DIGITAL MAPING OF INFRASTRUCTURAL FACILITIES
(A CASE STUDY OF ROYAL VALLEY ESTATE, SANGO ILORIN)

BY

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HND/23/SGI/FT/0103

BEING A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF SURVEYING AND GEO-INFORMATICS, INSTITUTE OF ENVIRONMENTAL STUDIES, (IES) KWARA STATE POLYTECHNIC, ILORIN.

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

MAY, 2025

CERTIFICATION

This is to certify that this project was carried out and written by OKE TEMITOPE JOHN Matric No: HND/23/SGI/FT/0103 of Department of Surveying and Geo-informatics, Institute of Environmental Studies, Kwara State Ilorin.

I hereby declare that he has conducted himself with due diligence, honesty and sobriety on the said project.

________________________ ______________________

SURV.R.S. AWOLEYE **DATE**

(Project Supervisor)

________________________ ______________________

SURV. A.O AKINYEDE **DATE**

(Project Coordinator)

________________________ ______________________

ABIMBOLA I. ISAU **DATE**

(Head of Department)

________________________ ______________________

EXTERNAL EXAMINER **DATE**

CERTIFICATION

I hereby certify that the information given in the above named project were obtained as a result of observations and measurements made and that the survey was carried out in accordance with Survey Laws and Regulations.

Candidate's Name: OKE TEMITOPE JOHN

Matric No: HND/23/SGI/FT/0103

Signature: ____________________-

Date: ____________________

DEDICATION

This project report is dedicated to almighty God and to my parents for their immoral support towards my career in whole.

ACKNOWLEDGEMENT

To almighty God who own life. I wish my sincere appreciation and gratitude for seeing me through my duration in KWARA STATE POLYTECHNIC and making my vision come to reality as gratitude. Also for his goodness, mercies, kindness and protection upon my life.

Furthermore, my sincere appreciation goes to my dear mom MRS. OKE FUNMILAYO and also to my brother OKE KAYODE (OGLOADED BLOG), my sisters OKE ENIOLA and OKE BLESSING and my friend MISS OYINDAMOLA for their immense support and contribution toward the success of this project.

I greatly appreciate the effort of my supervisor, in person of SURV.R.S. AWOLEYE for his understanding, and valuable contribution towards the successful completion of the project.

Also, I appreciate the effort of other lecturers during academic section, the HOD in person of Surv. Abimbola I. Isau and all of my lecturers in the department in person of Surv.Ayuba Abdulsalam, Surv.R.s Awoleye, Surv.Asonibare R.O, Surv. A.G Aremu, Surv. B.F Diran, Surv.Williams kazeem, and Surv. Kabir Babatunde.

I will also like to pay my sincere respect to my late dad LATE INSPECTOR OKE KAYODE may almighty God continue to make his soul rest in peace.

Finally my sincere gratitude also goes to all my friends within and outside the campus, whose various contributions in so many ways acted as a boost to my morale.

My special thanks also goes to my group members for their co-operation during the execution of this project, may almighty God bless you all.

ABSTRACT

The project was carried out to map out Digital mapping of infrastructural facilities of Royal Valley Estate, Sango, Ilorin, Ilorin East Local Government Area, kwara state. The geometric data were acquired using automated or digital ground Survey method due to the advanced in technology and accuracy for the data acquisition with the aid of a TOTAL STATION. Attribute data were obtained through social survey by means of oral interviews and observations. Graphic representation was carried out in Geographic Information System (GIS) and Computer Aided Design (CAD) environment for Digital Mapping of Infrastructural Facilities using ArcGIS 9.3 software.. Analyses performed gave rise to digital information in form of Digital Mapping, maps, and plans. The application areas of this information system were highlighted in this project report. Finally, a comprehensive report was written.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Digital mapping is an offshoot of the modern technology geared not necessarily towards achieving a replacement of the traditional analogue system of information, but to utilize the modern computerized digital system in improving the old system.

Uren and price (1994) defined infrastructure as any new done in a certain community that creates public response e.g. road, Electricity, drainage, school, dam, bore—holes etc.

Igbokwe (1999), define digital mapping as the marriage of sophisticated process control computer to the conventional mapping method.

Using a digital instrument to map infrastructure entails collection of all relevant data needed for the development and redevelopment of an environment.

Digital mapping is also known as "Database" driven map production.

Digitally mapping of infrastructural facilities of parts of kwara state polytechnic Ilorin will enable the authority to deep knowledge of the pattern of features (Natural and Artificial features) put in place and the available space

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1.2 AIM

The aim of this project is to map out infrastructural facilities as they exist on polytechnic land with the view of identifying their spatial location to solve geo-spatial problems in the area for proper physical planning and decision making

1.3 OBJECTIVES

1. To carry out perimeter survey of the project area.
2. Data acquisition
3. Data processing
4. Data presentation
5. Database Design

6. To produce a digital map or plan
7. To make observations to and provide record of all existing structures as well as those that are
8. probably under-construction.
9. To show the exact number of structures and their relative positions at present
10. To acquire X, Y, Z of all points picked within the project site
11. Creating of different layers for different types of infrastructure in the project area.

1.4 SIGNIFICANCE

A major significant of digital mapping (or computer mapping) is that it put the so-called "added value" to mapping activity with that digital mapping has made it possible for digital data to be available for other uses or applications. In other words, digital mapping creates database upon which data requirements for the establishment and operation of a functional geographic information system (GIS), land information system (LIS), multipurpose cadaster and other spatially-related information systems could be based. Digital data generated from digital mapping via with computer with the relevant software to create and generate various models such as road profiles, cross sections, digital terrain models, ortho-photo production and etc.

the results of these are uses for project planning, engineering and other purposes.

Other significance of digital mapping can be summarized as follows:

- Computer-based mapping system enables maps and other graphic related product to be produced quickly without recourse of manual drafting.
- Versatility is introduced in map. Map can be modified at any stage of production to suits users, that is, its support customized map production.
- Stored maps or mapping materials/data do not suffer from dimensional distortion (expansion or

  shrinkage) due to fluctuating weather conditions over the years, which is the case with analogue method.
- Increased efficiency and consistency in map production, i.e., quality control is assured. Quality and

  consistency of product are not compromised as a result of stress. A draftsman may get tired after long hours of work and thereby produce poor jobs. However since the computer work on the principles of "garbage in garbage out", poor quality maps can still be produced as a result of poor quality data entry. So care must be exercised in what is fed into the database of a DMS.

- Capacity to response to the increasingly complex and diverse requirements of planners and decision
  makers in respect of geo information products
- Information in the DBM can be used for other graphic products or transferred to conventional GIS.
  When once a database is in place, the derivation of user-dependent products become easy and less costly.
- Maps can be produced in layers depicting different themes, and several map layers can be superimposed on one another to create a composite map.
- The supervisory hierarchy associated with analogue mapping is virtually absent in digital mapping environment. After data had been acquired, map production is interactively controlled by a few specialists.

1.5 JUSTIFICATION FOR THE RESEARCH

- Digital mapping technology is one of the new opportunities offered by a new geographic information system (GIS). With advances in GIS techniques, it become apparent that computer systems could help significantly in geospatial information analysis and automated map production in digital mapping environment. Digital manuscript is kept in a computer files in (layers).
- Great advancement has been made in the field of digital mapping as a result of advances in the field of computer technology, application design software and database management system

1.6 LOCATION OF THE PROJECT AREA

Royal valley estate Sango Ilorin, kwara state, Ilorin south local government area. Nigeria. It lies approximately within latitude 8°2927.87"N and longitude 4°30'53.02"E with an approximate area of 5 hectares. The project site has some embedded facilities such as road, parking space, class room, telecommunication mast, administration block, electric pole, street light, etc.

