FACILITIES MANAGEMENT OF PART OF KWARA STATE POLYTECHNIC, ILORIN, KWARA STATE, USING GIS APPROACH

BY

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HND/23/SGI/FT/0018

SUBMITTED TO

DEPARTMENT OF SURVEYING AND GEO-INFORMATIC, INSTITUTE OF ENVIRONMENTAL STUDIES (I.E.S), KWARA STATE POLYTECHNIC, ILORIN.

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE HIGHER NATIONAL DIPLOMA (HND) IN SURVEYING AND GEO-INFORMATIC.

JULY, 2025

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DECLARATION

I hereby conclude that I IBRAHIM IREWUNMI FATIMAT with matriculation number HND/23/SGI/FT/0018 fully participated on this project and acquired more experience about facilities management of Part of Kwara State Polytechnic, Ilorin, Kwara State.

NAME OF STUDENT: I IBRAHIM IREWUNMI FATIMAT

STUDENT SIGNATURE:________________________________

DATE:____

CERTIFICATION

I hereby certify that this project was carried out by I IBRAHIM IREWUNMI FATIMAT was submitted on ______________________ day of ______________________________ 2025

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SURV. AWOLEYE R.S DATE

PROJECT SUPERVISOR

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SURV. AWOLEYE .R.S DATE

PROJECT COODINATOR

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SURV. ABIMBOLA ISAU I. DATE

HEAD OF DEPARTMENT

_________________________ ____________________

EXTERNAL SUPERVISOR DATE

DEDICATION

This project is dedicated to Almighty God for His goodness endures forever, for His wisdom, knowledge and understanding for the completion of the project.

ACKNOWLEDGEMENTS

With great encomium to Almighty ALLAH, The creator, Author the one who has given the rare privilege to be among the living soul thank you so much!

I am also grateful and thankful to my Supervisor SURV. AWOLEYE R.S. for his wonderful assistance and contributions despite his tight schedules; he still finds time to attend to vet my work.

To my lecturers, people of selfless interest, thanks so much my H.O.D. MR. ISAU IBRAHIM ABIMBOLA, SURV. BANJI, SURV. ABDULSALAM, SURV. KABIR, SURV. ASONIBARE, SURV. DIRAN, SURV. SURV. KAZEEM AND SURV. A.G AREMU. I pray that the good Lord will be with you and abide with you and your families always.

I will be nothing but an ungrateful if I fail to appreciate the efforts of my lovely, caring, incomparable PARENT MR. & MRS. IBRAHIM for their parental care and support since the inception of my educational carrier, you stood by me when things were tough and rough for me, you gave me hope when others mock me, I will forever be grateful for the motivation you always give to me at all time, if I will pray to have parents in my life again, I will pray to have people like you.

To my lovely friends, I so much appreciate your support, for their support and advice thank you so much.

MAY ALMIGHTY ALLAH BLESS YOU ALL [AMEN].

ABSTRACT

Facilities management (FM) in building construction plays a critical role in ensuring the functionality, sustainability, and operational efficiency of buildings throughout their life cycle. FM involves the integration of planning, design, construction, and operational processes to maintain and enhance the built environment, aligning it with organizational goals and user needs. At the design phase, early involvement of facilities management is essential to reduce future costs related to repairs and alterations during the operational phase. Facilities managers collaborate with clients, designers, and users to establish project briefs, review designs for functionality, maintainability, and serviceability, and ensure that materials and systems meet sustainability and operational efficiency criteria. They advise on the use of environmentally responsible materials, energy-efficient systems, and renewable energy sources to minimize environmental impact and operational costs. This early engagement helps in optimizing building performance and lifecycle costs while supporting sustainable building objectives. In the construction planning phase, facilities management contributes to improving the quality of the operating environment by coordinating resources, managing risks, and ensuring compliance with design specifications. FM supports the integration of project teams, communication protocols, and quality control measures, which are vital for achieving project goals on time and within budget. Facilities managers participate in design reviews, commissioning activities, and stakeholder communication to ensure the building meets operational requirements and user expectations. Their expertise bridges the gap between construction and long-term building management, enhancing project outcomes and sustainability. Overall, facilities management in building construction encompasses a comprehensive approach that integrates technical, environmental, and organizational aspects. It ensures that buildings are designed, constructed, and operated efficiently, sustainably, and in alignment with the needs of users and owners, ultimately adding value and minimizing lifecycle costs.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

The technology in facilities management includes both software and systems. Vast amounts of data are generated by built environments through Internet of Things (IoT) sensors, wi-fi, meters, gauges, and smart devices. The most effective solutions enable facilities management departments to make good use of this data by infusing analytics and artificial intelligence (AI) into an Integrated Workplace Management System (IWMS). These technologies deliver cognitive capabilities that make computer-aided facilities management possible — so you can analyze and learn from data, enabling you to achieve real-time visibility, perform predictive facilities maintenance, and create more productive, cost-efficient environments. Space management is an important part of facilities management. Like facilities management, space management is not only concerned with the amounts of space, but should also address the quality of space. Therefore, interaction with users and other organizational elements involved in facilities management is necessary. Managing facilities space involves storing, querying, and updating spatial data and GIS is a recommendable tool for building a geo-database. Many facilities departments are using computer aided design (CAD) software for drawings and plotting maps. Recently, however, many are adopting GIS to work with their CAD files. **(Wiggins, Jane M. 2010).**

The key functions of GIS use in facilities management are spatial visualization and geo-database management functions. It has been used extensively for facilities management in the public sector and has great potential for use in the private sector as well. The field of facility or facilities management (FM) focuses on assisting people. It guarantees the efficiency, sustainability, comfort, and functioning of the built environment, which includes the structures where we live and work as well as the infrastructure around them. A facilities management company is a professional service provider, responsible for the overall functionality, maintenance and security of a building. They typically manage a large facility or complex. The company looks after a school, housing, office, or shopping complex, hospital or warehouse.

Facility Management is all about easing out operations and boosting productivity with their complete assistance of all time-consuming daily tasks that are necessary for smooth functioning of a company or an individual. Facility management is a multidisciplinary field focused on the efficient and effective delivery of services that support an organization's core activities. It encompasses the integration of people, place, and process within the built environment. In educational institutions, effective facility management is crucial for maintaining infrastructure, ensuring a conducive learning environment, and optimizing operational efficiency. ***Jeffrey R. (2017).***

Facility management involves the coordination of physical workplace resources with the people and work of an organization. In large institutions like Kwara State Polytechnic, efficient facility management is essential for sustainability, maintenance planning, space utilization, and service delivery. Traditionally, facility management has been carried out using manual techniques which are prone to errors, data loss, and inefficiencies. However, the emergence of Geographic Information Systems (GIS) has revolutionized spatial data handling and management. GIS provides tools for mapping, analysis, and decision-making by integrating spatial and non-spatial data. Applying GIS in facility management enables the creation of smart campuses with improved asset tracking, maintenance scheduling, and infrastructure planning. This study focuses on the GIS-based approach to facility management in part of Kwara State Polytechnic's Moro Campus to demonstrate how digital mapping and spatial data can enhance the institution's infrastructure management. **(*Eltringham, Mark 3 August 2017).***

Geographic Information Systems (GIS) offer a powerful tool for facility management by providing a platform to visualize, analyze, and manage spatial data related to buildings, utilities, and other physical assets. GIS integrates various data layers, such as maps, images, and attribute information, to create a comprehensive view of the facility. Facilities management can be defined as the tools and services that support the functionality, safety, and sustainability of buildings, grounds, infrastructure, and real estate. Facilities management helps ensure the functionality, comfort, safety and efficiency of buildings and grounds, infrastructure, and real estate. Facility management service provider is in charge of people, groups, locations, and infrastructure. Roles in people and organizations include those in marketing, accounting, hospitality, human resources, information technology, and cleaning. ***Murray, James (2020-01-30).***

Facility management includes a wide range of tasks and responsibilities, these tasks may include:

- A facilities management service provider is also in charge of overseeing workplace construction, leasing, occupancy, maintenance, and furniture space and infrastructure accounts.
- Facility Management includes all sorts of mechanical, electric, and plumbing tasks to assure timely maintenance and efficient operations.
- The other major services provided range from the factory in factory model, employee transport, canteen services, and the list goes on.
- A corporate house can completely depend on a facility management company to keep the company operations running while they manage their productivity and daily tasks.

What Is The Importance Of Facilities Management

For people to do their best work and feel engaged in their environments, they need to be in buildings that are safe, welcoming, and efficient. Facilities management has a hand in everything that surrounds the people in facilities and on the grounds. Where they work, play, learn, and live should be comfortable, productive, and sustainable. Superior facilities management will contribute to your organization's bottom line, impacting the short- and long-term value of property, buildings, and equipment. Your efforts can be crucial to:

- Space optimization
- Guiding capital projects
- Energy management and maintenance
- Lease accounting
- Workplace experience

A smart building with integrated systems can realize 30–50% savings in existing buildings that are otherwise inefficient.

1.2 STATEMENT OF THE PROBLEM

Kwara State Polytechnic, like many educational institutions, faces challenges in managing its facilities efficiently. These challenges include:

- Inefficient Asset Tracking: Difficulty in accurately locating and tracking the condition of physical assets (e.g., buildings, equipment, utilities).
- Poor Space Utilization: Inadequate analysis of space usage, leading to underutilized or overcrowded areas.
- Ineffective Maintenance: Challenges in planning and executing maintenance activities, resulting in delayed repairs and increased operational costs.

- Lack of Data Integration: Disconnected data silos, making it difficult to integrate facility-related information for comprehensive analysis.
- Limited Decision Support: Insufficient information for informed decision-making regarding facility planning, resource allocation, and infrastructure development.

1.3.1 AIM

The aim of this project is to develop a GIS-based facility management system for a selected part of Kwara State Polytechnic, Moro, to improve the efficiency and effectiveness of facility management operations.

1.3.2 OBJECTIVES

To achieve the aim, the project will have the following objectives:

- Data Acquisition: Collect and compile spatial data (e.g., building footprints, utility networks) and attribute data (e.g., asset inventory, maintenance records) for the selected area.
- GIS Database Development: Create a GIS database to store, manage, and integrate spatial and attribute data related to facilities.
- Spatial Analysis: Perform spatial analysis to identify areas of concern, such as underutilized spaces, maintenance needs, and potential hazards.

- Application Development: Develop a user-friendly GIS application for facility management, enabling users to visualize data, generate reports, and support decision-making.
- System Evaluation: Evaluate the effectiveness of the GIS-based facility management system in improving operational efficiency and decision-making.

1.4. SIGNIFICANCE OF THE PROJECT

This project is significant for several reasons:

- Improved Efficiency: The implementation of a GIS-based system can streamline facility management operations, leading to reduced costs and improved resource utilization.
- Enhanced Decision-Making: The system provides valuable insights for informed decision-making regarding facility planning, maintenance, and resource allocation.
- Better Asset Management: The project will facilitate accurate tracking of physical assets, enabling proactive maintenance and extending the lifespan of infrastructure.
- Enhanced Learning Environment: By improving facility management, the project will contribute to creating a conducive and safe learning environment for students and staff.
- Contribution to Knowledge: The project will contribute to the body of knowledge on the application of GIS in facility management, providing a practical case study for other educational institutions.

1.5 SCOPE OF THE PROJECT

The scope of this project will be limited to a selected part of Kwara State Polytechnic, Moro. The project will focus on:

1. Data Collection: Gathering data on buildings, utilities, and other relevant assets within the selected area.
2. GIS Database: Creating a GIS database to store and manage spatial and attribute data.
3. GIS Application: Developing a user-friendly GIS application for facility management.
4. Analysis: Performing spatial analysis to identify areas of concern and support decision-making.
5. Plan Production/ Information Production
6. Comprehensive Report Writing

1.6 PERSONNEL INVOLVED

Table 1.1: Personnel

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

1.7 STUDY AREA

Part of Kwara State Polytechnic Ilorin, Moro Local Government, 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. It is located along old gebba road Ilorin, Kwara State

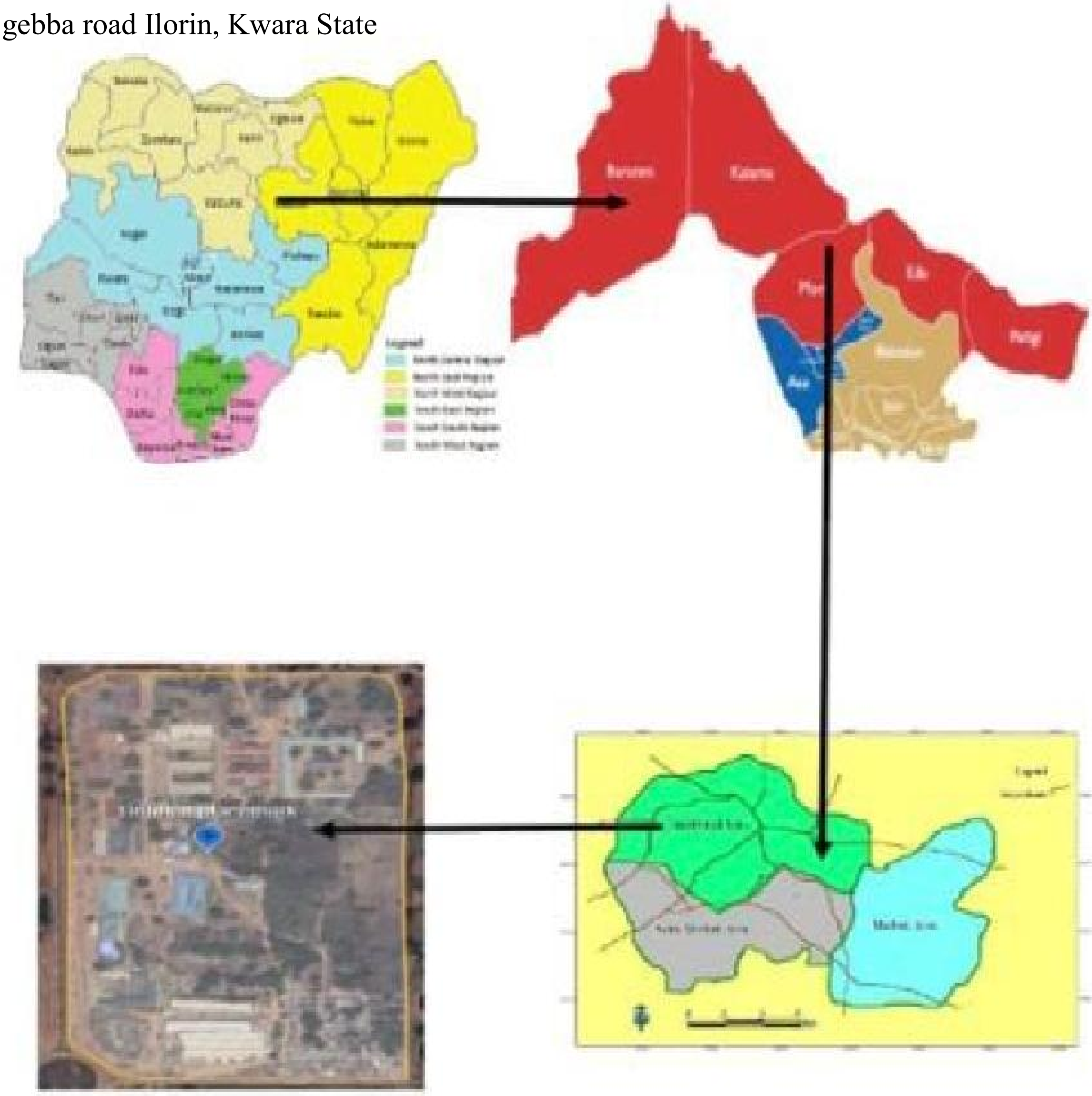


Fig. 1.1. goggle earth imagery of the study area

CHAPTER TWO

2.0 LITERATURE REVIEW

The discipline of facilities management is a relatively new, yet largely misunderstood profession. At the heart of this role is the capacity to integrate. In the face 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. ***(Murray, James 2020-01-30).***

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' in 1981 that has since spawned other professional associations worldwide. ***(Wubben, E. 2004)***

The term 'facilities management' (FM) has been the subject of much debate since its 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—tend 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''.

