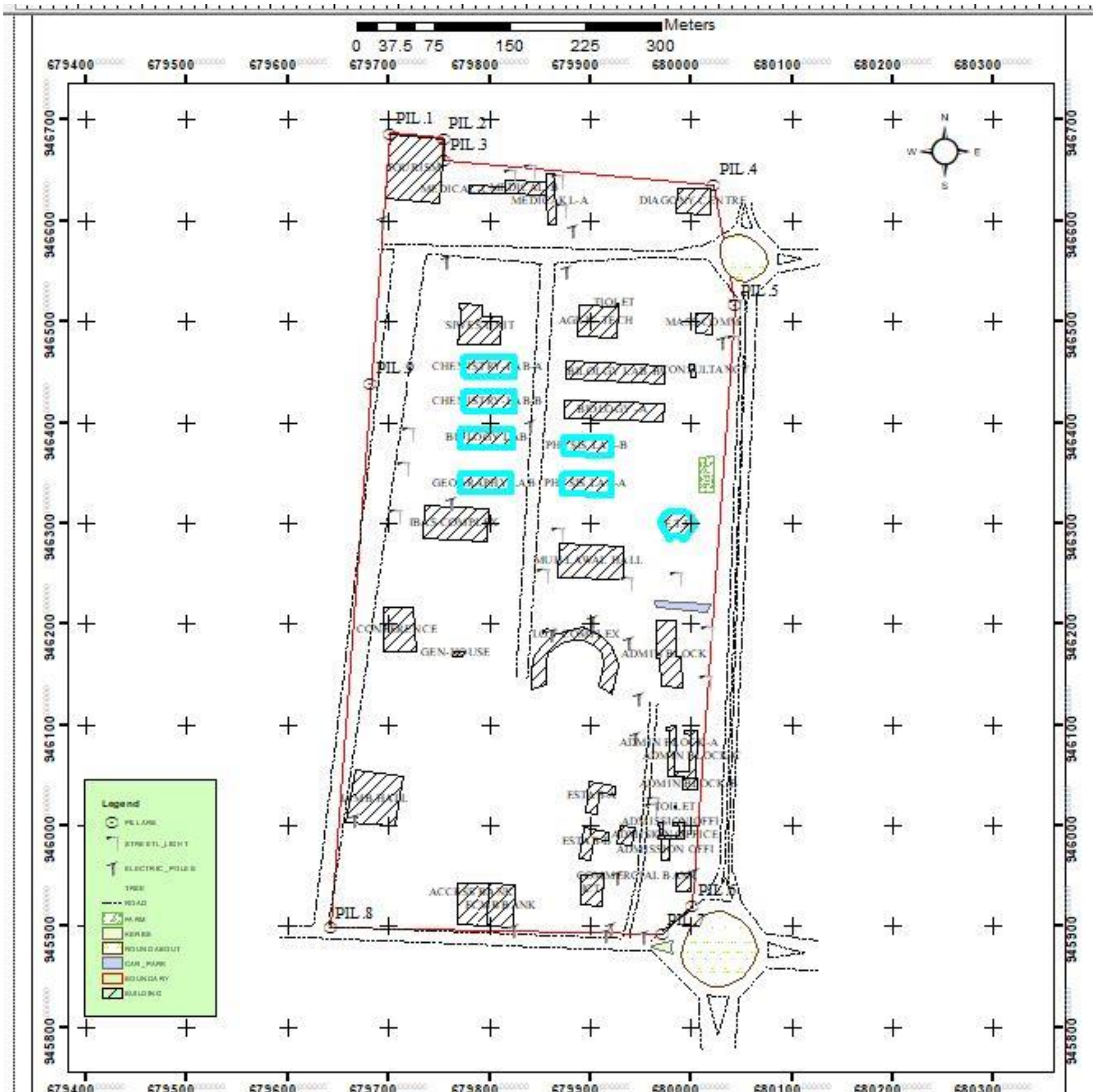
1 (1 out of 41 Selected)

BUILDING

- **Query question 3: "T**o query for the building purpose and that the area less than or equal to 192.69 meters square
- Analysis Name: Database extraction
- Analysis Type: Double criterion analysis
- Syntax: "BLD_PURP LIKE LECTURE AND SHAPE_LENGHT <= 192.69".