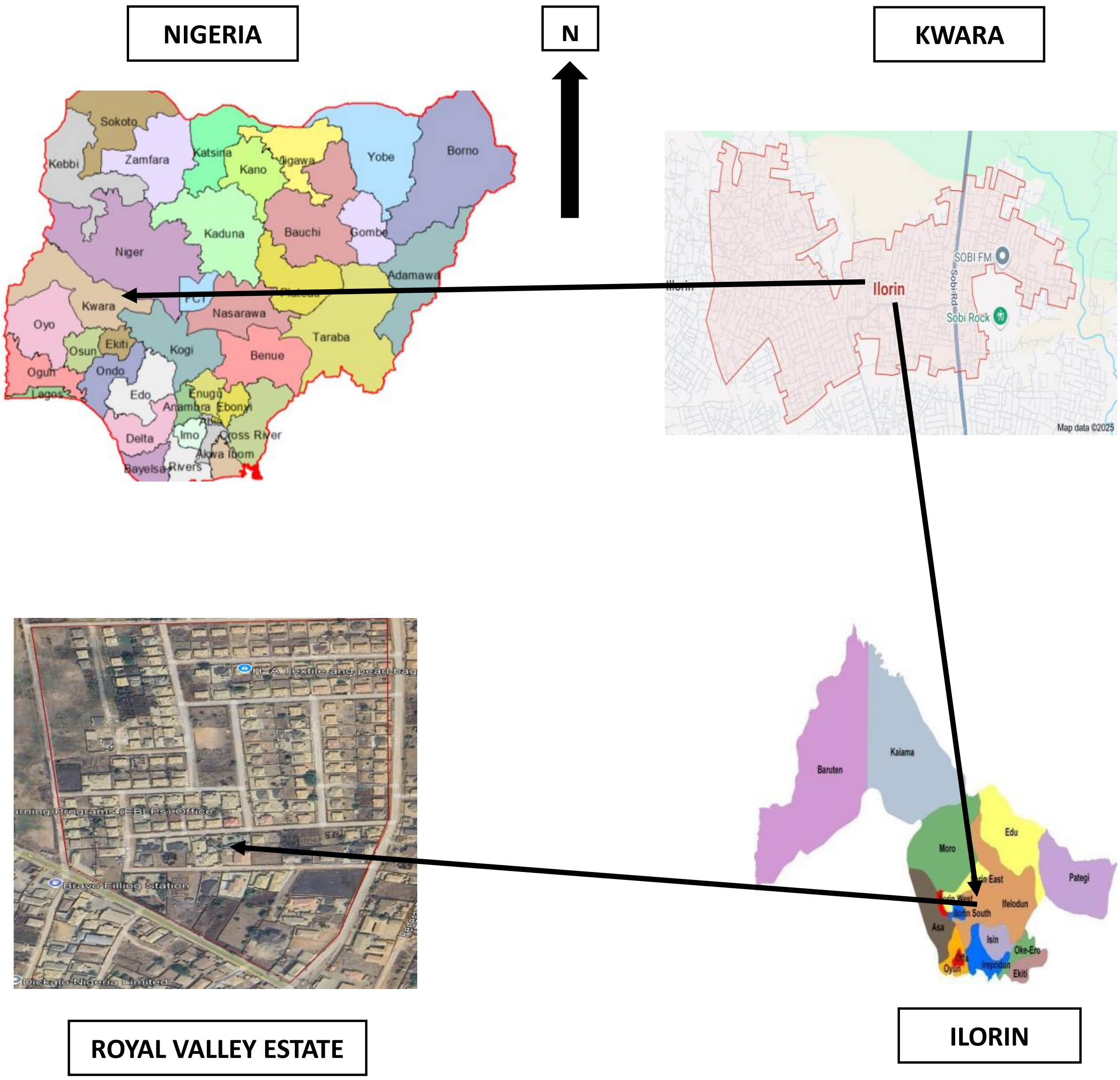

Figure 1.1: Map shows the study area of the project

1.7 SCOPE /STAGES OF ACTIVITIES

The following are the Scope/stages of activities propose in this project.

- Project Planning
- Reconnaissance
- Selection and marking out of points
- Instrument test
- Observations
- Downloading and Processing of data
- Report writing, printing and presentation

TABLE1.1 :- PERSONNEL

S/N	NAME	MATRIC NUMBER	REMARKS
1	OKE TEMITOPE JOHN	HND/23/SGI/FT/0103	AUTHOR
2	ALAI ABDULLAH AKANNI	HND/23/SGI/FT/0105	MEMBER
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7	ALADA TOLUWANI O.	HND/23/SGI/FT/0126	MEMBER
8	OLAREWAJU DAVID OLUWATOSIN	HND/23/SGI/FT/0131	MEMBER

CHAPTER TWO

2.0 LITERATURE REVIEW

Igbokwe, (1999). Define digital mapping as the marriage of sophisticated process control computer to the conventional mapping method.

Kennie et al (1990) define digital mapping as a computerized compilation and production of maps or plans using information in a digital format. In other words digital mapping is a computer-base mapping process which involved producing of maps (generally at medium and large-scale) forms. Spatial data hold in numerical form rather than in graphical or analogue form.

According to Shaun (1997), explained that perhaps the achievements with the widest impact has been the completion of the digital mapping program which has put the United Kingdom (UK) at the forefront of the whole world, making it easier for users and developers to introduce many new Geographic Information. We cannot but mention land while discussing topography. Land is the solid part of earth's surface. It is the foundation of all forms of human activities and man's most valuable resource without

which man would never have existed and which its continued existence and progress depends on. Land is the abode of man and almost all his activities are land based. This has given rise to a major human need for Geospatial Information that is centered on land especially on Information that result from the study and mapping of the features on the surface of land, including natural features such as mountains and rivers and constructed features such as highways and railroads which are used for 3-Dimensional spatial planning and developments.

Digital mapping refers to a computerized compilation and production of maps or plans using information in a digital format. In other words, digital mapping is a computer based mapping process which involves production of maps (generally at medium and large scales) from spatial data held in numeric form rather than in graphical or analogue form (Ndukwe, 2001).

Igbokwe (1999) defines digital mapping as the marriage of sophisticated process – control computers to the conventional mapping methods. Digital mapping is also referred to as data base driven map production. It is an offshoot of the modern computer technology geared not necessarily towards achieving a complete replacement of the traditional analogue system of information representation, but to

utilize the modern computerized digital system in improving the old system (Brink and Wolf, 1997). So the main objective is for compute to take over most of the tasks that are normally performed by the human operator in a conventional mapping process in other to quicken map production process and thus increase productivity and efficiency among other things. The computer has changed the mapping

process and it has increased the value of the map as a source of environmental information for all types of planning and
decision-making. Other terms used to describe digital mapping process is computer cartography, automated cartography, computer-assisted mapping (CAM) or simply automated mapping (Kennie and Petrie, 1990). It facilities the processing and production of topographic and updating of map information.

Computer base mapping system enables maps and other graphic related products to be produce quickly without recourse to manual capital investment in hard ware and software.

Versatility introduced in map production maps can be modified at any stage of production to suit users. That is, it supports customized map production, while the installation cost (space, connection network).

For (1994) defines infrastructural as those services derived from the set of public work traditionally supported by the public sector to enhance private sector production and to allow for household consumption.

Infrastructure can be classified into technical characteristics which are in viable and with long life spun economic characteristic that is external effects and economics of scale, high fixed capital and social Cost, high risk investment and institutional characteristic which include absence form market prices, central
planning and allocation control among others.

2.1 APPLICATIONS OF DIGITAL MAPPING IN URBAN PLANNING AND INFRASTRUCTURE DEVELOPMENT

Digital mapping technologies, particularly when integrated with Geographic Information Systems (GIS), Building Information Modeling (BIM), and advanced visualization tools, have profoundly transformed the practices of urban planning and infrastructure development. These modern tools empower planners with capabilities such as real-time data integration, the application of machine learning algorithms, and the use of cloud-based platforms for sophisticated urban analysis.