Concept of Facility Management

Facility Management (FM) is the practice of coordinating physical workspace with the people and work of an organization. According to the International Facility Management Association (IFMA), it involves integrating people, place, process, and technology to ensure functionality, comfort, safety, and efficiency.

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.

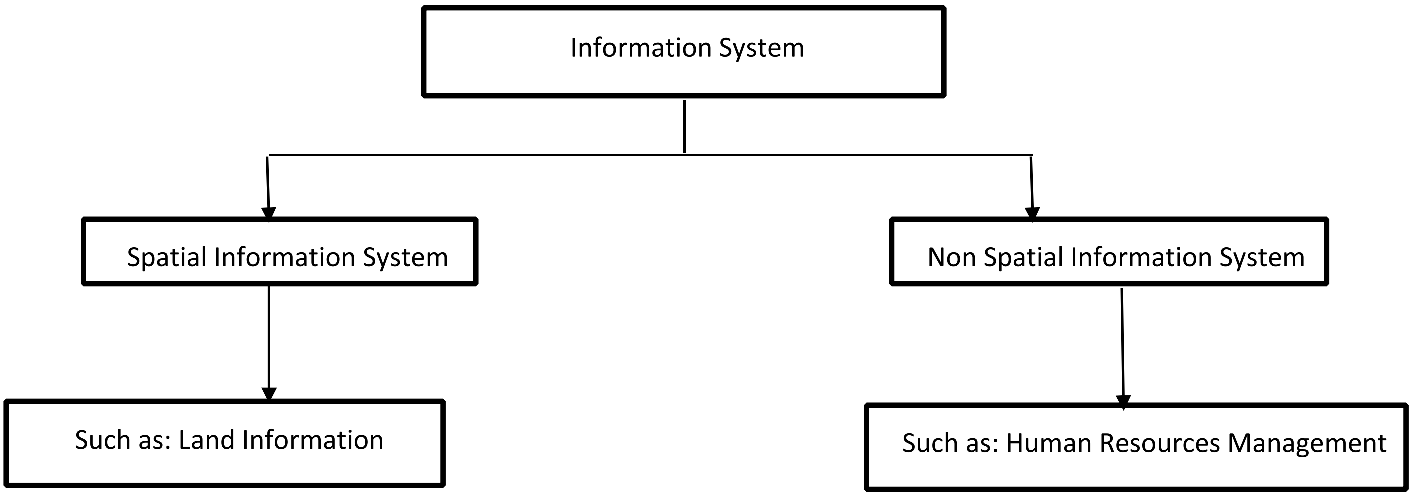
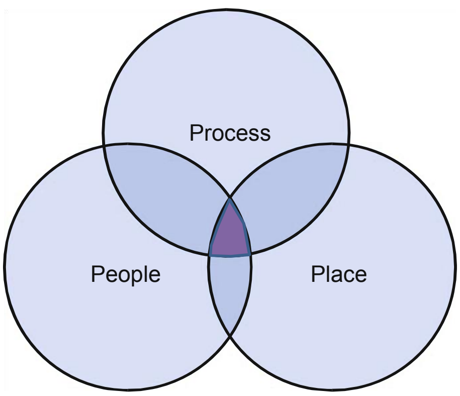


figure 2.1: concept of facility managements

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 organisation 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 outcomes. 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 international 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’ (International Facility Management Association 2009).



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''

The integration of Geographic Information Systems (GIS) into facility management has become increasingly prevalent, offering significant advantages in terms of efficiency, cost-effectiveness, and decision-making. This review synthesizes existing literature to provide a comprehensive understanding of the application of GIS in facility management, focusing on its relevance to the context of Kwara State Polytechnic. 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. GIS has been used to assist in the management of building spaces and facilities in recent years. With powerful capabilities for presenting data in visual formats and analyzing spatial relationships, GIS has gained popularity in both research and practice.

Several studies highlight the benefits of GIS in facility management, including improved space management, asset tracking, and maintenance scheduling. For instance, research by Smith (2018) demonstrated how GIS could optimize space utilization in educational institutions, leading to better resource allocation and reduced operational costs. Similarly, Jones (2019) emphasized the role of GIS in asset management, enabling real-time tracking of equipment and infrastructure, thereby enhancing maintenance efficiency and prolonging the lifespan of assets. ***(Pan, W. 2009).***

Brown (2020) showcased how GIS could be used to map emergency routes, identify potential hazards, and facilitate rapid response during crises. In the context of Kwara State Polytechnic, the implementation of GIS could enhance security measures by providing detailed spatial information for surveillance and access control. Considering the location of Kwara State Polytechnic in Ilorin, the application of GIS could also aid in integrating the facility's infrastructure with the broader urban planning initiatives of Moro Local Government (***Brown 2020).***

Concept of Facility Management

Facility Management (FM) is the practice of coordinating physical workspace with the people and work of an organization. According to the International Facility Management Association (IFMA), it involves integrating people, place, process, and technology to ensure functionality, comfort, safety, and efficiency.

Geographic Information System (GIS)is a technology used to collect, manage, analyze, and visualize spatial or geographical data. It allows users to view, interpret, and understand data to reveal patterns, trends, and relationships.

GIS in Facility Management

GIS has been adopted globally in facility management for purposes such as asset tracking, space allocation, emergency planning, and infrastructure maintenance. In academic institutions, GIS enables the creation of campus maps that link spatial features (like buildings and roads) to descriptive data (like usage, condition, and ownership).

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 ***(Ariff, N. R. M. 2016).***

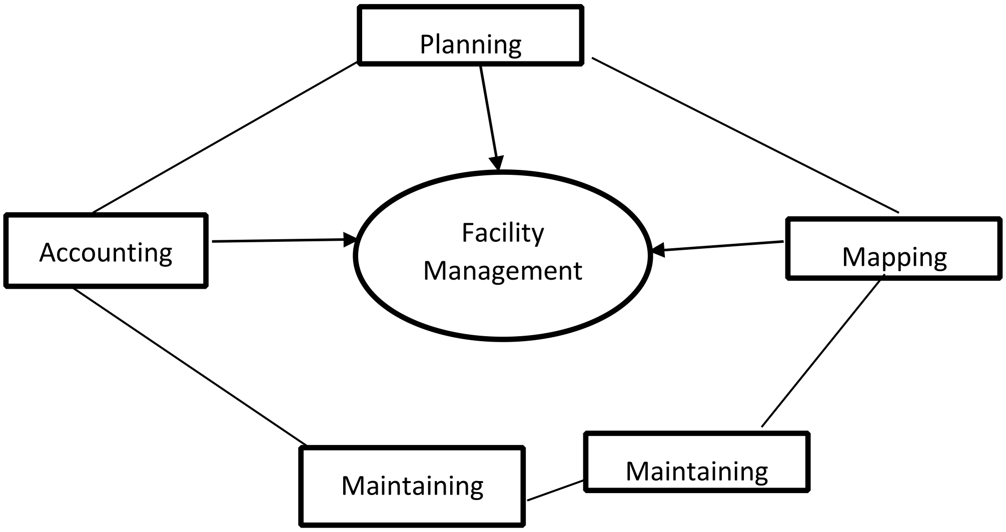


Figure 2.2:process of facility management

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 the table above, 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 (Operation and Management) 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(Robeel,2006).

By understanding theGeographic Information System (GIS) facilities, stakeholders and users can enhance land governance, improve land use planning, proper management and support sustainable development initiatives.

FACILITIES MANAGEMENT PROCESSES

In these conditions, organizations must ensure that they are responsive to change, and able to take advantage of technological innovation. Facilities management is the application of the total quality techniques to improve quality, add value and reduce the risks involved in occupying buildings and delivering reliable support services. Such an approach is required to provide and sustain an operational environment to meet the strategic needs of an organization. An ambience of quality can ensure that core business processes are well integrated and supported in an operational environment - the workplace. The process is cyclical and relates needs to a result that can be tested against user satisfaction with the service: • space - adapted to changing needs and effectively utilized; • environment - to create healthy and sustainable working environments; • information technology - to support effective communications; • support services - to provide quality services to satisfy users; • infrastructure - to provide appropriate capability and reliability. Organizations should have a clear strategy and well developed policies for facilities management embodied in a facilities plan, and should establish a single point of responsibility. **(*Berawi, A.R.B. 14 November 2017).***

The way in which facilities are organized in relation to central functions and to other operating units will determine the extent to which facilities support strategic needs. Value is added to an organization at the workplace through the provision of services in the most efficient and effective way: by the development and Many organizations now distinguish between the roles of purchaser and provider, and have moved towards the contract as a basis for service delivery. Organizations can release management time through using consultants and contractors. Third-party facilities management, outsourcing options and contract in out can all play their part. They also have to resolve issues concerning managing the facilities enterprise and privatization. The evolution of a facilities management organization can be traced from introduction and early awareness to consolidation and maturity as an autonomous business unit. Facilities management policies lay out an organization's response to vital issues such as space allocation and charging, environmental control and protection, and direct and contract employment. **(*Wiggins, Jane 2021).***

The policies will set a direction for the organization and establish the values and attitudes towards the facilities users - the corporation. its operating units and customers. individual employees and the public. The facilities plan will set out these policies and identify corporate guidelines and standards. The Principles of Scientific Management book (Taylor, 1911) has profound influence to the evolving theory of management science over the past ten decades. According to Jones and George (2012), the management theory has evolved from the scientific management theory in the 1880s and 1890s through the development of administrative management theory, behavioural management theory, management science theory and organizational environmental theory towards the theoretical system of contemporary management. In the past several decades, the revolution of integrated lifecycle management of built assets has made the facilities management (FM) one of the most fast-growing profession in the global construction industry with regard to clients' diverse needs and demands, and the formation of FM principles has been eventually in need for theory development for both research and practice for this profession ***(Taylor, 1911).***

The concept of total FM (Atkin and Brooks, 2015) has not only been adopted in practice, at Mitie for example, but also inspired management thought on three essential elements, including people, products and processes, to structure the FM body of knowledge (FMBOK) so as to derive a set of principles of FM. From FM profession point of view, people are FM professionals and their organisations, products are various FM services and processes are various management actions to provide FM services. A further review focussed on people, products and processes was therefore conducted into the evolution of management theory to set up a generic framework of management principles for FM. After looking into five major management theories summarised by Jones and George (2012), it has been found that the three essential elements as a whole set of essential elements of FM are well connected with key aspects inside the five management theories in terms of their coverage to all general management issues ***Jones and George (2012),***

Generally speaking, the best practice in FM satisfies two needs on dependability and sustainability. Dependability consists of issues about conditions of built assets and related FM services in terms of reliability, maintainability, supportability and adaptability. Sustainability includes all aspects of FM in relation to social, technical, economic, ecological and political issues. Based on needs for both dependability and sustainability in FM, and a comprehensive review and technical analysis into related literatures and practice, a set of six general principles of FM can be summarised within the FMBOK framework structure. For people, it emphasises professional competence and lean organisation. For products, it emphasises quality services and resources efficiency. For processes, it emphasises effective actions and dynamic responses. ***(Brooks. 2009).***

Generally speaking, the best practice in FM satisfies two needs on dependability and sustainability. Dependability consists of issues about conditions of built assets and related FM services in terms of reliability, maintainability, supportability and adaptability. Sustainability includes all aspects of FM in relation to social, technical, economic, ecological and political issues. Based on needs for both dependability and sustainability in FM, and a comprehensive review and technical analysis into related literatures and practice, a set of six general principles of FM can be summarised within the FMBOK framework structure. For people, it emphasises professional competence and lean organisation. For products, it emphasises quality services and resources efficiency. For processes, it emphasises effective actions and dynamic responses.

Facility management or **facilities management** (**FM**) is a professional discipline focused on coordinating the use of space, infrastructure, people, and organization. Facilities management ensures that physical assets and environments are managed effectively to meet the needs of their users. By integrating maintenance, safety, efficiency, and comfort, FM supports organizational goals within the built environment. The profession operates under global standards such as ISO 41001 and is guided by organizations like the International Facility Management Association (IFMA) ***(Oluwole (2009).***

The concept of facilities management originated in the 1960s, primarily in the context of IT systems management. The term was coined by IBM alumnus and Electronic Data Systems founder Ross Perot, to describe the integration of network management and support services. Over time, it expanded to include broader elements of building and operational management. Facility management as integral to the processes of strategic organizational planning was represented during a 1979 conference sponsored by Herman Miller. Following the meeting, the furniture manufacturer opened the Facility Management Institute (FMI), with its headquarters in Ann Arbor, Michigan. The National Facility Management Association (NFMA) was formed in 1980, separating the overall profession from a single enterprise. In 1982, the NFMA expanded to form the International Facility Management Association (IFMA)

In 1986, the first professional FM organization was launched in the UK, as the Association of Facility Managers (AFM). Facility management encompasses interdisciplinary business functions to balance the demand and supply of facilities and services. The term "facility" includes all tangible assets supporting an organization, such as real estate, buildings, infrastructure, HVAC systems, IT services, and more.

In 2017, ISO 41011 defined FM as the "organizational function which integrates people, place and process within the built environment with the purpose of improving the quality of life of people and the productivity of the core business."[5] The ISO definition was formally adopted by BIFM in August 2017. ISO 41001:2018 provided a management framework to implement these principles. (***David, G. Cotts. 1999).***

Facilities Management Is Divided Into Two Major Categories

1. **Hard FM**, referring to the management of physical infrastructure, including HVAC, plumbing, lighting, and maintenance.
2. **Soft FM**, referring to services supporting occupants including cleaning, catering, security, and event setups.

Key Competencies

According to the IFMA: "FM is the practice of coordinating the physical workplace with the people and work of the organization. It integrates the principles of business administration, architecture, and the behavioral and engineering sciences." In a 2017 global job task analysis, IFMA identified eleven competencies of facility management as:

- leadership and strategy
- operations and maintenance
- finance and business
- environmental stewardship and sustainability

- project management
- Human factors and ergonomics
- real estate and property management
- facility and technology management
- risk management
- communication
- quality and performance

The Institute of Workplace and Facilities Management, formerly the British Institute of Facilities Management, adopted the European definition and through its accredited qualification framework offers career path curriculum ranging from school leaver level through to master's degree level that is aligned with the European Qualifications framework.