Select By Attributes
Layer:
BUILDING
Only show selectable layers in this list
Method:
Create a new selection
OBJECTID
SHAPE_Length
SHAPE_Area
BLD_NAME
BLD_PURP
=
< >
Like
>
> =
And
<
< =
Or
_
%
( )
Not
Is
147.66883185322405
149.33109898260483
167.74479189815185
183.75436548567978
192.69944264767221
193.92247498771059
197.25200181813605
Get Unique Values
Go To:
SELECT * FROM BUILDING WHERE:
BLD_PURP LIKE 'LECTURE' AND SHAPE_Length <=
192.69944264767221
Clear
Verify
Help
Load...
Save...
OK
Apply
Close

Answer to the query 3.




| SN | NAMES | MATRIC NO. |
|---|---|---|
| 1. | ABIDOYE A. O. | HND/23/SGI/FT/0023 |
| 2. | AKINSOLA V. O | HND/23/SGI/FT/0017 |
| 3. | DAUDA A. A. | HND/23/SGI/FT/0015 |
| 4. | SALAWU K. N. | HND/23/SGI/FT/0016 |
| 5. | IBRAHIM I. F. | HND/23/SGI/FT/0018 |
| 6. | SOLIU F. O | HND/23/SGI/FT/0020 |
| 7. | ONI ISAAC A. | HND/23/SGI/FT/0025 |

WE HEREBY SATIFIED THAT THE FILED DATA USED WAS COLLECT DIRECTLY ON THE FIELD AND ITS WAS IN ACCONDANCE WITH THE SURVEY RULES AND REGULATION

## 4.8. APPLICATION OF RESULTS

The result obtained can be applied to the following;

* Ensuring efficient use of resources.

* Maximizing occupant comfort and safety.

* Managing maintenance schedules.

* Optimizing space utilization.

* It's essentially a roadmap for maintaining and enhancing the functionality of a building or facility.

# CHAPTER FIVE

## 5.0. SUMMARY, CONCLUSION, PROBLEM ENCOUTER AND RECOMMENDATION

### 5.1. COSTING

**Table 5.1. PLANNING**

| S/N | PERSONNEL | UNIT | PRICE | DAYS | REMARK |
|---|---|---|---|---|---|
| 1. | Principal Surveyor | 1 | #30,000 | 2 | #60,000 |
| 2. | Assistant Surveyor | 1 | #12,000 | 2 | #24,000 |
| 3. | Transport | 1 | #3,000 | 2 | #6,000 |
| 4. | Basic Equipment | 1 | #15,000 | 2 | #30,000 |
| 5. | Logistics | 1 | #10,000 | 2 | #20,000 |
| | Total | 1 | | | #140,000 |

**Table 5.2. DATA CAPTURE**

| S/N | PERSONNEL | UNIT | PRICE | DAYS | REMARK |
|---|---|---|---|---|---|
| 1. | Principal Surveyor | 1 | #30,000 | 5 | #150,000 |
| 2. | Assistant Surveyor | 1 | #12,000 | 5 | #60,000 |
| 3. | Chainman | 7 | #3,000 | 5 | #105,000 |
| 4. | Transport | 1 | #3,000 | 5 | #15,000 |
| 5. | Basic Equipment | 1 | #15,000 | 5 | #75,000 |
| 6. | Logistics | 1 | #10,000 | 5 | #50,000 |
| | Total | | | | #455,000 |

**Table 5.3. DATA DOWNLOAD**

| S/N | PERSONAL | UNIT | PRICE | DAYS | REMARK |
|---|---|---|---|---|---|
| 1. | Principal Surveyor | 1 | #30,000 | 1 | #30,000 |
| 2. | Transport | 1 | #3,000 | 1 | #3,000 |
| 3. | Basic Equipment | 1 | #15,000 | 1 | #15,000 |
| 4. | Logistics | 1 | #10,000 | 1 | #10,000 |
| | Total | | | | #58,000 |

**Table 5.4. DATA PROCESSING**

| S/N | PERSONNEL | UNIT | PRICE | DAYS | REMARK |
|---|---|---|---|---|---|
| 1. | Principal Surveyor | 1 | #30,000 | 8 | #240,000 |
| 2. | Assistant Surveyor | 1 | #12,000 | 8 | #96,000 |
| 3. | Transport | 1 | #3,000 | 8 | #24,000 |
| 4. | Basic Equipment | 1 | #15,000 | 8 | #120,000 |
| 5. | Logistics | 1 | #10,000 | 8 | #80,000 |
| | Total | | | | #560,000 |