One of the foundational applications is in **site analysis and feasibility studies**. Prior to the commencement of any construction project, digital maps provide access to detailed geospatial data, including information on land elevation, vegetation cover, hydrological features, and the proximity of existing infrastructure. This wealth of data allows urban planners to conduct thorough evaluations of potential sites, assessing existing transportation links, identifying and evaluating environmental risks such as flood-prone areas, and determining the site's proximity to essential amenities. Such detailed analysis facilitates informed decision-making regarding site feasibility and enables the early identification of potential challenges that could impact the project. Furthermore, digital mapping allows for the integration of demographic data layers, such as population density and income levels, enabling planners to tailor development projects to the specific needs and characteristics of the local communities they are intended to serve.

Optimizing land use and planning is another critical area where digital mapping demonstrates its value. By offering a clear visual representation of current land use patterns and existing planning policies, digital maps assist urban planners in identifying areas that are most suitable for new development initiatives. The ability to layer various data sets, including transportation networks, environmental constraints, and social infrastructure, ensures that land is utilized in the most efficient and sustainable manner possible. This multi-layered approach guides decisions related to the allocation of land for diverse purposes, such as residential housing, commercial districts, public parks, and industrial zones. GIS-based zoning maps, for example, enable the precise designation of land uses by overlaying property boundaries, building codes, and density requirements, providing a clear and enforceable framework for urban development.

Environmental impact assessment (EIA) is significantly enhanced through the use of digital mapping tools. These technologies facilitate the visualization of crucial environmental data, including flood risks, levels of air pollution, and the location of biodiversity hotspots, allowing planners to comprehensively assess the potential environmental implications of proposed development projects. GIS technology is particularly useful in this context, helping planners to identify and avoid ecologically sensitive areas and to design effective mitigation strategies, such as the creation of green corridors or buffer zones, to minimize environmental harm. Advanced mapping techniques can further support EIA by combining data from various sources, such as satellite imagery, air quality sensors, and terrain data, to model pollution dispersion patterns and visualize potential impacts.

In the **transportation and mobility planning** sector, digital maps are indispensable tools. They enable urban planners to model complex transportation systems, analyze existing traffic patterns, and optimize the design and operation of public transport networks. By simulating various scenarios, planners can identify effective solutions to reduce traffic congestion, improve the overall efficiency of transportation systems, and promote the adoption of more environmentally friendly modes of transport, such as cycling and walking. GIS tools are widely used for route optimization and the strategic planning of transportation infrastructure, ensuring that new developments are well-integrated into the existing network.

Digital mapping also provides direct support for **urban infrastructure development**. It streamlines the planning and design of essential utility networks, including systems for water supply, power distribution, and telecommunications. Advanced GIS platforms offer the capability to model underground infrastructure, providing detailed 3D visualizations of pipes, cables, and conduits, which is crucial for avoiding conflicts and ensuring efficient installation and maintenance. Modern mapping software assists in identifying optimal routes for new utility corridors by analyzing various factors, such as soil conditions, the location of existing infrastructure, and population density. Population density maps, derived from census data and visualized using GIS, provide valuable insights for infrastructure planning and resource allocation, helping to identify high-density areas that require additional services like transportation hubs, parks, or schools.

Beyond current applications, digital mapping tools, often powered by artificial intelligence (AI) and machine learning, are increasingly used to **forecast future urban needs**. By analyzing historical spatial data patterns, these technologies can predict future population growth, anticipate infrastructure demands, and identify emerging development trends. This predictive capability is invaluable for long-term planning, helping urban authorities to identify areas that will require infrastructure upgrades and to project changes in population density over extended periods.

2.2 TECHNOLOGIES UTILIZED IN DIGITAL MAPPING FOR INFRASTRUCTURE

The effective digital mapping of infrastructure relies on a suite of interconnected technologies that facilitate data acquisition, processing, analysis, and visualization. These technologies represent a significant advancement from traditional methods and are constantly evolving.

- **Geographic Information Systems (GIS):** GIS is arguably the cornerstone technology in digital mapping for infrastructure. It provides a powerful framework for the collection, storage, management, analysis, and visualization of spatial data. GIS enables the overlaying of multiple layers of data, such as property boundaries, utility networks, topographic features, and demographic information, to analyze complex urban patterns, identify spatial relationships, and support evidence-based decision-making for infrastructure projects. WebGIS platforms, which are accessible online without the need for local software installation, are particularly valuable for their visual analysis capabilities and ease of data sharing. GIS applications are diverse, ranging from urban planning and land management to environmental impact assessment and disaster response.

- **Remote Sensing:** This technology involves the acquisition of information about the Earth's surface from a distance, typically using sensors mounted on satellites or aircraft. Satellite imagery and aerial photography are key components of remote sensing used in infrastructure mapping. Satellite monitoring is a versatile tool for assessing the stability of existing infrastructure and monitoring environmental changes that could impact future development. Satellites equipped with Synthetic Aperture Radar (SAR) are particularly useful as they can penetrate cloud cover, ensuring consistent data acquisition regardless of weather conditions. Multispectral satellite data, which captures information across different electromagnetic spectra, is valuable for characterizing materials and classifying areas affected by changes, such as those resulting from construction or environmental events.
- **Drones and UAVs:** Unmanned Aerial Vehicles (UAVs), commonly known as drones, equipped with high-resolution cameras and various sensors, have become increasingly important tools for surveying and mapping. Drones offer an efficient and cost-effective method for collecting aerial data, particularly in areas that are difficult or dangerous to access using traditional ground-based methods. They are widely used for topographic surveys, infrastructure inspections, and creating detailed aerial maps. Drone surveying can be significantly faster than traditional methods and requires less manpower.
- **LiDAR:** Light Detection and Ranging (LiDAR) is a remote sensing technology that uses laser pulses to measure distances and create highly detailed 3D models of the Earth's surface. LiDAR data is invaluable for infrastructure planning, providing precise information on terrain elevation, ground features, and existing structures. It is used to create Digital Elevation Models (DEMs) and Digital Terrain Models (DTMs), which are essential for engineering design and environmental analysis. LiDAR systems can achieve centimeter-level accuracy, making them suitable for projects requiring high precision.
- **GPS/GNSS (Global Navigation Satellite Systems):** GPS and the broader category of GNSS, which include constellations like GLONASS, Galileo, and BeiDou, are fundamental for providing accurate positioning data. Real-Time Kinematic (RTK) systems, a type of GNSS technology, significantly enhance the accuracy and efficiency of surveying by providing centimeter-level positioning in real-time. GNSS receivers calculate their position by measuring the time it takes for signals to travel from satellites, and by tracking signals from multiple satellites, they can triangulate a location. This technology is essential for establishing control points, conducting boundary surveys, and accurately locating infrastructure elements.

- **Surveying Software:** Software is indispensable for processing the vast amounts of data collected in the field and transforming it into usable maps, plans, and reports. This includes various types of software:

- **CAD (Computer-Aided Design) Software:** Used for drafting and creating detailed technical drawings of infrastructure designs and survey plans.
- **GIS Software:** Essential for managing, analyzing, and visualizing spatial data, enabling complex spatial analyses and the creation of thematic maps.
- **Specialized Surveying Software:** Designed for specific surveying tasks such as traverse adjustments, coordinate transformations, volume calculations, and hydrographic data processing. Examples include SurvCE, FieldGenius, Leica Liscad, HYPACK (for hydrographic surveys), SURPAC, VisionPlus, CYPE (for quantity surveying aspects), and E-beacon (a web-based survey control finder application).
- **Essential Equipment:** Beyond software, a range of hardware is necessary for fieldwork and office operations:

- **Total Stations:** Electronic/optical instruments that measure angles and distances with high precision, crucial for boundary surveys, topographic mapping, and engineering layouts.
- **GPS/GNSS Receivers:** Used for collecting precise location data, especially RTK systems for centimeter-level accuracy.
- **Computers and Peripherals:** Powerful desktop computers or laptops are needed for data processing, analysis, and report generation, along with printers, plotters (for large-format maps), and scanners.
- **Vehicles:** Reliable transportation is essential for moving equipment and personnel to diverse survey sites.
- **Ancillary Equipment:** This includes essential field gear such as tripods (for instrument stability), prisms (targets for total stations), ranging poles, measuring tapes, safety gear (vests, hard hats), and vegetation clearing tools.