FM may also cover activities other than business services: these are referred to as non-core functions and vary from one business sector to another. FM is also subject to continuous innovation and development, under pressure to reduce costs and to add value to the core business of public or private sector client organizations.

Accredited academics

Facility management is supported with education, training, and professional qualifications often coordinated by FM institutes, universities, and associations. Degree programs exist at both undergraduate and post-graduate levels. Facility Management has been a recognised academic discipline since the 1990s. Initial FM research work in Europe started in universities in the UK, the Netherlands and the Nordic countries, where academies funded research centers and began to establish courses at Bachelors, Masters, and PhD levels. Early European FM research centers include the Centre for Facilities Management (CFM), founded in Glasgow in 1990; the Centre for People and Buildings at Delft University of Technology; and Metamorphose at the Norwegian University of Science and Technology The University of Moratuwa Faculty of Architecture in Sri Lanka has offered a BSc. degree in Facilities Management since 2006.

In 2018, 50 universities and research institutions were represented in EUROFM. The German Facility Management Association (GEFMA) has certified 16 FM study programs and courses at universities and universities of applied sciences in Germany. As of 2021, IFMA accredits university degree programs in the United States, Sri Lanka, South Korea, Singapore, Germany, Sweden, Hong Kong, Ireland, and the Netherlands. (Ludlow, G., & Shah, S. 2010).

Role of the facilities manager

Facilities managers (FMs) operate across business functions. The main priority of an FM is keeping people alive and safe. Facility managers need to operate at two levels:

- Strategically and tactically: helping clients, customers and end-users understand the potential impact of their decisions on the provision of space, services, cost, and business risk.

- Operationally: ensuring a corporate and cost-effective environment for the occupants to function.

EHS: environment, health and safety

The FM department in an organization is required to identify, analyze, evaluate, control, and manage many environment and safety-related issues. Failure to do so may lead to unhealthy conditions leading to employees falling sick, injury, loss of business, prosecution, and insurance claims. The confidence of customers and investors in the business may also be affected by adverse publicity from safety lapses.

Fire safety

The threat from fire carries one of the highest risks to loss of life, and the potential to damage property or shut down a business. The facilities management department will have in place maintenance, inspection, and testing for all of the facility's fire safety equipment and life safety systems, keeping records and certificates of compliance.

Security

Protection of employees and the business often comes under the control of the facilities management department, particularly the maintenance of security hardware. Staffed guarding may be under the control of a separate department.

Maintenance, testing and inspections

Maintenance, testing, and inspection schedules are required to ensure that the facility is operating safely and efficiently in compliance with statutory obligations, to maximize the life of equipment, and to reduce the risk of failure. The work is planned, often using a computer-aided facility management (CAFM) system. Building maintenance includes all preventative, remedial, and upgrades works required for the upkeep and improvement of buildings and their components. These works may include disciplines such as painting and decorating, carpentry, plumbing, glazing, plastering, and tiling.

Buildings may be designed with a view to minimizing their maintenance requirement.[18]

Cleaning

Cleaning operations are often undertaken out of business hours, but provision may be made during times of occupations for the cleaning of toilets, replenishing consumables (such as toilet rolls, soap) plus litter picking and reactive response is scheduled as a series of periodic (daily, weekly and monthly) tasks.

Operational

The facilities management department has responsibilities for the day-to-day running of the building; these tasks may be outsourced or carried out by directly employed staff. This is a policy issue, but due to the immediacy of the response required in many of the activities involved the facilities manager will often require daily reports or an escalation procedure.

Some issues require more than just periodic maintenance, for example, those that can stop or hamper the productivity of the business or that have safety implications. Many of these are managed by the facilities management "help desk" that staff is able to be contacted either by telephone or email. The response to help desk calls is prioritized but may be as simple as too hot or too cold, lights not working, photocopier jammed, coffee spills, or vending machine problems.

Help desks may be used to book meeting rooms, car parking spaces, and many other services, but this often depends on how the facilities department is organized. Facilities may be split into two sections, often referred to as "soft" services such as reception and post room, and "hard" services, such as the mechanical, fire, and electrical services. Due to climate change, FM providers are increasingly focused on environmental, social and governance compliance considerations.

Business continuity planning

All organizations should have a continuity plan so that in the event of a fire or major failure the business can recover quickly. In large organizations, it may be that the staff move to another site that has been set up to model the existing operation. The facilities management department would be one of the key players should it be necessary to move the business to a recovery site.

Space allocation and changes

In many organizations, office layouts are subject to frequent changes. This process is referred to as churn, and the percentage of the staff moved during a year is known as the "churn rate". These moves are normally planned by the facilities management department using a computer-aided design (CAD) system. In addition to meeting the needs of the business, compliance with statutory requirements related to office layouts include:

- The minimum amount of space to be provided per staff member
- fire safety arrangements
- lighting levels
- signage
- ventilation
- temperature control
- welfare arrangements such as toilets and drinking water

Consideration may also be given to vending, catering, or a place where staff can make a drink and take a break from their desk.

Theoretical Review on Facilities Management

Overview of Facilities Management (FM)

Facilities Management (FM) is a multidisciplinary field that integrates various activities, responsibilities, and knowledge areas to ensure the effective and efficient provision of support services within organizations. FM aims to maintain, improve, and adapt the buildings, systems, and services of an organization, aligning them with the organization's core objectives and supporting its primary functions3. The discipline has evolved significantly, especially since the late 20th century, becoming a critical component in both public and private sectors worldwide3.

Core Theoretical Foundations

- **Integration of Disciplines:** FM draws from business administration, architecture, engineering, and behavioral sciences. It is fundamentally about coordinating the physical workplace with people and organizational processes13.
- **Support Function:** FM is recognized as a supporting management function that bridges the gap between an organization's core business and its physical environment1.
- **Strategic, Tactical, and Operational Levels:** FM operates at multiple levels, from strategic planning and policy development to day-to-day operations and maintenance3.

Key Theoretical Models and Definitions

- The US Library of Congress defines FM as "the practice of coordinating the physical workplace with people and work of the organization, integrating principles of business administration, architecture, and the behavioral and engineering sciences"1.

- The Centre for FM at the University of Strathclyde describes FM as “the process by which an organization delivers and sustains a quality working environment and delivers quality support services to meet the organization's objectives at best cost”1.
- Various scholars have emphasized the integration of space management, environmental control, health and safety, and support services as central to FM3.

Theory Building in Facilities Management

- **Performance Measurement:** A significant area of theoretical development in FM is performance measurement. Theory building in this context often involves case study methodologies, integrating both qualitative and quantitative research to assess how FM contributes to organizational performance1.
- **Epistemological and Methodological Approaches:** Research in FM frequently adopts mixed methods, utilizing case studies, thematic analysis, and statistical techniques to validate theoretical frameworks12.
- **Framework Development:** Theoretical frameworks in FM are typically developed through literature reviews, identification of gaps, and empirical validation. For instance, frameworks for facilities maintenance management in higher education have been constructed to address challenges such as budget constraints, inadequate planning, and the need for strategic alignment with organizational goals2.

Scope and Functions of Facilities Management

FM encompasses a broad range of functions, which can be classified into several main areas, including:

- Space and workplace management
- Maintenance and operations
- Health, safety, and environmental management
- Support services (e.g., cleaning, security, catering)
- Real estate and property management
- Information technology and infrastructure support3

A recent literature review identified at least 37 distinct functions performed by FM professionals, highlighting the complexity and breadth of the field3.

Challenges and Theoretical Gaps

- **Lack of Standardization:** There is no universally agreed-upon definition or scope for FM, leading to variation in practice and understanding across regions and sectors13.
- **Resource Constraints:** Studies, particularly in the context of higher education institutions, have identified chronic issues such as insufficient maintenance budgets, lack of strategic planning, and inadequate technical staffing as major barriers to effective FM2.

- **Contextual Adaptation:** Theoretical models emphasize the need for FM practices to be tailored to the specific characteristics and needs of each organization, rather than relying solely on generic standards or best practices3.

Recent Theoretical Developments

- **Strategic Frameworks:** New frameworks are being developed to address emerging challenges, such as sustainability, quality control, and cost-effectiveness, especially in resource-constrained environments2.
- **Validation and Adaptability:** Theoretical models are increasingly being validated through empirical research and expert consultation, ensuring their relevance and adaptability to diverse organizational contexts2.

The theoretical landscape of facilities management is characterized by its multidisciplinary nature, evolving definitions, and the integration of strategic, tactical, and operational perspectives. While significant progress has been made in developing models and frameworks for FM, ongoing challenges related to standardization, resource allocation, and contextual adaptation remain central to both research and practice. Theoretical advances continue to shape FM as a vital support function, aligning the built environment with organizational objectives and operational efficiency.

Torbical and Stroh (2001) research suggested that service is the most important component in determining overall satisfaction. However, previous research have shown how residents of public housing have expressed dissatisfaction with their housing stock, being low quality housing that do not adequately match their needs, owing to lack of basic features such as good roads, schools, refuse disposal systems, security system, waste disposal, portable water, stable electricity, children playgrounds, community halls, car parks, facilities for the disables, fire escape route, fire prevention and fighting devices, adequate facilities management services, management response to repairs, and handling of residents' complaints (Salleh et al 2011; David Jiboye, 2012; E. Eyiah-Botwe, 2015).

Facilities management practice in Nigeria is still in an early development cycle unlike in more developed countries like Europe, United States, e.t.c. where the practice has been on since 1980's. Although facilities management in Nigeria has been embraced by some corporate organizations for effective productivity, some other sectors like the healthcare, manufacturing, educational and historic sectors are yet to explore the benefits of efficient facilities management on their performance. (Durodola, 2009).

Several organizations have been managing a number of assets in their facility portfolio using GIS for several years. In recent years, GIS has been applied in electricity distribution in an equitable and efficient manner, pavement management at airports and in utility management.

Stuart, R. and Kevin H. (2010) he discussed GIS applications adoption by US Air force to provide decision support system for the handlers of the Air Force bases management affairs.

Aerial Imagery or Global Positioning Systems (GPS) are the most commonly used primary sources of spatial data to be used for a facility geodatabase. While the aerial imagery gives a bird eye view of the nature of the facilities and through which the physical attributes of the facility can be derived from, the GPS fixed the relative position of the facility to the center of the earth surface. The limitations of these two data sources are often the fact that they could not penetrate the roof to see through what is inside a covered facility. This limitation led to increasing demand for more improved technologies to reduce the significant holes that this has left in the creation of facility geodatabases.

New technologies such as Computer Aided Design (CAD) floor plains or Building Information Model (BIM) are bridging the gap from the aerial imagery and GPS. The new technology provides inside information about the facilities to give a more complete description of the facilities. The integration of the new technology and geo-technology is making it gradually possible to unmask the business activities taking place inside the building (Stuart, R. and Kevin H., 2010).

Today, GIS provides a good alternative to analyze the spatial aspects of components of facility management workflows in a cost-effective manner. It provides support system that will optimize use of financial and human resources leading to optimal productivity.

However, according to (Stuart, R. and Kevin H., 2010) he said that no much achievement has been recorded in developing multidimensional visualization model that will provide a business support system. Such system will incorporate element of space, time and money in business decision making processes support systems. This system if developed will provide an advanced spatial analytic support system to support businesses that are situated in multiple geographical areas.

GIS provides platform that support the integration of information from spatial, temporal and informational dimensions. Such integrations provide solutions such as:

1) Optimal use of resources by integrating cost data with the visualization of space and occupancy.

2) Routing path for immediate evacuation during emergency.

3) Determining the total value of the land and property assets which the city has sold within a particular period of time.

4) Shortest route to deliver sold to the homes of new customers.

5) Model to determine and predict the spread and direction, effect of fire at any particular weather condition.

6) Visualization of energy consumption data at the room level while simultaneously managing maintenance workflows for mechanical, electrical and plumbing systems for a nationwide facility infrastructure.

Surface data such as topographical surfaces, aerial photos, parcel delineation. Paved and unpaved roads, wetlands, agricultural lands, soils map, building footprints, water bodies, CAD designs showing information not provided by aerial imagery can all be integrated using GIS to produce a base map of the area. The map could serve as a campus tour guide for the students and visitors. This map will assist in identification and collection of information about any features within the area. At Troy University, ArcGIS was used to generate the 3-D model of campus.

GIS tool provide efficient and effective management of surface and subsurface facilities. Subsurface facilities however create a daunting challenge to the managers, information such as exact location, network distribution and analysis, and management of sub surface facilities, are extremely tasking to the managers.

Adoption of GIS has simplified the problems associated with the management of these subsurface facilities. This can be identified by integration of aerial photo or any other ground feature with underground facilities, and then perform measurements; such as geographical location and the area extent. Also, GIS can provide network-based spatial analysis for utilities including flow direction and topology creation. Moreover, GIS can be used to track work orders such as landscape and utilities maintenance. For example, a list of maintenance tasks showing the description and location in the work order. In landscape management, GIS mapping and display capabilities can be used to map out the landscape features such as flowers, trees and other plants and them displayed using the symbols embedded in ArcMap. The locations of these features will be collected using GPS and plotted for display in ArcMap. These features have symbols in ArcMap that depict them. These features can further be draped on the digital elevation model to give a more accurate surface model of the landscape. ArcMap has graphical representation for different kind of trees and the ability to include schedule for regular requirements of watering, pruning, weeding, and fertilizing. Thus, GIS can help in maintenance of landscape appearance and increases productivity of the facilities department staff (Weiss M. D., 2009).

GIS can be used in facility space planning such as emergency planning and response. In space planning, map can contain the parking spaces allocated for visitors and students, accessible buildings, routes, etc. These can further be reclassified into handicap parking space, buildings that are handicap accessible.

Ferries State University (FSU) in its adoption of GIS to provision of services for physical challenged students, it integrates aerial photographs with other mapping techniques to map out handicap accessibility facilities. The space planning was possible by delineating the suitable areas in ArcMap using the aerial photograph as the data source. Pedestrian and Transportation planning can also be carried out showing paths on campus such as different paths for bicycles, cars, motorcycles while also displaying visitors and students parking spaces. This can be color coded to differentiate one path from the other or one parking space from another. Parking, Transit and Traffic services (PTTS) at Texas A & M University uses the campus GIS for mapping and managing bus routes, striping work on streets and parking lots, keeping track of signs, and managing parking lot allocations. PTTS is planning, with the Police Department, to implement a dispatching system for bus, police and 911 emergency uses (Bassham, C. R., 1994).

In emergency planning and response management, GIS can be used to show fire hydrants and display their locations. In the event of a fire or earthquake, a campus planner will be able to determine the area that are prone to fire risk and the area that are risk free. During the fire outbreak, GIS would be able to provide risk free path through which people can be evacuated from. In addition, it helps a campus planner under any emergency to quickly locate water and gas shut-off valves (Weiss, M. D., 2009).

Generation of 3D maps and events requires careful planning and design processes. The first process will be to examine the design process which will influence the look of the final outcome. The examination of the process is to have a better understanding of the application of the cues and resources to give a required output. The first step of the design process is data modelling. This involved data analysis, format conversion, etc. At this stage, geometric and semantic aspects are reshaped and aggregated and classified in the format required with the specific software used for designing and producing 3D maps. Symbolization is the next step. This step involves defining the legend for both the Digital terrain model section and the thematic objects. The last step is visualization. Parameters are chosen for creating the image and completing the scenery that will become the final 3D map (Haeberling, C., 2002).