**Table 5.5. DATA PRESENTATION**

| S/N | PERSONNEL | UNIT | PRICE | DAYS | REMARK |
|---|---|---|---|---|---|
| 1. | Principal Surveyor | 1 | #30,000 | 1 | #30,000 |
| 2. | Assistant Surveyor | 1 | #12,000 | 1 | #12,000 |
| 3. | Transport | 1 | #3,000 | 1 | #3,000 |
| 4. | Basic Equipment | 1 | #15,000 | 1 | #15,000 |
| 5. | Logistics | 1 | #10,000 | 1 | #10,000 |
| | Total | | | | #70,000 |

**Table 5.6. REPORT WRITING**

| S/N | PERSONNEL | UNIT | PRICE | DAYS | REMARK |
|---|---|---|---|---|---|
| 1. | Principal Surveyor | 1 | #30,000 | 10 | #300,000 |
| 2. | Transport | 1 | #3,000 | 10 | #30,000 |
| 3. | Basic Equipment | 1 | #15,000 | 10 | #150,000 |
| 4. | Logistics | 1 | #10,000 | 10 | #100,000 |
| | Total | | | | #580,000 |

**Table 5.7. SUMMARY**

| | | |
|---|---|---|
| 1. | Planning | #140,000 |
| 2. | Data Capture | #455,000 |
| 3. | Data Download | #58,000 |
| 4. | Data Processing | #560,000 |
| 5. | Data Presentation | #70,000 |
| 6. | Report Writing | #580,000 |
| | Total | #1,863,000 |

* Mobilization and demobilization 10%

1,863,000 * 10 ÷ 100 = #186,300

* V.A.T. 2.5%

1,863,000 * 2.5 ÷ 100 = #46,575

Total Cost

#1,863,000 + #186,300 + #46,575

= #2,095,875.

**Appendix i**

bnd1,680001.553,945920.709,305.03

2bld,679998.724,945935.038,305.427

3bld,679999.37,945952.393,305.747

4bld,679985.139,945953.611,305.899

5Ep,680002.449,945953.267,305.904

6bld,679969.713,945966.376,306.162

7bld,679978.467,945966.005,306.203

8str,679962.742,945980.018,306.873

9str,679963.074,945982.566,306.968

10str,679964.353,945982.451,306.955

11bld,679966.006,945987.485,307.213

12tree,679967.245,945904.712,304.414

13bnd2,679970.974,945892.196,303.848

14Ep,679951.406,945891.426,303.848

15tree,679946.62,945896.648,304.023

16DR,679940.237,945887.579,302.966

17DR,679939.218,945887.348,302.645

18Rd,679931.045,945888.016,303.114

19DR,679929.541,945887.406,302.639

20DR,679928.99,945887.693,302.628

21Ep,679919.632,945898.553,304.019

22Ep,679914.223,945892.929,303.664

23bank,679911.575,945920.464,304.7

24bank,679889.953,945921.531,304.753

25Ep,679915.076,945919.52,304.599

26tree,679931.218,945947.97,305.577

27Ep,679926.29,945949.63,305.493

28gtb,679915.953,945952.093,305.385

29bld,679900.379,945966.825,306.214

30bld,679888.661,945968.32,306.514

31bld,679917.742,945986.294,306.808

32bld,679918.61,945994.023,307.217

33bld,679892.925,945998.188,309.093

34tree,679927.623,946001.143,307.61

35mosq,679928.788,946000.146,307.496

36mosq,679926.197,945982.778,306.943

37mosq,679943.303,945998.462,307.366

38tree,679939.646,946005.798,307.642

39tree,679938.425,945999.848,307.45

40sl,679957.398,945996.07,307.502

41sl,679959.991,946015.805,308.185

42sl,679961.136,946023.735,308.413

43bld,679971.797,946037.722,308.565

44bld,679982.727,946039.467,308.674

45bld,679983.532,946015.505,308.485

46str,679984.655,946017.96,308.269

47str,679984.73,946019.205,308.241

48str,679983.214,946019.476,308.336

49spt,679988.212,946022.841,308.542XX

50spt,679992.515,946017.403,308.476

51spt,679987.166,946010.653,308.193

52spt,679987.891,946003.31,308.362

53spt,679983.968,946027.112,308.665

54spt,679987.104,946035.048,308.644

55bld,679990.722,946036.027,308.705

56bld,679992.34,946002.873,308.571

57bld,680006.482,946035.908,308.558

58bld,680002.833,946047.922,309.255

59bld,679976.883,946049.044,309.107

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64spt,679968.906,946062.177,309.556