2.3 APPLICATIONS IN INFRASTRUCTURE LIFECYCLE

Digital mapping plays a vital role across the entire lifecycle of infrastructural facilities, from initial planning and design through construction, management, and maintenance, and even in disaster response.

2.3.1 PLANNING AND DESIGN

- **Site Analysis and Feasibility Studies:** Digital maps provide detailed data on terrain, environmental features, and existing infrastructure, enabling comprehensive site evaluations and informed decisions about project feasibility.
- **Land Use Optimization:** By visualizing current land use and planning policies, digital maps help identify optimal areas for new development and ensure efficient allocation of land resources.
- **Environmental Impact Assessment (EIA):** Digital tools facilitate the visualization and analysis of environmental data, allowing planners to assess the potential impacts of projects and design mitigation strategies.
- **Transportation and Mobility Planning:** Digital maps are used to model transport systems, analyze traffic patterns, and optimize routes and networks.
- **Utility Network Planning:** GIS and 3D visualization tools streamline the planning of essential utility networks, including water, power, and telecommunications, by modeling underground infrastructure and identifying optimal routes.

2.3.2 CONSTRUCTION

- **Setting Out:** Precise measurements from digital maps are used to accurately mark the location and alignment of infrastructure elements on the ground before construction begins.
- **Construction Monitoring:** Digital mapping techniques, including drone surveys and laser scanning, can be used to monitor construction progress, verify adherence to design specifications (as-built surveys), and identify any deviations.

2.3.3 MANAGEMENT AND MAINTENANCE

- **Asset Management:** Digital maps and GIS are used to create comprehensive inventories of infrastructure assets, enabling efficient tracking, management, and maintenance planning. Digital Asset Management (DAM) systems can centralize and manage digital content related to infrastructure assets.
- **Monitoring Structural Health:** Remote sensing techniques, such as satellite monitoring and specialized sensors, can be used to monitor the structural integrity of bridges, pipelines, and other infrastructure over time, detecting subtle changes that may indicate potential issues. Digital twins, virtual replicas of physical assets, enable real-time monitoring and performance tracking.

- **Tracking Changes:** Digital maps facilitate the tracking of changes in land use, environmental conditions, and infrastructure over time by comparing data collected at different periods.

2.3.4 DISASTER MANAGEMENT

- **Mapping Hazard-Prone Areas:** Digital maps are crucial for identifying and mapping areas susceptible to natural disasters such as floods, landslides, and wildfires, aiding in risk assessment and preparedness planning.
- **Planning Response and Resource Allocation:** During and after a disaster, digital maps provide real-time information on affected areas, infrastructure status, and resource locations, supporting efficient response planning and resource allocation.
- **Flood Mapping and Monitoring:** Satellite imagery and GIS are used for delineating flood extents, predicting their progression, and assessing impacts, supporting flood management strategies.

2.4 DIGITAL MAPPING OF INFRASTRUCTURE IN NIGERIA

In Nigeria, digital mapping and geospatial technologies are increasingly recognized as essential tools for driving infrastructure development, urban planning, and effective land administration. Surveyors, equipped with modern digital tools, play a fundamental role in providing the accurate and reliable geospatial data that forms the bedrock of these initiatives. Accurate land surveys are crucial for defining property boundaries, supporting urban planning efforts, and underpinning the construction of vital infrastructure such as roads, bridges, and railways. The continuous growth in population and economic development in Nigeria fuels a sustained demand for professional surveying services and the digital mapping capabilities that support them.

The demand for surveying services is particularly evident in rapidly developing urban centers like Ibadan, Oyo State. Ibadan's significant population and status as a major commercial and research hub generate substantial demand for a wide range of surveying services to support both commercial and residential developments. The city and Oyo State are experiencing a surge in infrastructure development projects, including extensive road constructions and rehabilitations, upgrades to the Ibadan Airport, and the development of a circular road project. The Oyo State government has demonstrated a strong commitment to infrastructure, allocating a significant portion of its budget to this sector. These projects necessitate various types of surveying, including engineering surveys for design and construction, topographic surveys for terrain mapping, and cadastral surveys for land acquisition and planning. The burgeoning real estate market in Ibadan, driven by urbanization and relatively affordable land prices, also generates consistent demand for cadastral surveys, boundary surveys, and the preparation of survey plans for property transactions and land titles.

Government agencies at both the federal and state levels are increasingly adopting digital mapping initiatives to support infrastructure development and land management. The Office of the Surveyor-General of the Federation (OSGoF) has a constitutional mandate to coordinate survey and mapping activities and produce accurate geospatial data for informed decision-making. OSGoF has launched pioneering projects, such as a high-resolution drone mapping initiative in Abuja, aimed at creating detailed topographical maps and 3D digital twin representations of the city. These initiatives leverage modern technology to enhance urban planning, security, and disaster management. The Oyo State Surveyor-General's Office is also actively involved in generating geographic information for planning and development, including digital mapping of the state and the establishment of a Geographic Information System. Their ongoing projects include layout surveys for agricultural and residential purposes and the inspection and charting of survey plans.

2.5 CHALLENGES OF DIGITAL MAPPING IMPLEMENTATION IN DEVELOPING COUNTRIES (AND NIGERIA)

Despite the clear benefits and growing adoption of digital mapping for infrastructure, its implementation in developing countries, including Nigeria, faces a range of significant challenges. These obstacles can hinder the effective utilization of these technologies and slow down development progress.

A primary challenge is the **lack of awareness and understanding** regarding the capabilities and importance of digital mapping and GIS. This lack of awareness extends to the general public, policymakers, and even some professionals, leading to misunderstandings and underutilization of these powerful tools.

- **Data limitations** pose another significant hurdle. Accessing and acquiring accurate, detailed, and up-to-date spatial and demographic data can be difficult. Converting existing paper maps and analogue data into digital formats is a time-consuming and resource-intensive process. Furthermore, even when digital data exists, issues of confidentiality, accuracy, completeness, and consistency can arise, impacting its usability.
- **Inadequate infrastructure** is a major constraint, particularly in Nigeria. Unreliable power supply and limited internet connectivity, especially in rural areas, impede the effective use of

digital technologies. Poor road networks also make it challenging to access remote areas for data collection.

- **Financial constraints** are a significant barrier to adopting modern digital mapping technologies. The initial investment in modern equipment (like total stations, GPS/GNSS, and drones) and software licenses can be substantial. There is often inadequate funding for data collection and the ongoing maintenance and upgrades of technology.
- A **lack of skilled personnel** with expertise in modern digital mapping techniques is a persistent challenge. While Nigerian institutions offer surveying education, there is a shortage of graduates adequately trained in the latest technologies. This necessitates significant investment in training and professional development programs.
- **Regulatory and policy gaps** can create uncertainty and hinder the widespread adoption of digital mapping. Inconsistent government policies and bureaucratic hurdles can delay the approval process for survey plans and create a challenging business environment. There may also be inadequate regulations concerning data ownership, intellectual property rights, and data sharing.
- **Corruption** remains a significant challenge in the Nigerian business environment and can impact the implementation of digital mapping projects. It can lead to demands for bribes, inflate costs, and undermine the integrity of data and processes.
- **Complex land ownership systems and frequent land disputes** in Nigeria can complicate surveying efforts and lead to delays in project completion. Traditional land tenure systems and a lack of clear documentation can make it difficult to accurately delineate boundaries and establish clear ownership rights.
- **Standards and Regulations**

Adherence to established standards and regulations is paramount in digital mapping to ensure the accuracy, compatibility, and reliability of geospatial data, particularly for critical infrastructure projects. These standards often dictate various aspects of the mapping process:

- **Accuracy Standards:** Digital data must meet or reference published accuracy standards to ensure appropriate positional accuracy. Testing against known accurate base maps or photography is often required to determine data accuracy.
- **Coordinate Systems and Datums:** Digital data should be referenced in standardized coordinate systems and geodetic datums to ensure uniformity in measurements and mapping.
- **Metadata:** Digital data should be accompanied by comprehensive metadata records that document how the data were produced, their accuracy, and other relevant information.