(Keith C. Clarke, 1995): -Define a GIS as a system of hardware, software, and procedures designed to support the capture, management, manipulation, analysis, modeling, and display of spatially-referenced data for solving complex planning and management problems.

(David G. Cotts, 1999): -He defined Facility management as the practice of coordinating the physical workplace with the people and work of the organization; it integrates the principles of business administration, architecture, and the behavioral and engineering sciences.

(Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind, 2005): - Defined a GIS as a powerful set of tools for collecting, storing, retrieving at will, transforming, and displaying spatial data for a particular set of purposes.

(Keith Alexander, 2003): - Define facility management as a profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, process, and technology.

With growing environmental concerns, facility management has increasingly focused on sustainability. This includes implementing energy-efficient systems, reducing waste, and promoting sustainable practices. Studies have shown that sustainable facility management can lead to significant cost savings and environmental benefits (Elmualim et al., 2010).

The adoption of technology in FM, such as Building Information Modeling (BIM) and Computer-Aided Facility Management (CAFM) systems, has revolutionized the field. These technologies enhance the accuracy and efficiency of facility management practices by providing detailed data and analytics for decision-making (Kassem et al., 2015).

Future trends in facility management include a greater focus on smart buildings, increased use of artificial intelligence and machine learning for predictive maintenance, and a stronger emphasis on sustainability and resilience in the face of climate change (Roper & Payant, 2014).

According to Alkaabi and Saeed (2014), GIS-based mapping enhances the understanding of facility layouts and spatial distribution, aiding in efficient space utilization and planning.

GIS integrates various types of spatial data, including CAD drawings, satellite imagery, and sensor data, providing a comprehensive view of facilities. This integration supports more informed decision-making and efficient management of resources (Zhu et al., 2014).

GIS plays a critical role in emergency planning and safety management by providing detailed maps of facilities, including evacuation routes, fire exits, and hazard locations. This information is vital for developing effective emergency response plans and ensuring occupant safety (Tsou et al., 2005).

GIS can map and analyze energy consumption patterns within a facility, identifying areas of high energy usage and potential for efficiency improvements. This analysis supports the implementation of energy-saving measures and sustainability initiatives (Huang et al., 2010).

GIS enables the monitoring of environmental factors such as air quality, temperature, and humidity within facilities. This monitoring helps maintain optimal conditions for occupants and supports environmental sustainability efforts (Guan et al., 2015).

Integrating diverse data sources into a GIS platform can be challenging due to differences in data formats, scales, and accuracy. Ensuring high-quality, accurate spatial data is crucial for effective GIS applications in facility management (Alavi et al., 2014).

Implementing GIS technology requires significant investment in software, hardware, and training. Smaller organizations may face financial constraints that limit their ability to adopt GIS for facility management (Khorram et al., 2008).

Effective use of GIS in facility management requires specialized knowledge and skills. Providing adequate training for facility managers and staff is essential to maximize the benefits of GIS technology (Pfeffer et al., 2013).

Combining GIS with BIM can provide a more detailed and dynamic representation of facilities, enhancing capabilities for design, construction, and facility management. This integration supports more holistic and data-driven decision-making (Sebastian & van Berlo, 2010).

The incorporation of real-time data from Internet of Things (IOT) sensors into GIS platforms can provide up-to-date information on facility conditions, improving monitoring and responsiveness. This trend is likely to enhance the efficiency and effectiveness of facility management practices (Klein et al., 2017).

The move towards smart facilities involves leveraging GIS and other technologies to create more intelligent and sustainable buildings. This includes optimizing energy use, improving occupant comfort, and reducing environmental impacts (Aziz et al., 2016).

he Principles of Scientific Management book (Taylor, 1911) has profound influence to the evolving theory of management science over the past ten decades. According to Jones and George (2012), the management theory has evolved from the scientific management theory in the 1880s and 1890s through the development of administrative management theory, behavioural management theory, management science theory and organizational environmental theory towards the theoretical system of contemporary management. In the past several decades, the revolution of integrated lifecycle management of built assets has made the facilities management (FM) one of the most fast-growing profession in the global construction industry with regard to clients' diverse needs and demands, and the formation of FM principles has been eventually in need for theory development for both research and practice for this profession.

The concept of total FM (Atkin and Brooks, 2015) has not only been adopted in practice, at Mitie for example, but also inspired management thought on three essential elements, including people, products and processes, to structure the FM body of knowledge (FMBOK) so as to derive a set of principles of FM. From FM profession point of view, people are FM professionals and their organisations, products are various FM services and processes are various management actions to provide FM services. A further review focussed on people, products and processes was therefore conducted into the evolution of management theory to set up a generic framework of management principles for FM. After looking into five major management theories summarised by Jones and George (2012), it has been found that the three essential elements as a whole set of essential elements of FM are well connected with key aspects inside the five management theories in terms of their coverage to all general management issues.

In the world of business, decisions are driven by pressures to improve quality, reduce costs and minimize risks. This means that organizations must frequently undergo deep cultural changes involving all business processes, often with fundamental shifts in their organizational structures and working patterns. In this climate of change, quality of life and environmental issues are involved which together with issues of heritage and of conservation become part of the business agenda. Facilities management is at the heart of this process. Facilities management is a key business discipline. Large corporations recognize its importance for business success. Smaller enterprises improve their performance by making better use of resources, often by forming networks and partnerships. Consultants and contractors in turn develop a variety of services to support this organizational effectiveness. When times are difficult in business, when there is increasing corporate restructuring and growing uncertainty, facilities management becomes an area of substantial growth. Evidence of this can be seen as those professional bodies of the construction, hospitality and information technology industries increasingly recognize the opportunities that facilities management provides to their members to develop new value-added services, better integrated with an organization's business needs. Many relevant professional associations consolidate and work together to promote the professional status and role of facilities managers. Facilities management consultants offer management and advisory services and undertake work on behalf of corporate and public sector clients on an agency or management contracting basis. Major contracting organizations offer contracted business services, either independently or in a 'total facilities management' package. Given the quest for improved effectiveness, especially when promoted by government policy, the market in both the public and private sectors expands rapidly. In a business context where the raised expectations of clients lead to enhanced customer awareness, where economic, technological and environmental issues are affected by proliferating legislation, and where traditiona! discipline boundaries are challenged by information technology, facilities management can have its greatest impact. Many of these contexts also involve a redefining of the roles of purchaser and provider, and a move towards a contract basis for service delivery. The informed buyer or intelligent client requires more management time at the interface with the user, more effective use of contracting out and less time administering inappropriate and cumbersome contracts. Effective quality systems, in which there is an appropriate balance between social, environmental, technical and economic issues, can release time to enable 'competition for quality', but who understands enough about the client's business that they can deliver quality facilities and so realize organizational effectiveness? Can such a person exist? Market research has identified the need in facilities management for a kind of hybrid manaager, a cross between professional manager and technical professional, combining the ability to make things happen with a level of technical understanding to enable facilities in organizations to be tuned to strategic needs. This requires the development of an appropriate balance of management and technical skills. Such a balance can lead to healthy and ecologically sound buildings in a business context, and resolve the relationships between organizations, the individual, the environment and the business community. Strategic facilities managers are judged by their managerial capabilities rather than their technical competence. In many cases this means adding business, social and personal skills to a technical skills base. New groups of management skills, covering people, marketing, purchasing and contract, are involved. In an applied field like this it is vital that these skills are exercised in a practical, industrially relevant context. The education and training of facilities managers, underpinned by research, must either be seen as part of general management development, or end up being marginalized. Facilities managers must have an understanding of facilities and services, recognize when further expertise is needed, contribute to strategic business planning and be in line for senior management posts in an organization. Occupational competency-based management standards for facilities managers are essential. An open, individual, corporate, continuing system for such standards has to register a demonstrable ability to manage at junior (operational), middle (tactical) or senior management (strategic) levels. The aim is a mix of technical competence, language skills, cultural sensitivity and, at the top, a controlling vision that can bind activities together in many different countries. The need for such able and experienced managers is strong and widespread. To meet the challenges of the next century the profession must organize in such a way as to be responsive to these needs. Professional associations in facilities management will flourish if they develop an open and positive approach to serving the needs of the consumer. United they could foster a strategy to: • define standards for quality of performance and service; • provide full support to practitioners by establishing a collective knowledge base and providing up-to-date information; • provide guidance to the educational sector to support the development of modular courses at undergraduate, postgraduate and post-experience level; • provide the means for an open exchange of experience and skills; • create the conditions to promote advancement of the discipline, receptive to new ideas arid supportive of a breadth of vision.* Advancement of the profession hinges upon the assurance of quality and upon the value added by the service. The agenda for a professional quality system includes creating a ladder of educational opportunity and establishing qualifications, promoting the continuous development of skills and experience, and creating and maintaining an accessible collective database. By establishing this quality system the profession can achieve a status and recognition that will provide an influence in business strategy and a strong voice in environmental politics. Such developments require close collaboration between academics, practitioners and researchers on a pannational basis. The mechanisms should be created to support the processes of professional development through research, education and training. If facilities management is to be acknowledged as a profession with its own rigorous discipline, it needs to sow the seeds for a strategy and infrastructure to promote development. 'Centres of excellence' should be created and linked into a network, to provide the focus for all this. The University of Strathclyde, through the Centre for Facilities Management, has been involved in facilities management education in the United Kingdom since the middle of 1980. The first short courses were jointly presented with DEGW in 1984. The MSc and Diploma in Facilities Management has been running since 1987, with the aim of graduating high quality, innovative thinkers with a balance of managerial and technical skills and understanding, capable of contributing to the development of facilities management research and practice. Since 1994, CFM has consolidated its role and diversified its courses still further. Its aims and objectives are met by providing a mix of quality learning opportunities, supported by quality learning materials, information and facilities with the support and guidance of well qualified core staff. It is working to create qualifications that provide a ladder of opportunity to bridge from functional to general management.

To ensure it is fully aware of and can anticipate change, and to maintain standards, CFM has an Advisory Board, comprising representatives from all sectors of the industry. It makes visiting appointments to benefit from the experience and expertise of the leading practitioners and researchers in the field and it has strong working relationships with prominent companies. Professional associations in the FM field are also represented. The Centre is a focus for research and discussion and seeks to create an atmosphere of enquiry and debate. It also provides the opportunity to meet leading experts from education, research and practice. CFM staff are well qualified, experienced professionals dedicated to supporting learning needs. They are all active in research, provide services to some of the leading companies in the UK, and bring up-to-date knowledge and recent experience to its courses. It is in the forefront of facilities management education in the United Kingdom and has a flourishing international reputation for its work. Its aim is to be recognized as a 'centre for excellence' in the field.

*Professional qualifications and undergraduate and postgraduate courses are increasingly available. Associations have been formed to promote facilities management and to represent the interests of members in the United States (IFMA), Japan (JFMA), Australia (FMA) and in Europe in the United Kingdom (BIFM), the Netherlands (NEFMA), Germany (GEFMA), Denmark (DFM), Hungary (HUFMA) and Finland (FIFMA). The associations, academic institutions and research organizations in Europe collaborate through the European Facilities Management Network (EuroFM) ***(Zhang, S., & Jiang, C. 2015)***

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.

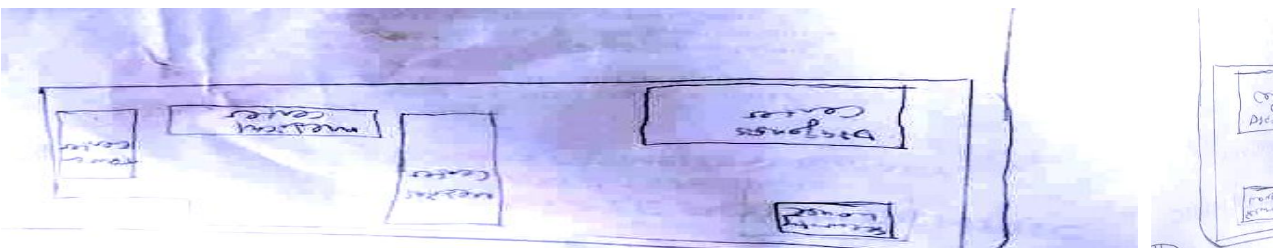
iv. The kind of instruments to be used in executing the project.

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.



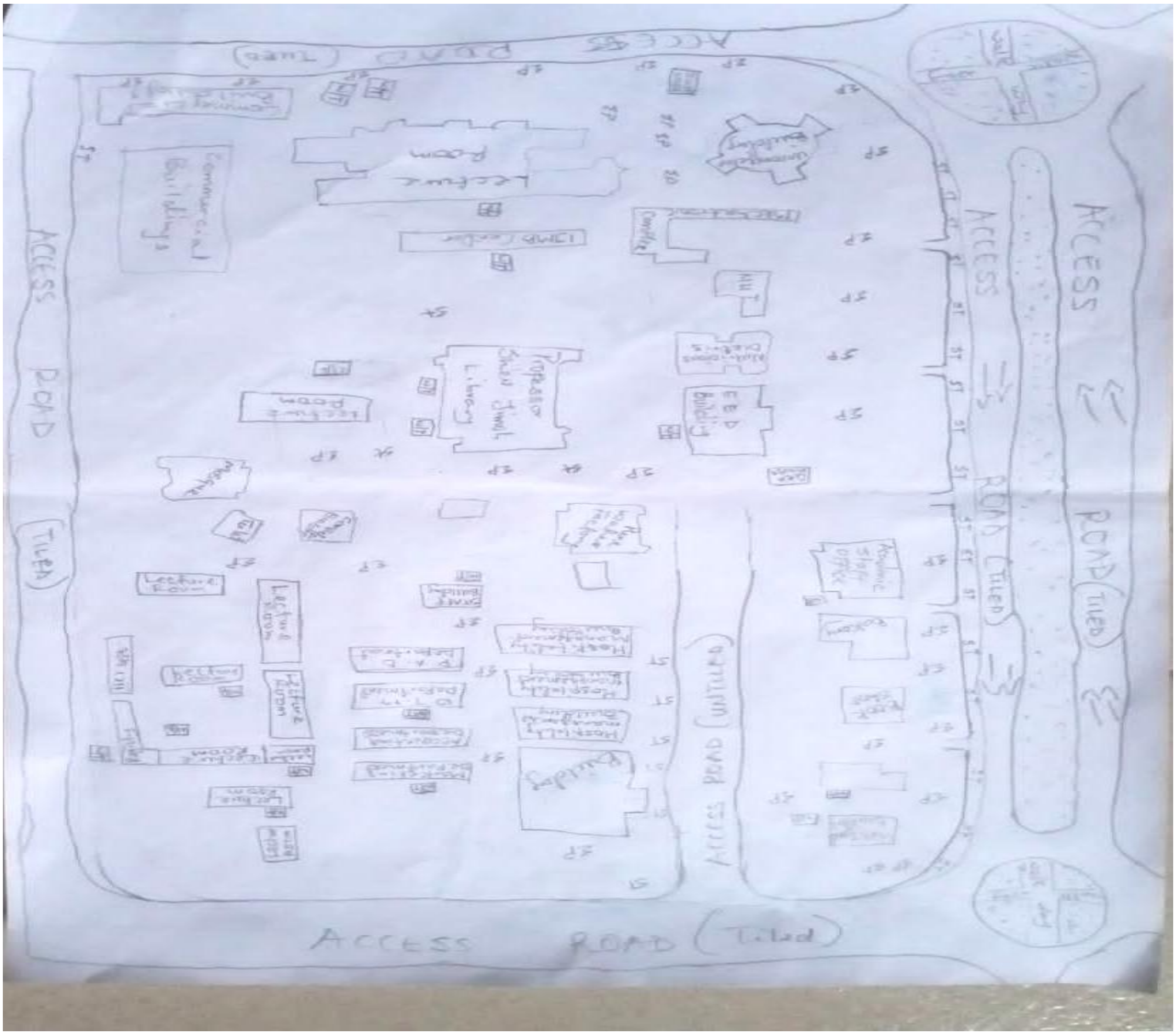


Fig. 3.1. Recci Diagram

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.