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69spt,679967.188,946090.828,310.681

70spt,679964.664,946098.415,311.171

71spt,679957.51,946097.69,311.003

72bld,679974.621,946099.158,311.079

73tree,679999.806,946104.888,311.397

74tree,680010.315,946112.512,311.854

75tree,680011.129,946117.7,311.931

76tree,680011.712,946123.067,312.152

77spt,680010.009,946129.671,312.375

78spt,680002.863,946125.025,312.208

79spt,679999.388,946115.06,311.689

80spt,679996.786,946110.187,311.491

81spt,679992.748,946104.278,311.317

82spt,679988.481,946109.369,311.415

83spt,679986.602,946116.996,311.622

84spt,679986.322,946125.052,311.734

85spt,679980.628,946130.727,312.337

86sl,679982.536,946130.339,312.35

87tree,679974.682,946131.68,312.215

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89tree,679953.554,946110.003,311.382

90tree,679953.104,946105.441,311.056

91tree,679950.595,946093.033,310.555

92Ep,679943.533,946087.757,310.126

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95spt,679920.822,946073.274,309.835

96spt,679915.118,946068.241,310.027

97spt,679908.301,946060.959,310.158

98spt,679909.131,946051.957,309.678

99bld,679899.243,946043.445,309.387

100str,679896.051,946043.006,309.31

101str,679895.49,946040.816,309.26

102str,679893.879,946041.01,309.22

103bld,679894.41,946014.383,308.269

104spt,679890.712,946019.163,308.4

105spt,679895.133,946023.257,308.791

106spt,679896.372,946031.022,308.777

107spt,679888.733,946036.616,309.284

108spt,679892.145,946049.028,309.57

109spt,679898.83,946064.598,310.391

110spt,679896.11,946075.478,310.822

111spt,679899.352,946085.679,311.27

112spt,679900.45,946095.169,311.583

113spt,679889.678,946100.794,311.319

114spt,679879.884,946100.892,311.081

115spt,679875.602,946110.656,311.435

116spt,679860.786,946122.723,311.712

117str,679855.831,946126.252,311.908

118str,679853.412,946125.261,311.866

119str,679851.166,946129.422,312.287

120iotbld,679850.27,946130.672,312.546

121spt,679841.314,946135.195,312.355

122spt,679835.787,946144.524,312.647

123spt,679841.647,946151.983,313.49

124spt,679837.819,946164.575,313.736

125iotbld,679850.445,946177.42,313.803

126iotbld,679862.438,946189.159,314.463

127Ep,679861.389,946190.354,314.38

128genhouse,679858.56,946193.401,314.353

129genhouse,679853.433,946191.354,314.288

130genhouse,679852.175,946193.779,314.345

131spt,679847.82,946190.812,314.204

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133spt,679844.792,946183.229,314.106

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135spt,679851.064,946199.602,314.568

136spt,679855.333,946207.683,315.227

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140Ep,679901.842,946203.883,314.81

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143spt,679914.716,946201.78,314.945

144bld,679909.053,946189.322,314.736

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148Ep,679936.655,946183.366,315.413

149spt,679939.43,946174.292,314.662

150iotbld,679928.413,946159.401,314.111

151iotbld,679921.013,946130.8,312.808

152spt,679938.628,946129.621,311.581

153Ep,679947.624,946126.676,311.676

154recbld,679969.467,946138.179,312.658

155recbld,679988.307,946136.553,313.33

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157sl,680013.476,946142.779,313.247