- **Data Formats and Structure:** Standards may specify preferred data formats and directory structures for digital map products to ensure compatibility and ease of use.
- **Map Elements:** Guidelines may exist for the inclusion and representation of standard map elements such as north arrows, legends, and disclaimers.
- **Documentation:** Comprehensive documentation of the data collection and processing methods is important for transparency and reproducibility.

In Nigeria, the Surveyors Council of Nigeria (SURCON) is the primary regulatory body responsible for setting standards, licensing surveyors, and overseeing the practice of surveying. Compliance with SURCON regulations is mandatory for producing legally recognized survey plans. State-specific regulations, such as those in Oyo State, also provide detailed guidelines for surveying practices and the submission and approval of survey plans.

2.6 FUTURE TRENDS IN GEOSPATIAL TECHNOLOGY FOR INFRASTRUCTURE

The field of geospatial technology is dynamic, with continuous advancements expected to shape the future of digital mapping for infrastructure. Several key trends are emerging:

- **AI and Machine Learning in Geospatial Analysis:** Artificial intelligence and machine learning are increasingly being integrated into geospatial workflows to automate complex analyses, identify patterns in large datasets, and enhance predictive modeling for urban planning and infrastructure management. AI can be used for tasks such as object detection in satellite imagery (identifying roads, buildings) and predicting environmental changes or disaster risks.
- **Integration of IoT with GIS:** The combination of Internet of Things (IoT) sensors with GIS enables the collection and analysis of real-time location-based data, supporting smart city initiatives and the dynamic management of infrastructure assets.
- **Cloud-Based GIS Solutions:** Cloud computing is expanding the accessibility and functionality of GIS, enabling seamless data storage, sharing, and analysis without the need for extensive local infrastructure. This facilitates collaboration and supports the processing of large datasets.
- **Advancements in 3D GIS and Digital Twins:** 3D GIS technology and digital twins (virtual models of physical entities) are becoming increasingly important for urban development and infrastructure management, allowing for detailed visualization, simulation, and analysis of

various scenarios. Digital twins enable real-time monitoring and performance tracking of infrastructure assets.

- **Remote Sensing Advancements:** Continued advancements in remote sensing techniques, including the development of quantum sensing, are expected to improve the precision and capabilities of monitoring infrastructure and environmental changes.
- **Open Data and Interoperability:** There is a growing push for open geospatial data and interoperable systems to ensure seamless data integration and analysis across different platforms and organizations.

2.7 CONCLUSION

Digital mapping has fundamentally transformed the field of surveying and its application to infrastructural facilities. Building upon traditional methods, the integration of computer technology has led to increased accuracy, efficiency, and versatility in map production and spatial data management. Technologies such as GIS, remote sensing, drones, LiDAR, and GPS/GNSS are now indispensable tools throughout the infrastructure lifecycle, from initial planning and design to construction, management, and maintenance, and even in disaster response.

In Nigeria, digital mapping is playing an increasingly crucial role in supporting infrastructure development, urban planning, and land administration, driven by population growth and economic development. Urban centers like Ibadan demonstrate a significant demand for surveying services, fueled by ongoing infrastructure and real estate projects. Government agencies are actively adopting digital mapping initiatives to enhance governance and service delivery.

However, the full potential of digital mapping in Nigeria is yet to be realized due to significant challenges. These include a lack of awareness and understanding of the technology, limitations in accessing accurate and comprehensive data, inadequate infrastructure (particularly power and internet), financial constraints related to acquiring modern equipment and software, a shortage of skilled personnel, and complexities arising from regulatory gaps and traditional land ownership systems. Addressing these challenges requires concerted efforts, including investment in technology and training, improving data management systems, fostering collaboration between government and private sectors, and raising public awareness about the value of professional surveying and digital mapping.

As geospatial technology continues to evolve with advancements in AI, IoT, cloud computing, and digital twins, the opportunities for leveraging digital mapping to support sustainable infrastructure development in Nigeria will only expand. By strategically addressing the existing challenges and embracing future trends, Nigeria can harness the full power of digital mapping to build resilient infrastructure, facilitate urban growth, and enhance the quality of life for its citizens.

CHAPTER THREE

3.0 METHODOLOGY

This stage involves the methods and procedure used in planning, data acquisition, dataprocessing, and creation of database, creation of database management system and information presentation. These operations were logically structured and carried out in stages involving database design. It is normally considered to involve a spatially referenced and structured digital database and appropriate application software for geospatial analysis. This basically describes the techniques and principles adopted in carrying out the project.

Geographic information system methods were adopted in accomplishing the desired results.

3.1 DATABASE DESIGN

The design of any database involves three stages namely;

i Conceptual design

ii Logical design

iii Physical design

3.1.1 VIEW OF REALITY

In database design, there is need for reality which is referred to as the phenomenon that actually exists, including all aspects which may or may not be perceived by individuals. The view of reality however, is the mental abstraction of the reality for a particular application or group of applications. For this application, the view of reality is made of the topography of the project. Since it isnot possible to represent the real world, the only option is to conceptualize and model it in a specified manner to represent the real world. The area of interest to us in this project Includes; Green Reserve, Roads, Electric poles, Trees, Water Facilities, Buildings, Footballpitch, Streams.

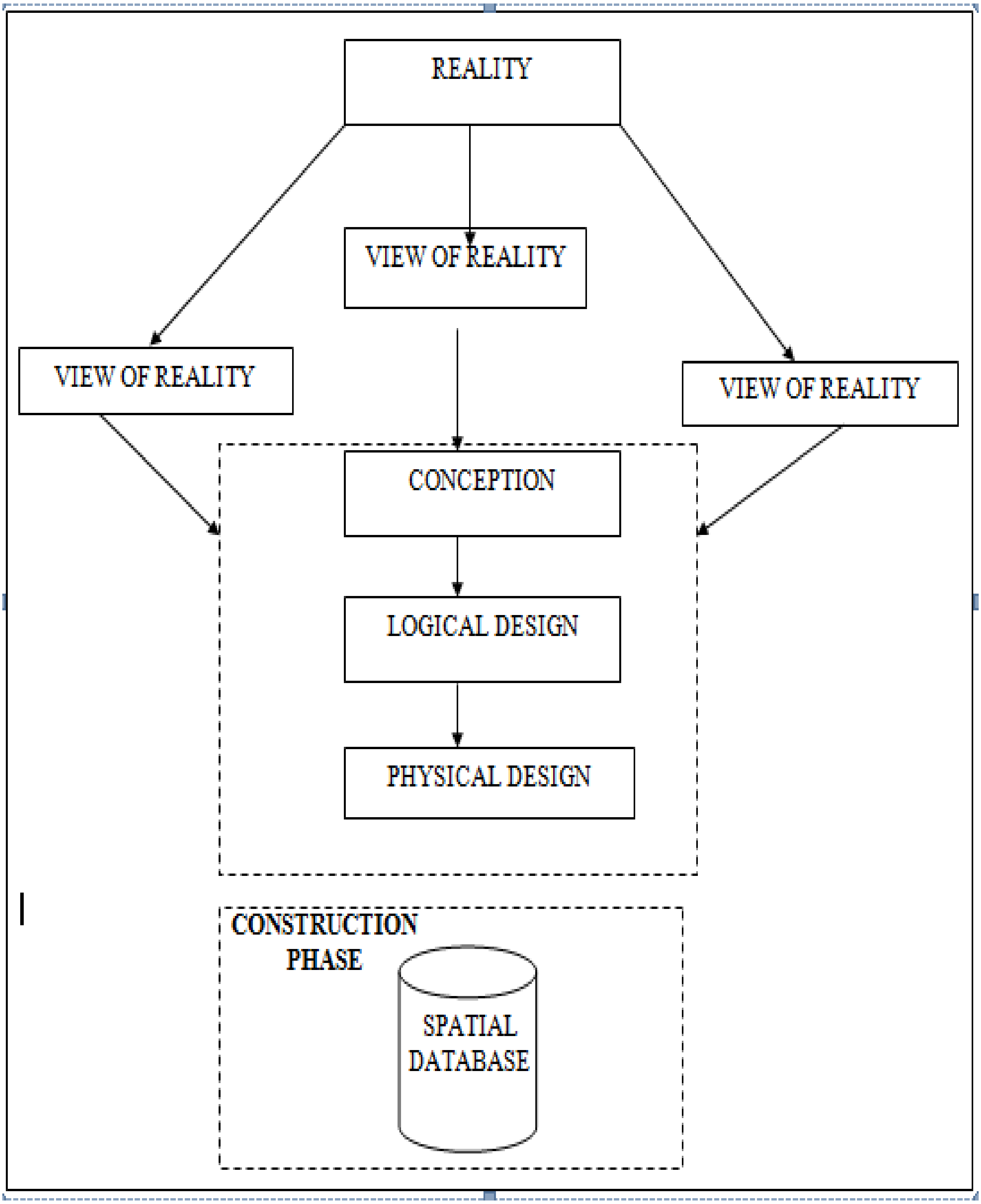


Fig. 3.1 Design and Construction Phases in Spatial Database

3.1.2 CONCEPTUAL DESIGN

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

a. Vegetation area (polygon)

b. Roads (line)

c. Trees (point)

d. Boundary line (polygon)

e. Buildings(polygon)