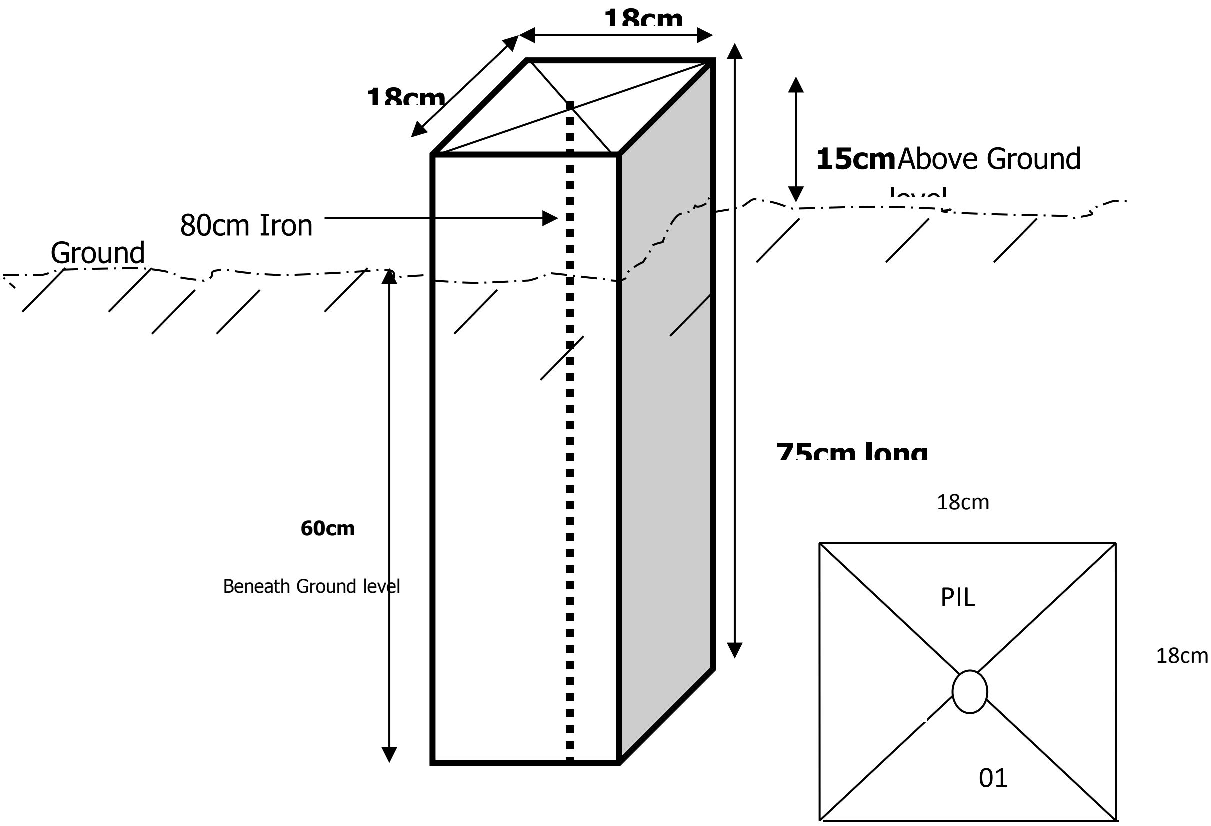


Figure 1.9: Pre- cast property beacon

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 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.

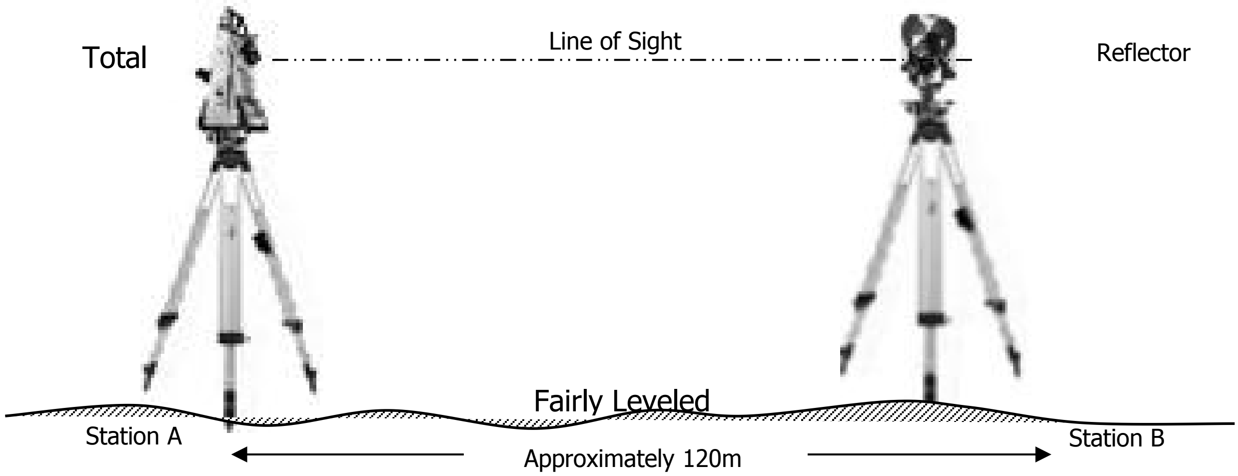


Figure 1.6. : Instrument set-up for horizontal collimation test and vertical index test

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.

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

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

3.6. DATA ACQUISITION

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.

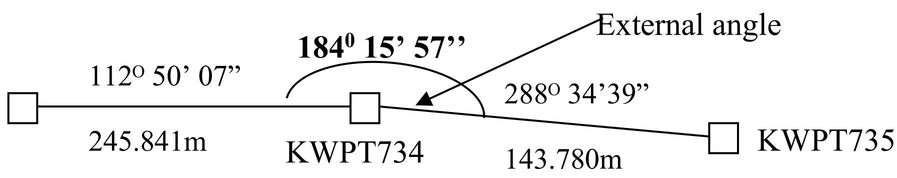


Fig. 1.6 Shows the computed check angle and check distance as obtained from the control pillars.

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 ⇨ **<u>179^{0} 33’ 19’’</u>**

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 ⇨ **<u>179^{0} 33’ 12’’</u>**

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

= (**<u>179^{0} 33’ 19’’</u>**- **<u>179^{0} 33’ 12’’</u>**) = **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.

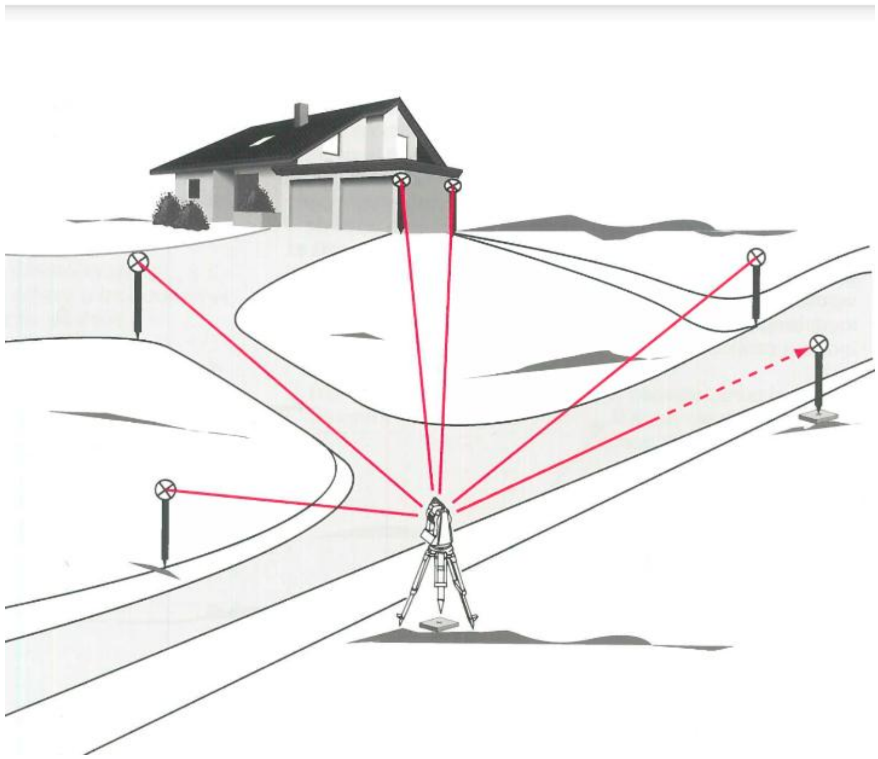


Fig. 1.8 Show the observation process of using total station.

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.

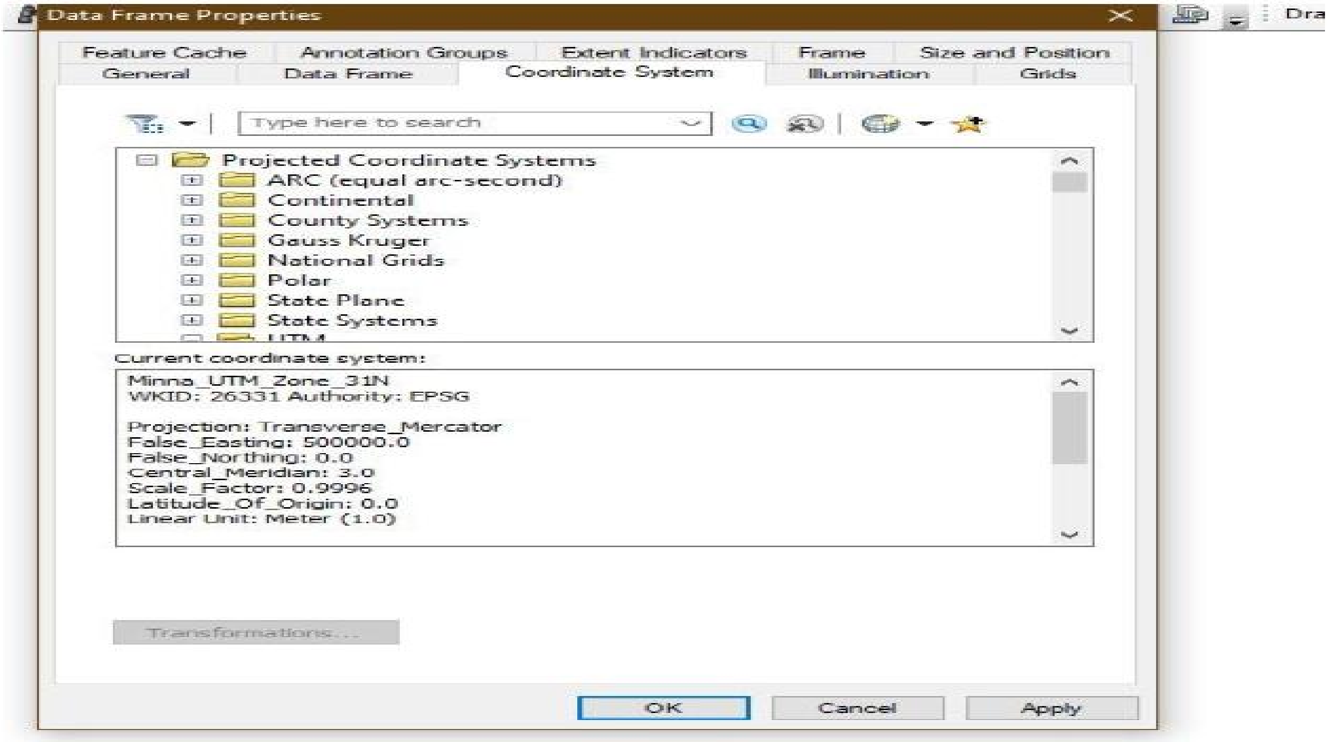
* Frame Properties dialog box appear.

* 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.



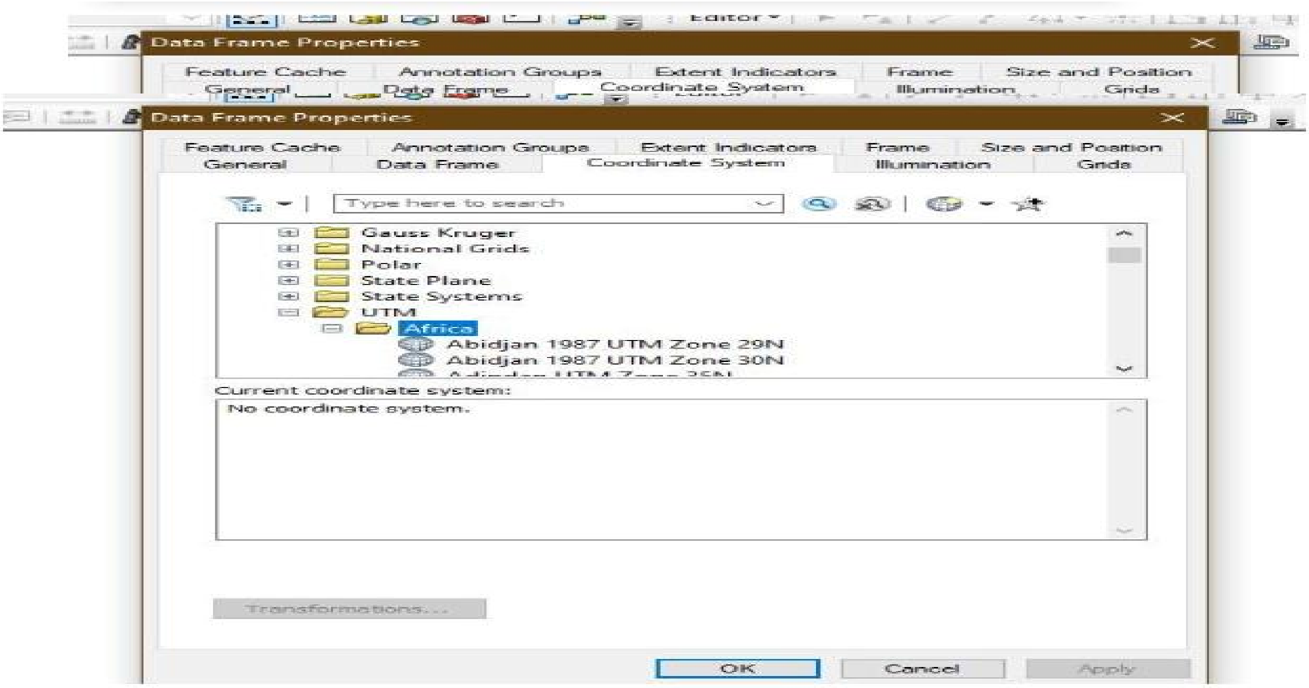


Fig 4.1. setting of units on ArcMap

✓ **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	946390.298	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
59	Polygon	105.45	720.61	E.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.