158spt,680025.065,946145.5,313.202

159tree,680019.078,946151.97,313.464

160tree,680019.278,946156.925,313.322

161tree,680013.13,946162.19,313.762

162spt,680010.315,946170.357,314.334

163spt,680005.425,946192.509,314.898

164sl,680015.327,946192.955,315.007

165spt,680008.594,946202.369,315.172

166spt,679994.076,946204.672,315.339

167recbld,679984.189,946204.478,315.442

168spt,679978.443,946208.804,315.661

169park,679963.226,946223.944,316.333

170park,679964.43,946217.62,316.111

171recbld,679965.631,946205.542,315.672

172recbld,679964.989,946203.903,315.587

173str,679987.609,946220.723,316.05

174str,679987.4,946219.44,315.978

175str,679986.085,946220.984,316.003

176park,680015.108,946212.547,315.512

177tree,680018.861,946219.613,315.808

178spt,680014.758,946225.428,315.898

179tree,680006.385,946231.69,316.557

180spt,679999.351,946228.385,316.251

181spt,679987.348,946239.564,316.827

182sl,679984.519,946245.583,317.412

183spt,679971.822,946245.145,317.291

184spt,679960.457,946244.878,317.405

185spt,679948.429,946244.273,317.266

186sl,679935.524,946242.081,317.515

187HALL,679932.222,946244.134,317.601

188flw,679922.809,946241.583,317.165

189flw,679934.083,946241.146,317.366

190flw,679928.585,946241.375,317.343

191flw,679875.609,946243.447,316.237

192flw,679872.196,946243.686,316.26

193HALL,679868,946246.945,316.38

194spt,679863.1,946248.494,316.311

195spt,679862.028,946258.078,316.687

196sl,679852.432,946249.983,316.747

197spt,679850.85,946256.565,317.056

198spt,679846.943,946278.828,318.518

199spt,679854.526,946289.235,318.359

200sl,679867.033,946289.549,317.91

201HALL,679868.738,946279.925,317.789

202spt,679875.736,946286.279,317.778

203flw,679876.301,946290.444,317.899

204flw,679885.508,946289.456,317.913

205flw,679895.579,946289.105,317.971

206spt,679897.502,946286.067,317.98

207flw,679905.651,946288.569,318.113

208flw,679915.684,946288.166,318.223

209spt,679924.355,946288.183,318.401

210spt,679930.064,946294.245,318.596

211spt,679925.662,946304.69,318.877

212spt,679923.011,946317.638,319.168

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215spt,679907.945,946324.134,319.139