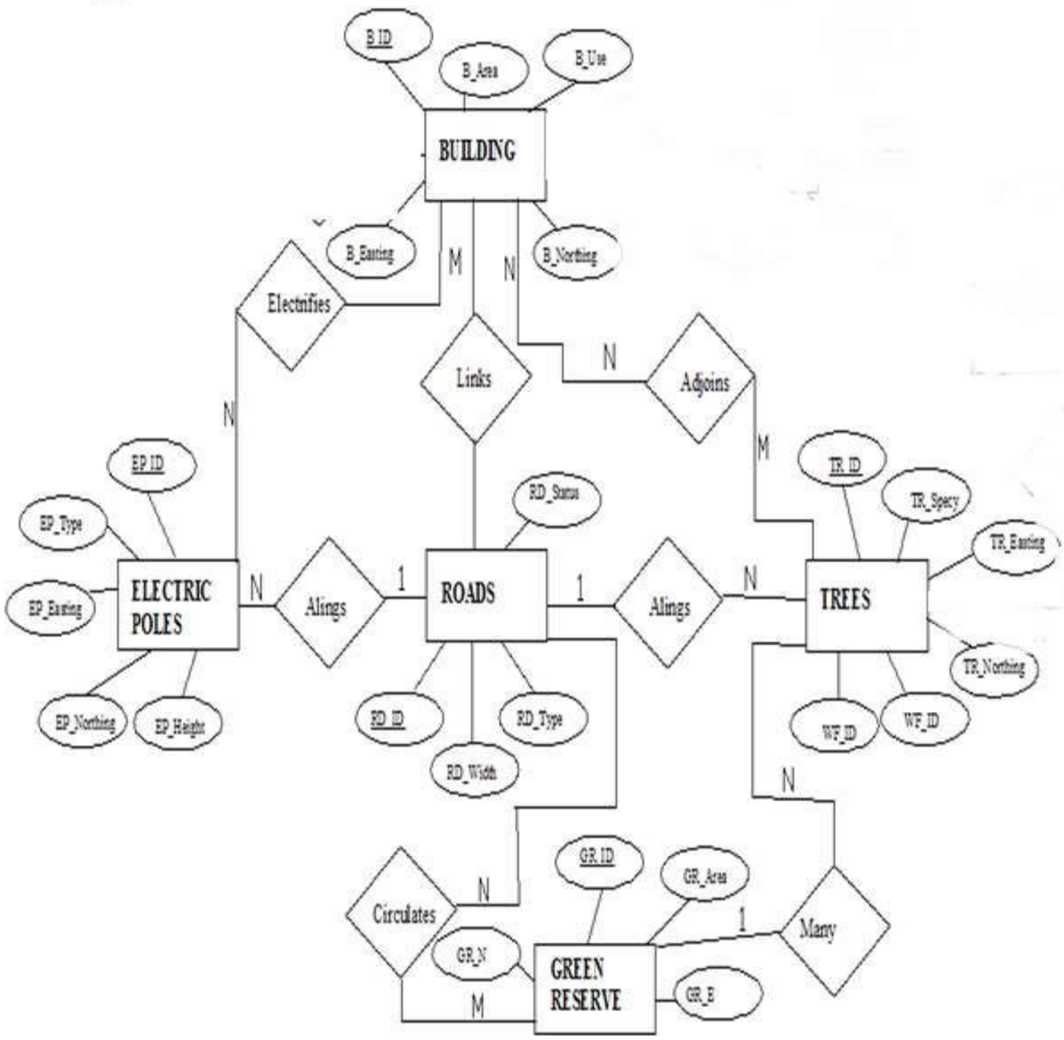


Fig. 3.2.: E-R Diagram (Entity relationship diagram)

3.1.3 LOGICAL DESIGN

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

i Building(B_ID, B_Area, B_Name, B_Easting, B_Northing)

ii Roads (R_ID, R_Width, R_Type, R-Condition, R_Easting, R_Northing)

iii Vegetation (V_ID,GR_Area,)

iv Tree (TR_ID, TR_spp, TR_Importance, TR_Easting, TR_Northing)

v Electric Pole (EP_No, EP_Type, EP_Height,EP_Easting, EP_Northing)

vi Water Facility (WF_ID, WF_Depth,WF_Type, WF_Easting, WF_Northing)

vii Football Pitch (FP_ID , FP_Area, FP_Status)

viii Stream(S_ID, Length, Width)

3.1.4 PHYSICAL DESIGN

Table 3.1: Building and its attribute

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

Table 3.2: Road and its attributes

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

Table 3.3: Trees and its attributes

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

3.2 RECONNAISSANCE

This is the preparatory stage before the execution of this project; it involves collection of available information about the project area.
The necessary step taken for the successful execution of the project involves two stages, which are:-

1. Office Planning
2. Field reconnaissance

3.2.1 OFFICE PLANNING

This involves the collection of information about the study area, testing the instrument to be used in execution of the project and itemizing the numbers of equipment needed, number of days to be use, how each activity is to be carried out, delegation of works to each team members based on supervisor's guide/instructions.

Table 3.4 Coordinates of Controls

Station	Northing (m)	Easting (m)	Height (m)
KWCS 625T	941451.040	674200.278	255.212
KWCS 623T	941753.095	673845.702	250.532
KWCP 690	94I802.041	673810.314	249.087

Source: Surveyor general office Kwara

3.2.2 FIELD RECONNAISSANCE

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

i. Boundary points was selected

ii. The distribution of features was studied

iii. Controls to be used were located

iv. Method and type of instrument to be uses was determined

v. Subsidiary point for Ground control Points were picked and define using nail and bottle cock

vi. A diagram of the study area was drawn.