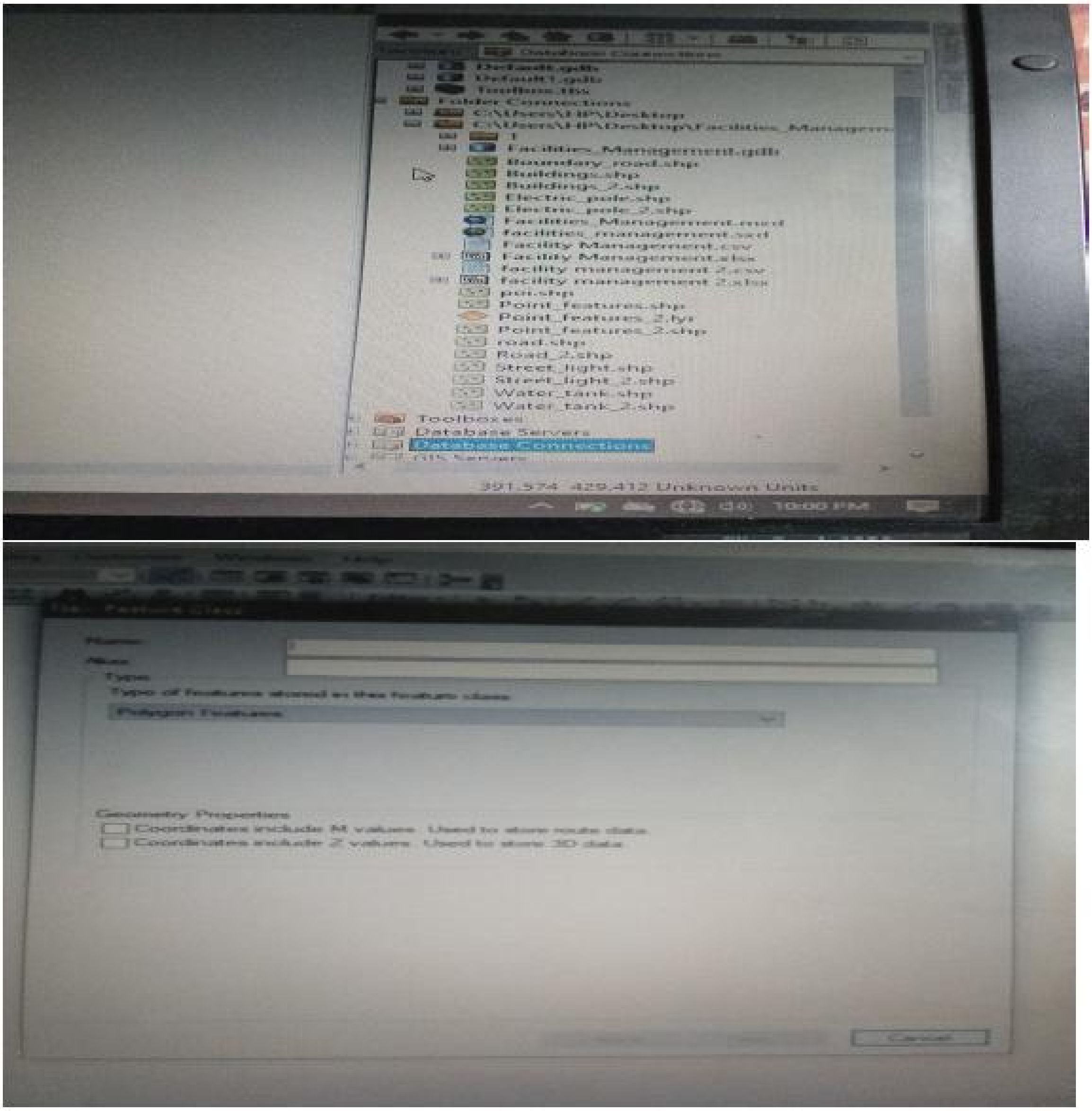


Fig 4.3. New dataset creation

✓ **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.

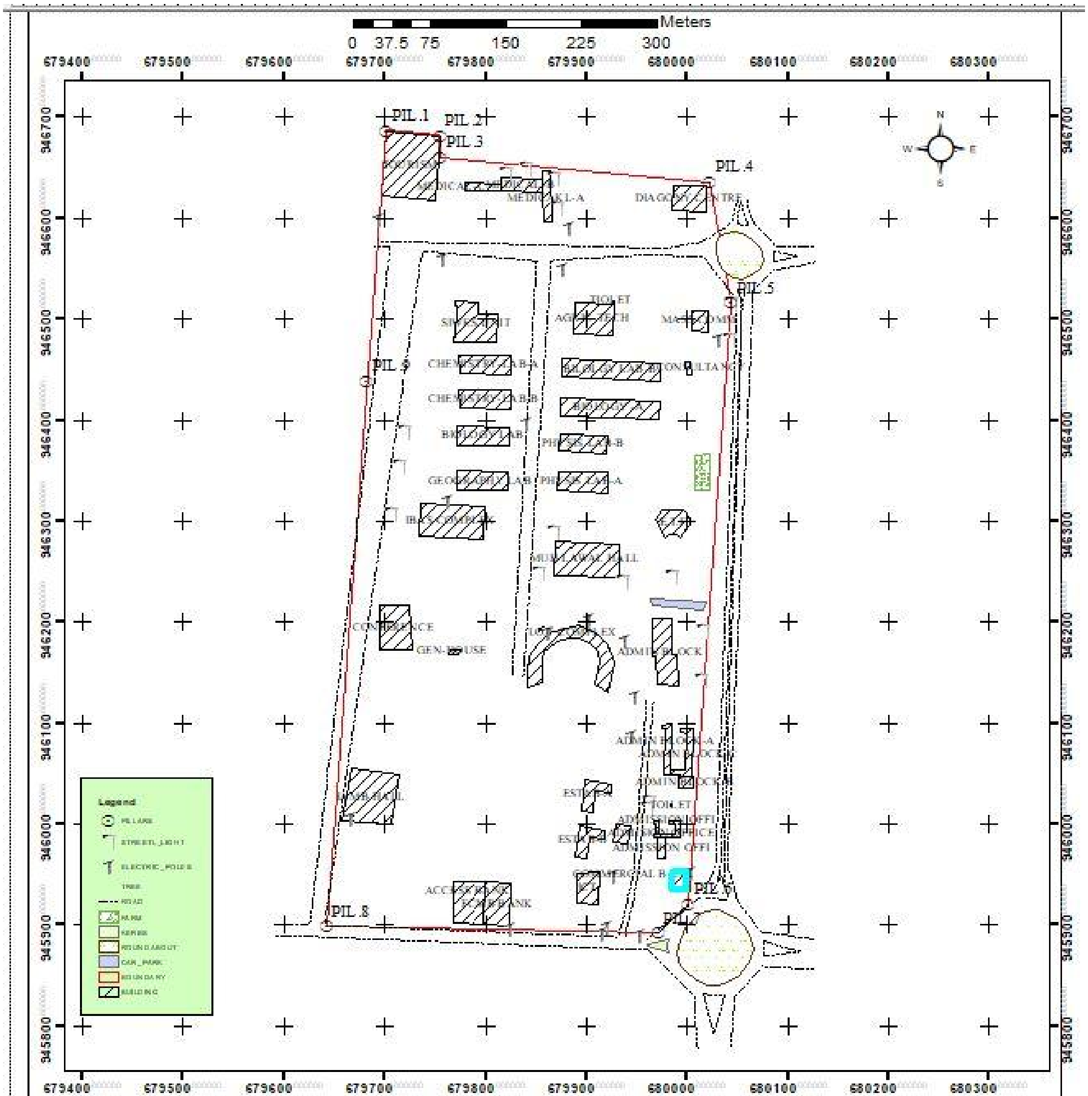


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Fig 4.4. Digitizing on ArcMap

✓ **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.

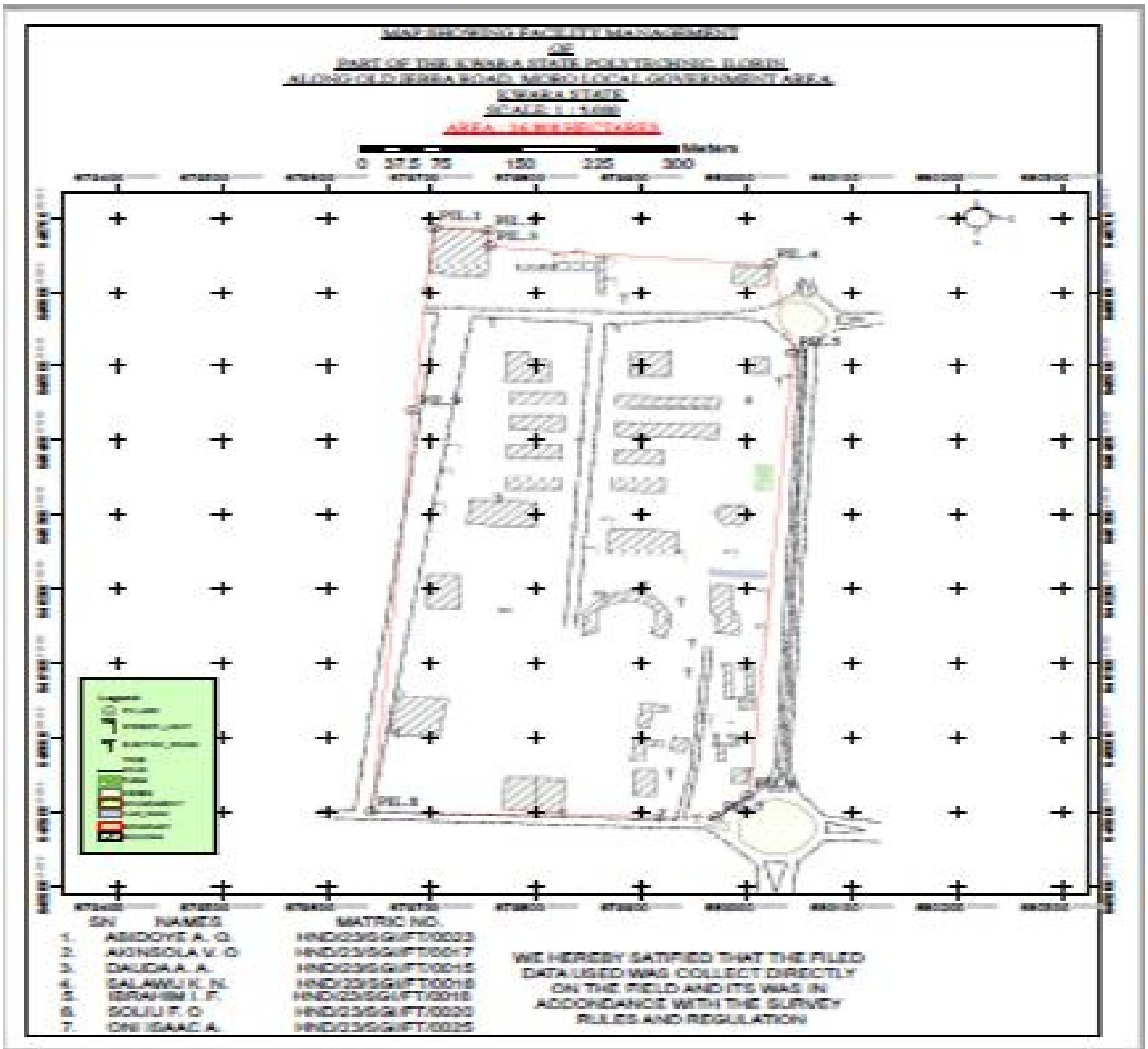


Fig 4.7. Facility Management map

4.5. RESULT ANALYSIS

The facility management project commenced with the usage of a South (NTS-350R) 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 involves extracting information from spatial datasets by posing specific questions and then analyzing the data to gain insights or make decisions.

A query 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: "To 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.