216spt,679894.785,946323.517,319.075

217spt,679891.188,946313.417,318.748

218spt,679880.275,946316.353,318.837

219phylabB,679871.385,946330.846,319.702

220sl,679865.6,946330.835,320.257

221spt,679854.205,946333.648,320.415

222spt,679851.82,946346.503,320.943

223spt,679863.95,946357.107,320.773

224spt,679861.734,946371.907,321.531

225spt,679854.29,946388.65,322.545

226spt,679871.439,946348.487,320.843

227labB,679871.543,946348.617,320.786

228labB,679868.321,946362.215,320.778

229labA,679869.717,946368.262,321.46

230labA,679872.292,946369.447,321.375

231labA,679873.225,946386.362,321.477

232spt,679877.107,946391.721,321.835

233Ep,679877.207,946395.018,322.157

234spt,679888.942,946395.505,322.218

235sl,679897.92,946395.377,322.146

236spt,679908.405,946393.793,322.034

237Ep,679916.355,946392.766,322.051

238labA,679920.821,946385.067,321.317

239spt,679930.212,946384.164,321.562

240spt,679931.977,946378.503,321.441

241spt,679940.614,946374.718,321.435

242spt,679930.728,946359.746,320.828

243spt,679940.326,946348.681,320.555

244spt,679949.13,946340.51,320.505

245spt,679933.365,946327.57,319.537

246sl,679922.323,946323.282,319.617

247spt,679946.381,946312.41,319.53

248spt,679961.735,946307.531,319.868

249bld,679967.872,946302.28,320.124

250bld,679977.75,946283.855,319.443

251bld,679993.018,946283.593,319.27

252bld,680004.329,946300.539,320.369

253bld,679998.345,946309.339,321.432

254tree,680010.161,946301.343,320.357

255tree,680011.17,946307.794,320.944

256tree,680009.009,946293.252,319.737

257spt,680015.59,946297.693,319.74

258spt,680015.574,946289.681,319.16

259Ep,680022.041,946285.189,319.244

260spt,680022.367,946297.7,320.001

261spt,680020.231,946314.929,322.069

262farm,680021.584,946330.48,322.24

263farm,680022.711,946366.014,322.821

264spt,680027,946360.883,322.324

265spt,680031.595,946350.845,321.481

266spt,680024.335,946344.812,321.828

267spt,680031.067,946331.416,320.716

268spt,680028.347,946323.488,319.878

269spt,679977.281,946388.974,323.011

270labC,679972.044,946401.172,323.314

271labC,679973.272,946419.088,323.233

272labD,679973.871,946433.423,324.022

273labD,679974.748,946456.641,324.966

274spt,679980.711,946456.634,325.093

275spt,679988.131,946449.638,325.106

276spt,679996.524,946452.748,325.135

277spt,679997.235,946440.418,324.772

278spt,679989.428,946434.214,324.237

279tree,679980.064,946429.48,324.194

280masscom,679998.842,946444.882,325.33

281masscom,679998.304,946457.975,325.499

282masscom,680003.72,946445.049,325.531

283spt,680013.136,946456.603,326.05

284spt,680018.707,946450.098,325.732

285tree,680023.094,946448.891,325.958

286spt,680022.83,946462.642,326.321

287masscom,680019.616,946463.454,326.582

288spt,680026.965,946465.006,326.318

289spt,680035.748,946460.119,326.238

290tree,680040.409,946451.978,325.533

291spt,680040.567,946462.387,325.748

292spt,680035.476,946469.089,326.414

293sl,680042.413,946480.408,326.592

294Ep,680029.941,946480.736,326.896

295,680019.483,946471.675,326.482

296,679999.146,946471.334,325.945

297spt,679998.007,946481.651,326.093

298mask,679997.217,946490.219,326.913

299masscom,680003.856,946488.335,326.839

300spt,680012.837,946484.376,326.657

301masscom,680019.78,946487.755,326.977

302spt,680027.827,946490.813,327.234

303spt,680038.345,946495.925,327.444

304spt,680032.6,946507.278,327.747

305masscom,680020.028,946508.713,327.869

306spt,680034.704,946514.238,328.098

307sl,680043.577,946516.198,328.225

308spt,680040.037,946527.784,328.685

309Rd,680040.641,946530.175,328.466

310Rd,680049.621,946529.962,328.464

311Rd,680056.905,946529.803,328.469

312Rd,680066.174,946529.973,328.493

313Rd,680053.986,946539.521,328.665

314Rd,680076.521,946559.448,329.637

315Rd,680085.77,946561.146,329.847

316Rd,680085.395,946555.48,329.582

317Rd,680086.484,946549.999,329.342

318Rd,680085.656,946567.188,330.158

319Rd,680086.534,946572.799,330.393

320Rd,680054.639,946584.625,330.726

321Rd,680054.653,946593.432,331.035

322Rd,680061.27,946593.253,331.125

323Rd,680066.437,946595.111,331.226

324Rd,680050.053,946594.909,331.106

325Rd,680045.444,946596.765,331.157