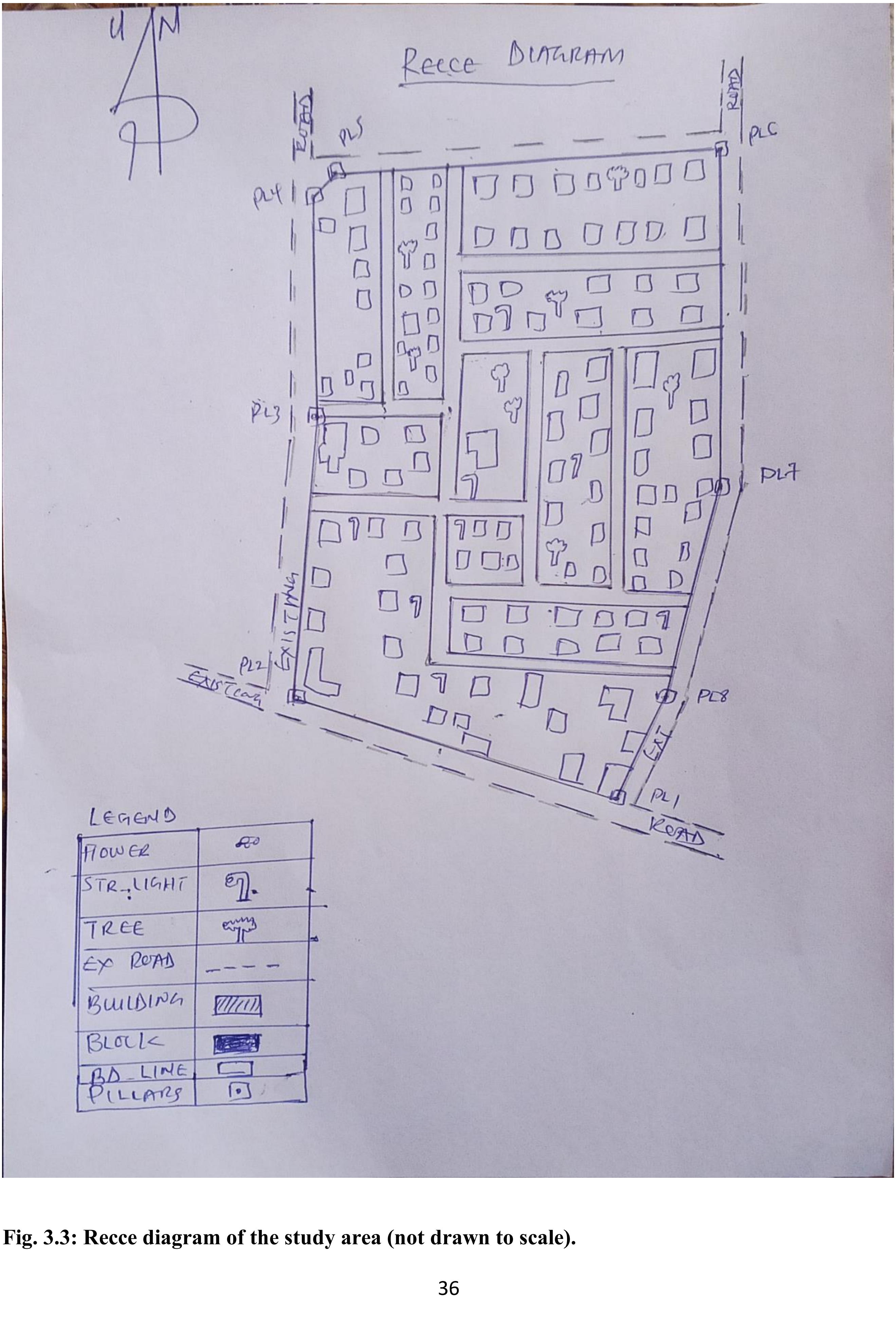


Fig. 3.3: Recce diagram of the study area (not drawn to scale).

3.3 EQUIPMENT USED/ SYSTEM SELECTION AND SOFTWARE

3.3.1 HARDWARE USED

i. Total station

ii. 1 reflector with a tracking rod.

iii. 1 Tripod

iv. One (1) 50m tape

v. One (1) umbrella

vi. 1 cutlass

vii. Hand held GPS

viii. Hammer

ix. Nails and bottle cover

x. Field book and writing materials

xi. 1-No of Personal Computer HP655 and its accessories

xii. 1-No of HP Desk Jet K7100 A3 printer

xiii. 1-No of HP Desk Jet 1110 A4 printer

3.3.2 SOFTWARE COMPONENT

i. Notepad.

ii. Microsoft Excel.

iii. AutoCAD 2007

iv. ArcGIS 10.3

v. Microsoft Word.

3.4 INSTRUMENT TEST

To ensure data quality, the Total Station used for this project was tested for both vertical index and horizontal collimation errors. It was also to ascertain the efficiency and reliability of the instrument. The procedure used is described below.

3.4.1 HORIZONTAL COLLIMATION TEST

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

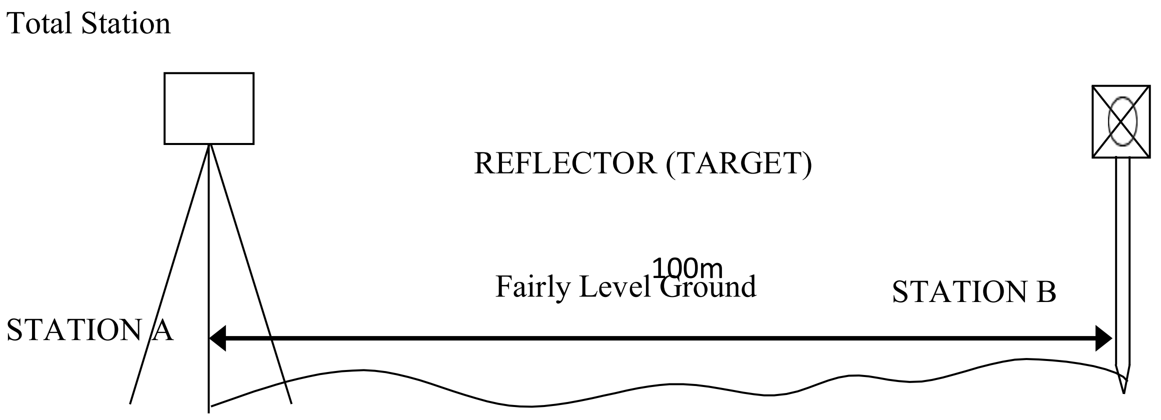


Fig 3.4: Horizontal Collimation and Vertical Index error test.

Table 3.5: Horizontal Collimation Data

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

3.4.2 VERTICAL INDEX ERROR TEST

This test was conducted to verify the accuracy of the vertical reading when the line of sight is horizontal. The desired measurement for this test is exactly ninety degrees (90˚), any deviation from this value is referred to as the vertical index error.

The Total Station was positioned over a specific point, and necessary temporary adjustments were made to ensure proper alignment and functionality. A target was placed approximately 100 meters away from the Total Station, and the instrument was aimed at the target. The target was bisected by aligning the instrument on the face left, and the corresponding reading was recorded. Similarly, the target was then bisected on the face right, and the respective reading was also recorded. The recorded readings are provided below:

Table 3.6: Vertical Index Data

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

3.4.3 ANALYSIS OF COLLIMATION AND VERTICAL INDEX DATA

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

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

Vertical collimation = {(FL + FR) – 360} = (90˚00‟00” + 270˚00‟02”) - 360} = 02”

The result shows that the instrument is still in good working condition.

3.5 CONTROL CHECK

Three control beacons (KWCS 625T, KWCS 623T and KWCP 690) were used. In order to ascertain the in-situ of the control beacons, a check was carried out on them by observing the angle between them and comparing the result obtained with the computed angles from the giving coordinates.

The total station instrument was set on the control beacon KWCS 623T. After performing all the necessary temporary adjustment, the reflector was placed on the control beacon KWCS 625T which served as the back station. The horizontal angular reading was taken and recorded while the instrument was on face left. The reflector was then taken to the control beacon KWCP 690 which serves as the forward station, the horizontal angle reading was then taken and recorded on both face left and face right. The reflector was taken back to the back station, the horizontal angle was then recorded on face right

Table 3.7: showing the back computation of the control coordinates

From STN	Bearing	Dist (m)	ΔN	ΔE	Northing (m)	Easting (m)	To STN
					941451.040	674200.278	KWCS 625T
KWCS 625T	130°25'37''	**465.791**	302.055	-354.576	941753.095	673845.702	KWCS 623T
KWCS 623T	149°38'02''	**60.399**	48.946	-35.388	941802.041	673810.314	KWCP 690

Table 3.8: showing the distance observation result of the control check

FROM	OBSERVED DISTANCE (m)	COMPUTED DISTANCE (m)	TO
KWCS 625T	465.902	465.791	KWCS 623T
KWCS 623T	60.521	60.399	KWCP 690

Table 3.9 showing the observation result of the control check

STN	SIGHT	FACE	OBSERVED HZ ANGLE	REDUCED HZANGLE	MEAN
	KWCS 625T	**L1**	**195° 14' 07''**		
KWCS 623T	**KWCP 690**	**L2**	**64° 47' 29''**	**130°26'38''**	
	KWCP 690	**R2**	**15° 14' 13''**	**130°26'22''**	
	KWCS 625T	**R1**	**145° 40' 35''**		**130°26'30''**

Difference in angle (observed - computed) =188° 31' 40"-188° 31' 36"

= 00° 00' 04"

Since the allowable accuracy (angular) of third order traverse of one station is 00° 00' 30" and the result obtained from the control check (00° 00' 04") is less than allowable error. Therefore, the controls were angularly intact.