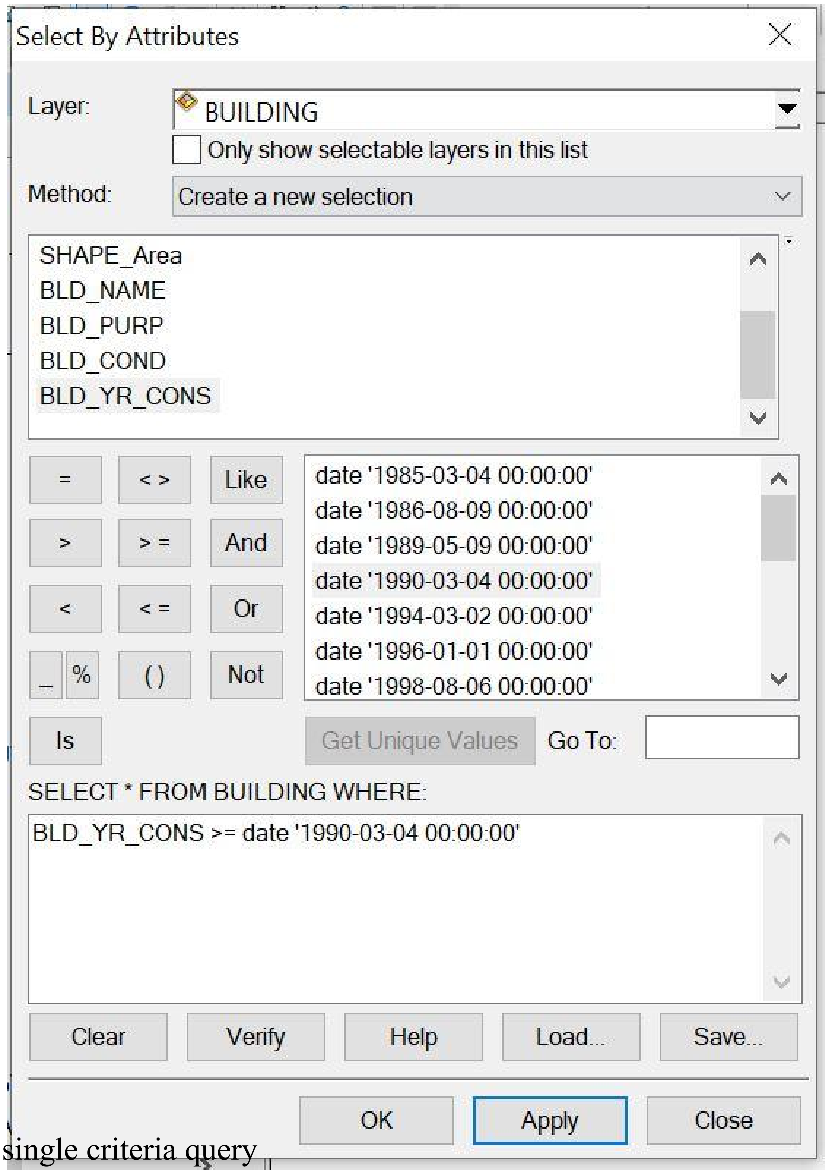
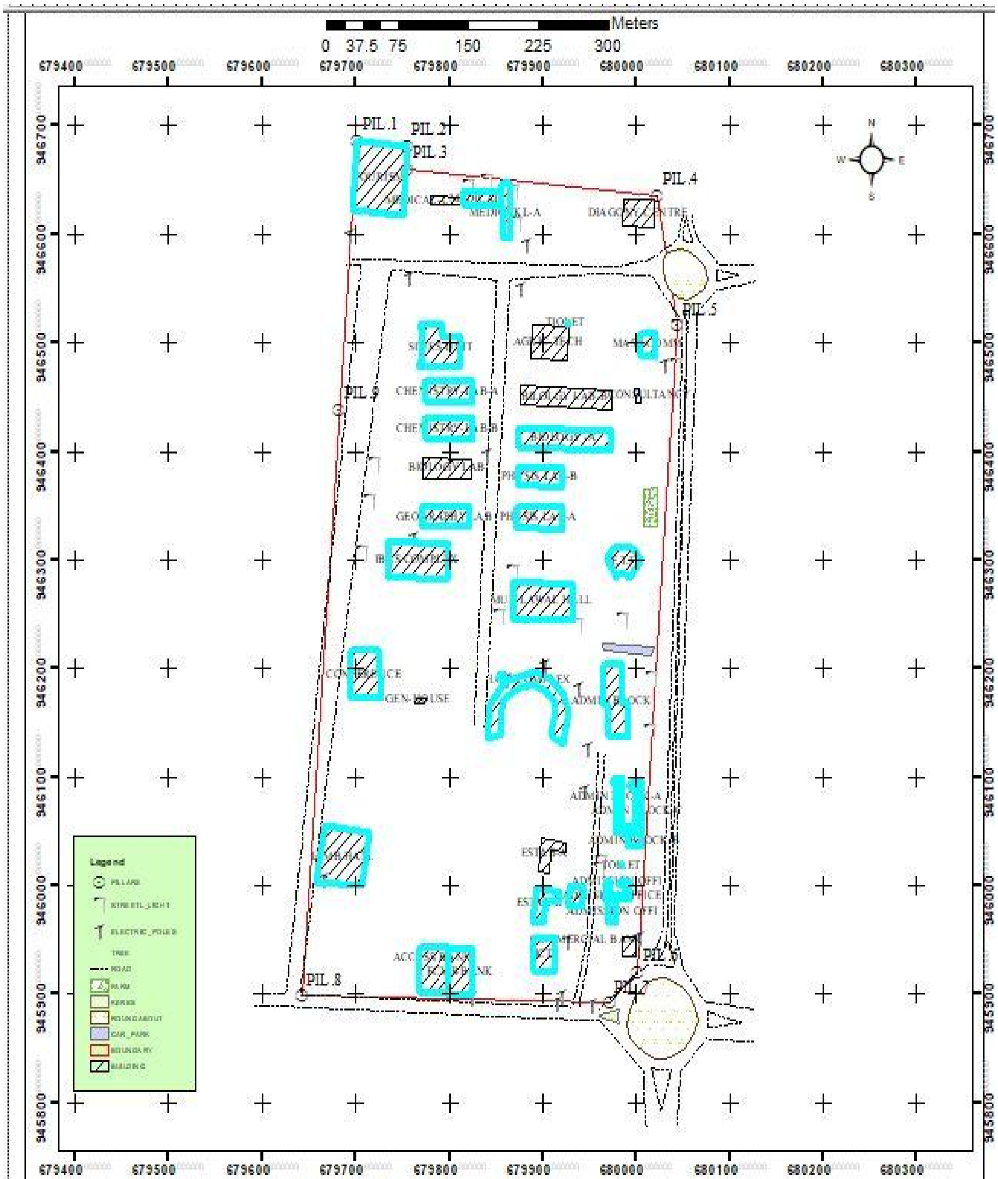


Fig. 4.12. single criteria query

Answer to query 1.



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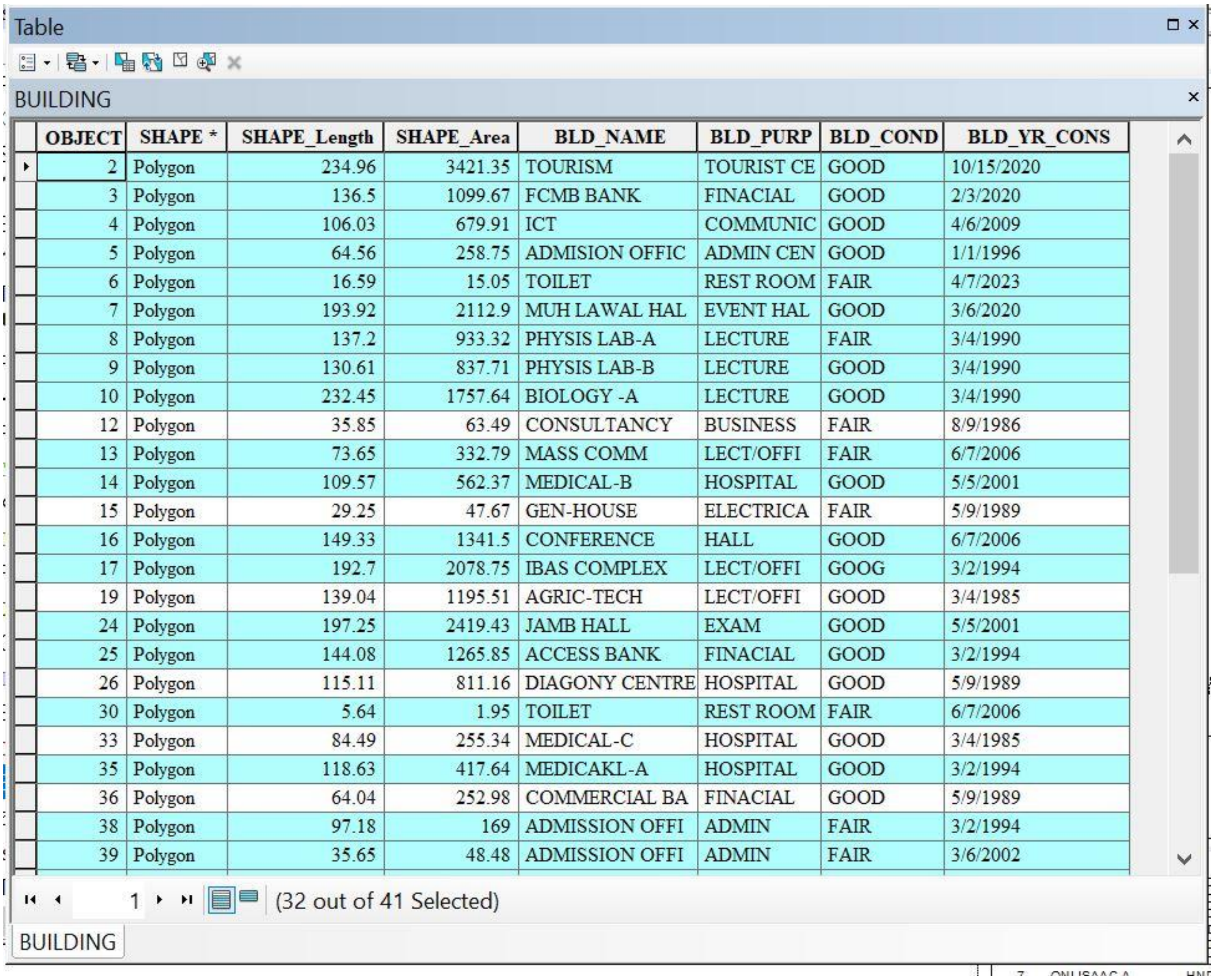


Table

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)

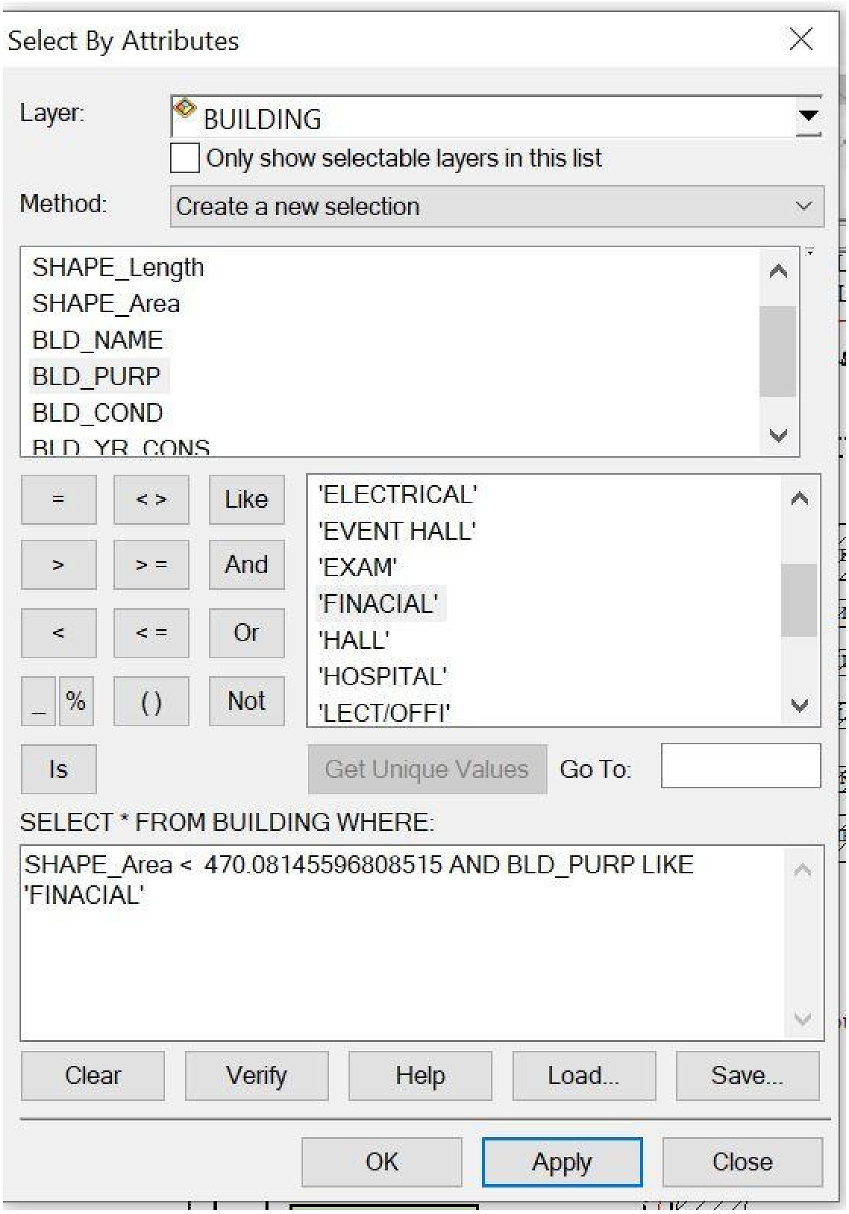
BUILDING

Query question: “To 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.