326spt,680039.314,946597.149,331.337

327spt,680029.489,946601.468,331.371

328spt,680029.315,946607.711,331.316

329spt,680020.265,946607.672,331.059

330diag,680018.165,946606.693,331.033

331diag,680019.206,946631.691,331.924

332bnd,680022.153,946636.213,332.084

333diag,679986.934,946632.21,331.734

334str,679985.026,946628.196,331.654

335str,679984.992,946626.379,331.629

336str,679982.885,946628.303,331.694

337diag,679984.852,946607.814,330.549

338spt,679982.58,946605.019,330.415

339spt,679973.666,946603.998,330.397

340tree,679974.176,946601.549,330.353

341tree,679973.397,946589.542,330.078

342spt,679972.963,946584.72,329.732

343spt,679963.879,946586.222,329.788

344spt,679956.87,946595.672,330.023

345spt,679946.013,946601.875,330.038

346spt,679930.75,946619.622,330.885

347tree,679928.45,946620.919,331.284

348spt,679914.1,946611.046,329.64

349spt,679898.087,946597.825,329.061

350spt,679882.187,946591.781,329.079

351Ep,679875.747,946590.333,329.26

352tree,679868.701,946594.905,329.836

353med,679865.249,946596.022,329.607

354spt,679866.317,946613.264,330.764

355sl,679870.104,946611.749,330.448

356tree,679869.002,946620.45,330.338

357sl,679867.365,946640.719,331.482

358med,679863.455,946647.28,331.563

359sl,679838.988,946649.763,331.865

360sl,679820.621,946645.326,331.859

361med,679814.12,946640.925,331.792

362str,679807.614,946638.115,331.85

363med,679814.689,946627.061,331.338

364spt,679817.665,946616.079,330.645

365tree,679828.122,946614.044,330.841

366spt,679838.385,946613.781,330.356

367spt,679844.583,946621.483,330.737

368med,679855.856,946625.727,330.825

369med,679787.222,946631.296,331.769

370med,679779.997,946635.003,332.057

371spt,679780.163,946627.553,331.861

372spt,679770.268,946631.912,331.989

373spt,679762.184,946637.866,332.338

374bnd,679755.017,946660.031,333.075

375tourism,679754.057,946681.55,333.794

376bnd,679753.911,946682.645,333.981

377tourism,679750.219,946617.823,331.961

378spt,679748.369,946609.748,331.671

379spt,679726.428,946604.74,331.752

380spt,679711.234,946605.009,332.005

381tourism,679695.999,946619.976,332.841

382tourism,679701.524,946687.047,335.035

383bnd,679700.667,946687.499,335.004

384Ep,679692.385,946600.43,332.309

385bnd,679692.343,946579.706,331.427

386DR,679692.364,946578.639,331.36

387Rd,679703.943,946571.196,331.086

388Rd,679740.373,946576.544,330.725

389Rd,679738.515,946566.698,330.366

390DR,679737.454,946566.239,330.273

391Rd,679753.241,946565.427,330.238

392DR,679753.961,946565.058,330.165

393bnd,679759.686,946576.959,330.508

394DR,679759.724,946577.133,330.501

395DR,679759.861,946575.944,330.488

396Ep,679757.002,946560.945,330.053

397spt,679762.26,946554.368,329.652

398spt,679773.919,946545.447,329.265

399spt,679783.794,946545.283,329.106

400tree,679797.339,946532.097,328.547

401tree,679805.074,946530.922,328.508

402spt,679817.284,946535.3,328.231

403spt,679833.269,946524.568,327.689

404spt,679851.315,946542.722,327.869

405Rd,679850.677,946557.627,328.313

406Rd,679864.795,946556.813,328.179

407DR,679865.273,946555.801,328.113

408Ep,679875.386,946550.603,327.754

409spt,679888.512,946543.863,327.896

410spt,679891.642,946533.864,327.368

411spt,679888.834,946517.123,326.999

412masscom,679889.05,946517.058,326.937

413spt,679899.912,946522.355,327.064

414spt,679915.491,946519.935,326.838

415spt,679926.835,946515.582,326.717

416str,679926.944,946517.327,326.867

417str,679927.02,946518.465,326.937

418str,679925.635,946518.897,326.872

419masscom,679925.66,946484.247,325.628

420Ep,679922.207,946477.535,325.07

421spt,679912.947,946469.803,324.723

422spt,679898.424,946477.188,325.108

423phyD,679876.904,946460.337,324.493

424phyD,679875.601,946442.7,324.511

425phyD,679874.442,946422.755,323.12

426phyC,679874.342,946422.841,323.074

427phyC,679874.329,946404.951,323.035

428siwes,679811.118,946489.542,327.46

429siwes,679811.301,946504.852,327.813

430siwes,679794.779,946508.074,327.399

431siwes,679792.125,946517.124,328.323

432siwes,679778.86,946518.031,328.422

433spt,679757.972,946500.52,327.88

434spt,679747.861,946485.376,327.359

435spt,679765.4,946468.931,326.499