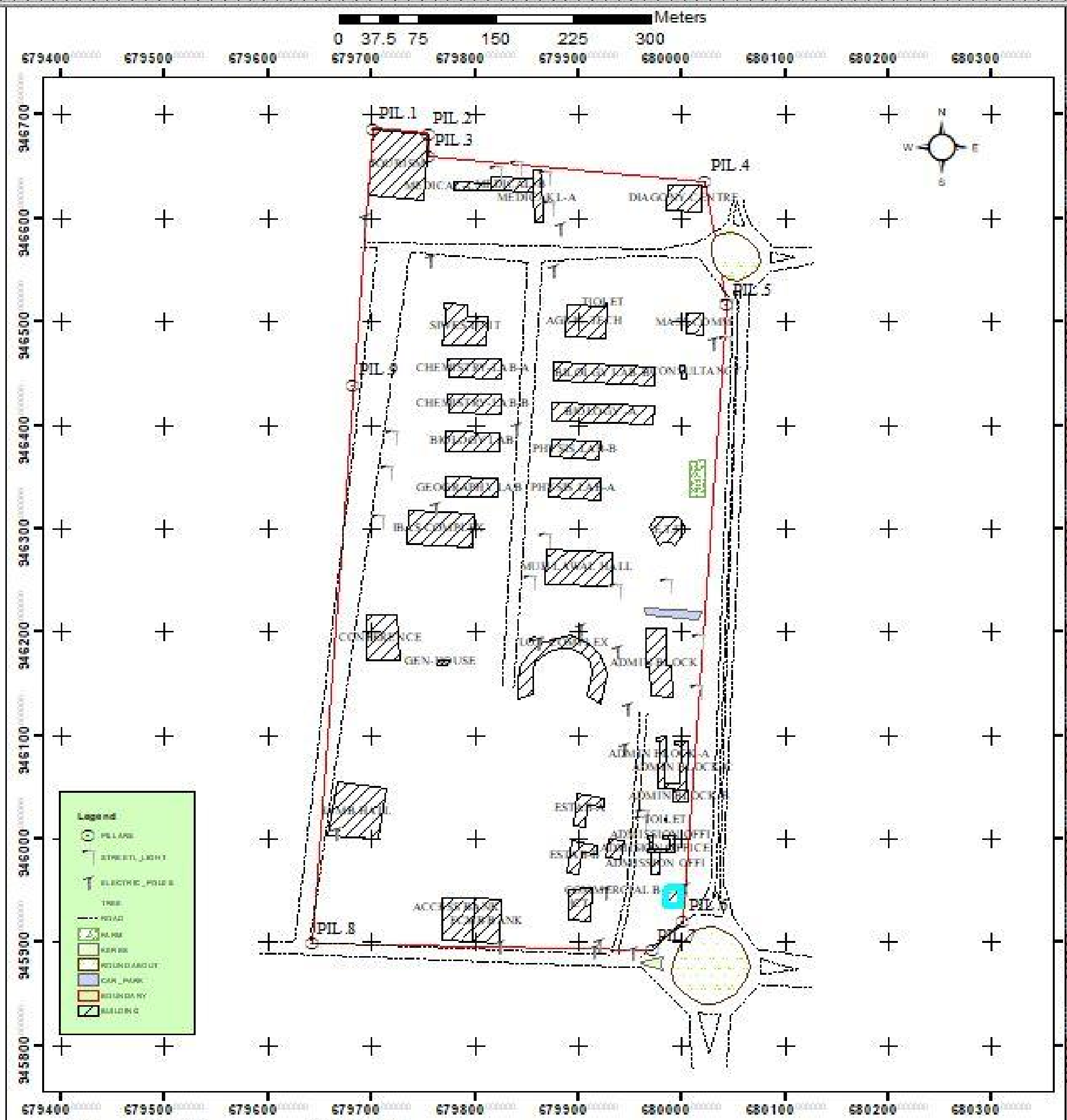


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Table

BUILDING

OBJECT	SHAPE *	SHAPE_Length	SHAPE_Area	BLD_NAME	BLD_PURP	BLD_COND	BLD_YR_CONS
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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
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17	Polygon	192.7	2078.75	IBAS COMPLEX	LECT/OFFI	GOOG	3/2/1994
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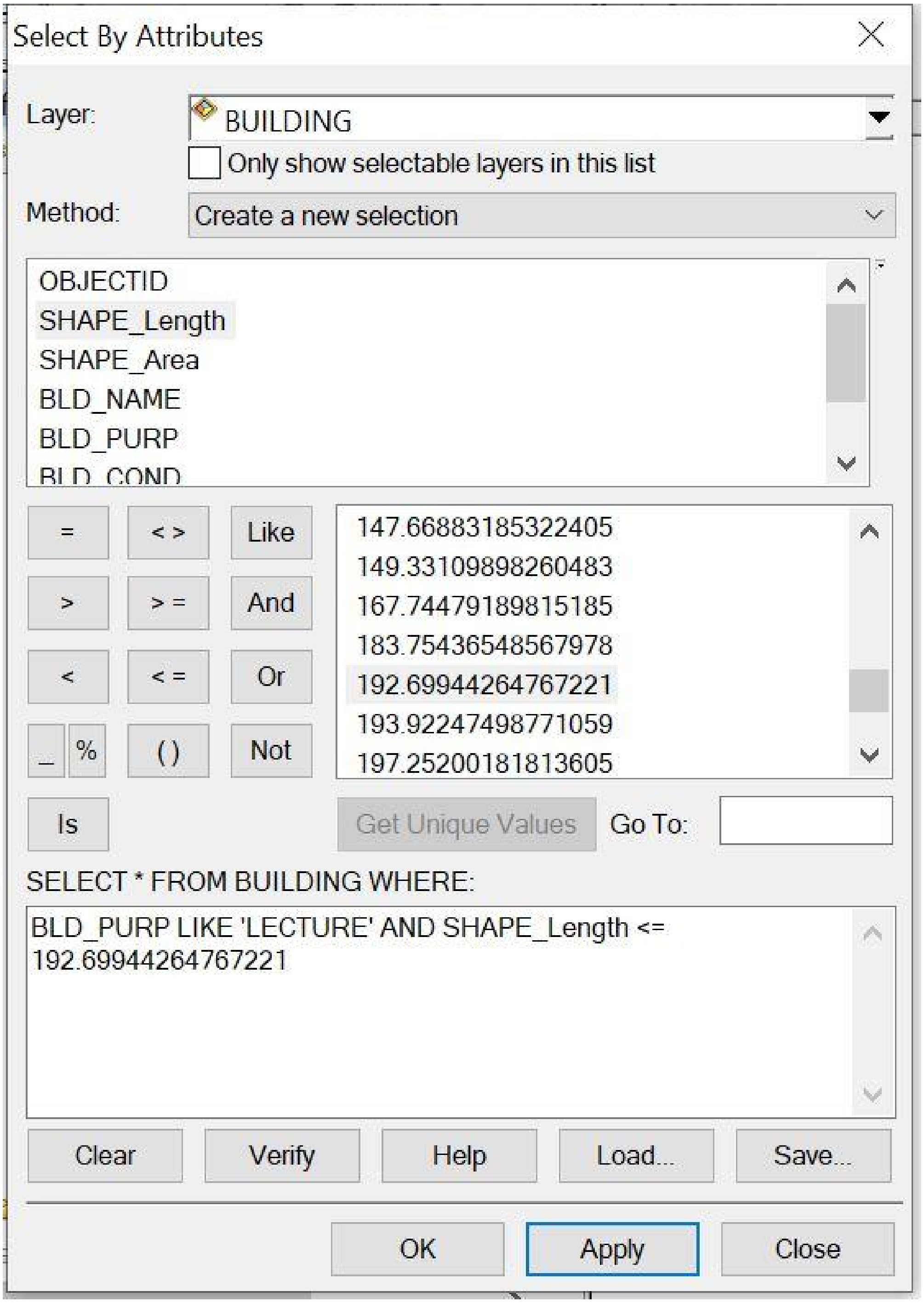
25	Polygon	144.08	1265.85	ACCESS BANK	FINACIAL	GOOD	3/2/1994
26	Polygon	115.11	811.16	DIAGONY CENTRE	HOSPITAL	GOOD	5/9/1989
30	Polygon	5.64	1.95	TOILET	REST ROOM	FAIR	6/7/2006
33	Polygon	84.49	255.34	MEDICAL-C	HOSPITAL	GOOD	3/4/1985
35	Polygon	118.63	417.64	MEDICAKL-A	HOSPITAL	GOOD	3/2/1994
36	Polygon	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

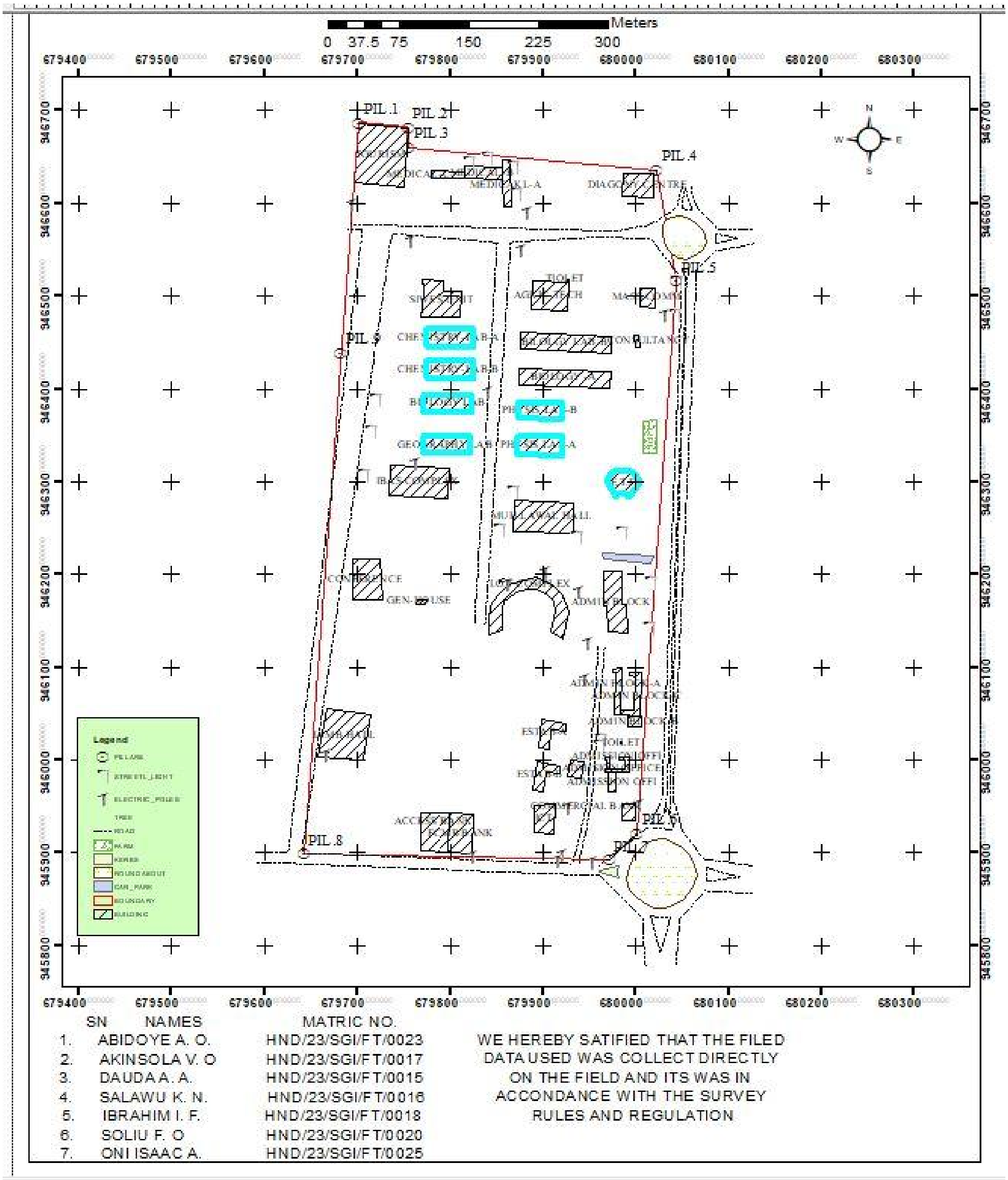
1 (1 out of 41 Selected)

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
BLD_COND
=
< >
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.



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.

5.2 SUMMARY OF FACILITIES MANAGEMENT

Facilities management (FM) is a multidisciplinary organizational function that integrates people, places, and processes within the built environment to ensure the functionality, comfort, safety, and efficiency of buildings, infrastructure, and real estate assets. It encompasses a broad range of responsibilities including maintenance management, asset lifecycle management, health and safety compliance, energy management, vendor and lease management, space planning, project and budget management, and sustainability planning. The goal of FM is to improve occupants' quality of life while enhancing the productivity and operational efficiency of the core business.

Facilities management can be divided into two main categories:

Hard services: Maintenance and management of physical infrastructure such as HVAC, plumbing, electrical systems, fire safety, and security systems.

Soft services: Non-technical services including cleaning, waste management, landscaping, catering, and space utilization.

Effective facilities management leads to increased asset value, reduced operational costs, enhanced sustainability, and improved safety and compliance.

5.3 CONCLUSION ON FACILITIES MANAGEMENT

Facilities management is critical to the smooth operation and long-term success of organizations by ensuring that physical environments are safe, efficient, and conducive to productivity. A well-executed FM program optimizes resource use, enhances occupant comfort, supports sustainability goals, and mitigates risks related to safety and compliance. The integration of technology such as Computerized Maintenance Management Systems (CMMS), Internet of Things (IoT), and building automation systems further enables predictive maintenance and operational efficiency. FM also plays a vital role in managing projects, vendors, and budgets effectively to avoid delays and cost overruns.

5.4 PROBLEMS ENCOUNTERED IN FACILITIES MANAGEMENT

Facilities management faces several challenges that can impact its effectiveness:

Budget constraints and cost control: Balancing the need to minimize operational costs while maintaining quality and sustainability can be difficult. Facility managers must negotiate and prioritize expenditures carefully.

Maintenance of aging equipment: Older assets require more frequent attention and repair, increasing maintenance complexity and costs.

Technology adoption and integration: Lack of modern technology can lead to reactive rather than proactive management, reducing efficiency.

Sustainability vs. cost pressures: Implementing green initiatives while controlling budgets is a persistent challenge.

Workforce management: Ensuring skilled, motivated teams and recognizing their efforts is essential but often overlooked.

Compliance and safety: Keeping up with evolving regulations and ensuring safe environments requires continuous vigilance.

Space optimization: Efficiently managing and adapting space to meet changing organizational needs can be complex.

5.5 RECOMMENDATIONS FOR EFFECTIVE FACILITIES MANAGEMENT

To overcome these challenges and maximize the benefits of facilities management, the following recommendations are advised:

Adopt technology and automation: Implement CMMS, Integrated Workplace Management Systems (IWMS), and IoT-enabled devices to streamline maintenance, energy management, and real-time monitoring.

Develop clear processes and workflows: Standardize and continuously update facility management procedures to ensure consistency and efficiency in operations.

Invest in team development: Provide training, technical support, and recognize the contributions of FM staff to boost morale and productivity.

Prioritize preventive maintenance: Schedule regular inspections and upkeep to extend asset life and reduce unexpected failures.

Balance sustainability with cost management: Use energy-efficient technologies like LED lighting and smart HVAC controls to reduce environmental impact while controlling expenses.

Enhance safety and compliance programs: Conduct regular risk assessments, safety training, and ensure adherence to regulations to protect occupants and avoid penalties.

Optimize space utilization: Employ strategic space planning to maximize functional use and reduce wasted areas, adapting to organizational changes.

Effective vendor and contract management: Negotiate favorable terms and monitor service delivery to ensure quality and cost-effectiveness.

Implementing these best practices will help facilities managers deliver operational efficiency, safety, sustainability, and occupant satisfaction, ultimately supporting the organization's overall success.

This comprehensive overview highlights the essential aspects of facilities management, the common obstacles faced, and practical strategies to enhance FM effectiveness in any organization.

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APPENDIX 1

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

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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

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51spt,679987.166,946010.653,308.193

52spt,679987.891,946003.31,308.362

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96spt,679915.118,946068.241,310.027
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101str,679895.49,946040.816,309.26
102str,679893.879,946041.01,309.22
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119str,679851.166,946129.422,312.287
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122spt,679835.787,946144.524,312.647
123spt,679841.647,946151.983,313.49
124spt,679837.819,946164.575,313.736
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126iotbld,679862.438,946189.159,314.463
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128genhouse,679858.56,946193.401,314.353
129genhouse,679853.433,946191.354,314.288
130genhouse,679852.175,946193.779,314.345
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187HALL,679932.222,946244.134,317.601
188flw,679922.809,946241.583,317.165
189flw,679934.083,946241.146,317.366
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201HALL,679868.738,946279.925,317.789
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211spt,679925.662,946304.69,318.877
212spt,679923.011,946317.638,319.168
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225spt,679854.29,946388.65,322.545

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227labB,679871.543,946348.617,320.786

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229labA,679869.717,946368.262,321.46

230labA,679872.292,946369.447,321.375

231labA,679873.225,946386.362,321.477

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237Ep,679916.355,946392.766,322.051

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239spt,679930.212,946384.164,321.562

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241spt,679940.614,946374.718,321.435

242spt,679930.728,946359.746,320.828

243spt,679940.326,946348.681,320.555

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245spt,679933.365,946327.57,319.537

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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

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272labD,679973.871,946433.423,324.022
273labD,679974.748,946456.641,324.966
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284spt,680018.707,946450.098,325.732
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314Rd,680076.521,946559.448,329.637
315Rd,680085.77,946561.146,329.847
316Rd,680085.395,946555.48,329.582
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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
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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

APPENDIX 2

543Rd,680015.023,945831.861,302.547

544Rd,680008.185,945829.006,302.226

545Rd,680037.147,945830.331,302.596

546Rd,680046.548,945829.766,302.324

School Facilities Survey

Does the school have double glazed or UPVC windows?

◯ Yes ◯ No

Is the school warm enough?

◯ Yes ◯ No

Is there sufficient lighting in the hallways?

◯ Yes ◯ No

Is there sufficient lighting in the classrooms?

◯ Yes ◯ No

Are the benches in a satisfactory condition?

◯ Yes ◯ No

Are the chairs in a satisfactory condition?

◯ Yes ◯ No

Are the lockers big enough for your needs?

◯ Yes ◯ No

Are possessions in the lockers sufficiently safe?

◯ Yes ◯ No

Are the black/whiteboards in the classrooms in good condition?

◯ Yes ◯ No

Are there always writing materials available for the black/whiteboards?

◯ Yes ◯ No

Is the computer lab sufficiently equipped?

◯ Yes ◯ No

Is the sports suite equipment sufficient?

◯ Yes ◯ No

Does the school have a sufficient number of bicycle racks?

◯ Yes ◯ No

Is the school car park big enough?

◯ Yes ◯ No