436lab,679773.686,946464.84,326.309

437spt,679786.077,946474.385,326.467

438spt,679800.348,946477.709,326.478

439spt,679808.88,946465.732,325.953

440lab,679825.205,946464.11,325.626

441spt,679832.263,946454.383,325.097

442tree,679841.479,946443.802,324.979

443spt,679836.611,946433.405,324.791

444spt,679840.71,946421.725,324.204

445sl,679843.568,946419.033,324.092

446str,679837.827,946407.144,323.659

447Ep,679839.873,946397.401,323.141

448spt,679833.502,946389.207,322.777

449spt,679839.897,946379.734,322.265

450spt,679828.421,946364.884,321.999

451spt,679836.122,946345.598,321.188

452lab,679821.687,946330.154,320.689

453spt,679819.882,946320.826,320.08

454spt,679812.306,946311.131,319.839

455ibasbld,679798.422,946314.969,320.305

456spt,679807.785,946295.85,319.677

457spt,679804.041,946284.353,319.198

458ibas,679796.616,946282.4,319.371

459spt,679780.583,946276.183,318.238

460spt,679772.829,946267.091,317.887

461spt,679755.961,946265.67,318.231

462spt,679749.541,946274.529,318.485

463spt,679734.099,946281.723,319.138

464spt,679733.006,946285.714,319.612

465spt,679723.714,946289.567,320.765

466sl,679706.427,946308.804,321.843

467spt,679719.407,946320.134,321.847

468ibas,679734.738,946318.282,321.374

469spt,679744.3,946332.602,321.916

470spt,679762.173,946330.736,321.611

471Ep,679762.223,946321.77,321.652

472str,679778.259,946321.119,321.018

473str,679780.514,946321.239,320.941

474str,679780.375,946319.129,321.025

475spt,679786.529,946328.307,320.588

476spt,679789.767,946319.323,320.675

477spt,679760.324,946343.063,321.974

478spt,679762.895,946357.967,322.449

479spt,679756.169,946379.483,323.445

480spt,679744.338,946388.777,324.37

481spt,679724.84,946387.462,324.48

482sl,679719.34,946389.328,324.635

483spt,679718.355,946368.399,323.298

484sl,679714.089,946355.145,323.126

485tree,679714.976,946332.789,322.782

486spt,679701.659,946277.468,320.652

487spt,679710.039,946259.778,319.527

488spt,679712.659,946245.359,319.17

489spt,679717.405,946223.476,318.638

490confe,679724.363,946216.6,318.346

491spt,679712.324,946222.709,318.634

492spt,679700.275,946222.701,318.734

493conf,679695.032,946217.477,318.649

494spt,679691.685,946207.163,318.352

495spt,679694.233,946192.327,317.707

496spt,679687.173,946179.679,317.446

497sl,679684.133,946171.226,317.288

498conf,679695.404,946173.152,317.111

499spt,679705.372,946164.723,316.326

500spt,679739.323,946169.855,315.974

501str,679761.513,946167.475,315.439

502str,679761.565,946165.877,315.361

503str,679763.633,946165.947,315.37

504toilet,679763.724,946168.653,315.318

505toilet,679764.159,946173.539,315.623

506toilet,679773.717,946173.249,315.333

507jamb,679667.644,946055.692,312.325

508jamb,679713.683,946049.057,311.138

509jamb,679657.435,946003.657,309.503

510str,679659.401,945994.96,309.083

511str,679673.217,945988.752,308.963

512str,679686.344,945995.935,309.356

513Ep,679665.236,946007.4,309.855

514bnd,679641.989,945898.537,304.249

515DR,679641.058,945898.56,304.298

516acbank,679767.196,945902.127,304.054

517acbank,679768.429,945942.749,304.927

518acbank,679797.233,945900.11,303.306

519fcmb,679823.157,945899.068,302.299

520Ep,679823.612,945897.795,302.293

521fcmb,679825.385,945940.806,303.377

522fcmb,679799.229,945942.602,304.032

523Rd,679960.583,945881.56,303.427

524Rd,679960.955,945885.462,303.397

525Rd,679960.597,945879.86,303.415

526Rd,679960.273,945876.384,303.311

527Rd,679980.368,945879.049,303.967

528Rd,679990.803,945880,303.78

529Rd,680065.766,945877.053,303.758

530Rd,680075.93,945877.731,304.157

531Rd,680073.689,945860.416,303.749

532Rd,680077.007,945858.284,303.83

533Rd,680074.737,945892.084,304.534

534Rd,680077.752,945894.679,304.644

535Rd,680048.003,945926.195,305.26

536Rd,680040.838,945925.336,305.266

537Rd,680031.644,945925.362,305.355

538Rd,680029.91,945915.743,304.974

539Rd,680019.595,945926.285,305.348

540Rd,680013.997,945929.263,305.319

541Rd,680019.203,945841.305,302.768

542Rd,680022.998,945831.059,302.63

543Rd,680015.023,945831.861,302.547

544Rd,680008.185,945829.006,302.226

545Rd,680037.147,945830.531,302.596

546Rd,680046.548,945829.766,302.324