3.6 MONUMENTATION

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

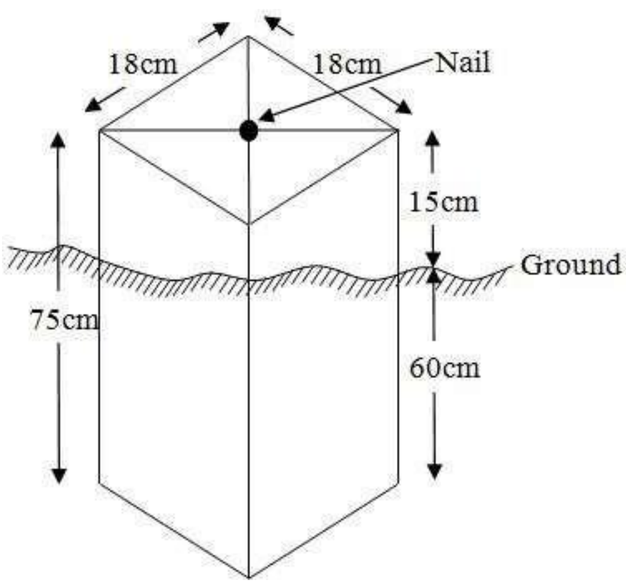


Fig. 3.5: Pillar Description

3.7 DATA ACQUISITION

PRIMARY DATA SOURCE

Field observation was the primary source of data for this project. Ground based method was used in acquiring data with the use of Total Station Instrument, which involved the collection of X, Y, Z data through coordinated Ground control Points (GCP) established at conspicuous points within the study area .

SECONDARY DATA SOURCE

An imagery of the area was acquired through Updated Google earth; this was used to ascertain the extent of coverage of the project area.

3.7.1 GEOMETRIC DATA ACQUISITION

The total station instrument was set carefully on control point KWCS 623T back sight taken to KWCS 625T after necessary station adjustments has been carried out on it. The adjustments includes; centering, leveling and focusing. The following procedureswere then followed to determine the position of the next point KWCS 623T and the same procedure were repeated until all we come close to the site. The method used in acquiring data on site was radiation method where two or more points are coordinatedfrom one point.

i. Having set up the instrument and temporary adjustment carried out, the instrument was powered „on‟ and a job was created under job menu in the internal memory of the instrument. The job created was named GRP6B

ii. On the job, the coordinates of the three (3) control points were keyed in to the memory of the instrument and some codes were also saved. The codes include

iii. „RD‟ for road, „SP‟ for spot height, „BD for buildings, etc.

iv. The height of the instrument was measured and saved on the memory of the instrument as well as the reflector height.

v. On coordinate menu, orientation was set by inputting the coordinates of the instrument station and back sight. The reflector at the back station was perfectly bisected before the orientation was confirmed by clicking „yes‟.

vi. Having done the orientation, the reflector at the next nail; was bisected and „obs‟ (observe) option was clicked. The three dimensional coordinate of the point (E,N, H) were displayed on the display unit of the instrument and „rec‟ (record) wasclicked to save the data into the memory of the instrument. For subsequent observation after this, „all‟ option was used instead of pressing „obs‟ and pressing

vii. „Record" later.

viii. It was ensured that the center of the prism of the reflector was bisected and that it was set perfectly on the tripod in order to minimize the error on height determination.

ix. The instrument is been shifted to another nail after all details, spot height and boundary point visible from the instrument station have been picked, set over it and temporary adjustments carried out.

x. Nonetheless, the above operations were repeated until all the boundary points with heights were coordinated.

xi. In this project all spot height are not in grid intervals but randomly acquired. Three edges (3) of building were picked. At the end of data acquisition process all details were acquired and properly recorded to be shown in their respective positions on the plan.

3.7.2 ATTRIBUTES DATA ACQUISITION

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

3.8 DATA DOWNLOADING AND PROCESSING

3.8.1 DATA DOWNLOADING AND EDITING

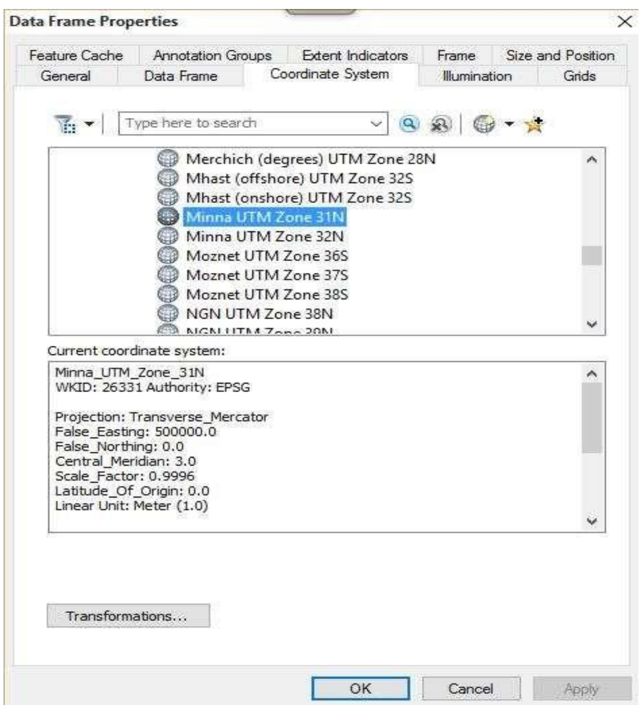
This is stage whereby all data acquired which were automatically stored in the Total Station were downloaded into personal computer. This was done with the aid of downloading cable connected to the computer and some associated complementing software installed on the System.

3.8.2 DATA PROCESSING AND DATA EDITING

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

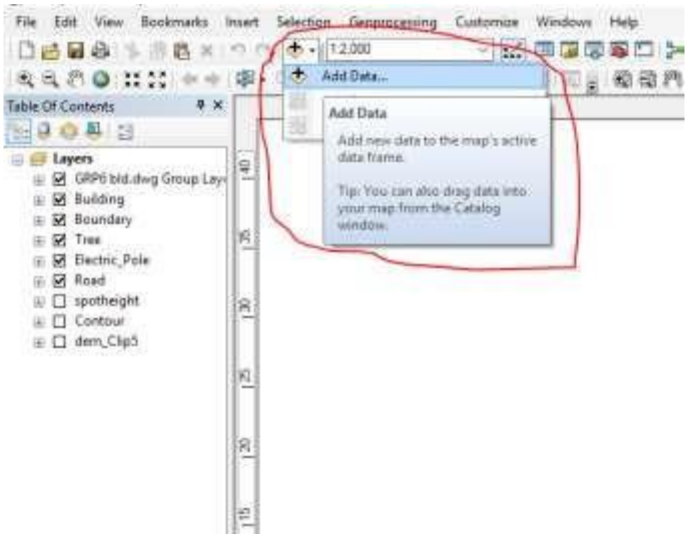
3.8.3 DATA PROCESSING USING ARCGIS 10.3

Before launching of ArcGIS AutoCAD was used in plotting of feature data saving them separately in different file named road, boundary line, buildings, trees and electric poles.

- Launch the Arc Map in ArcGIS 10.3
- Click on A NEW EMPTY MAP on the dialog box displayed after loading
- 

- Click on Tools on the menu bar, then select extensions, mark all and close.
- At the LHS, right click on layers, and then select properties.
- Click on coordinate system to set the projection system to MINNA DATUM ZONE31N and general to set the unit, then apply and okay.
- Add data was selected at the tool bar all saved AutoCAD fie was selected and

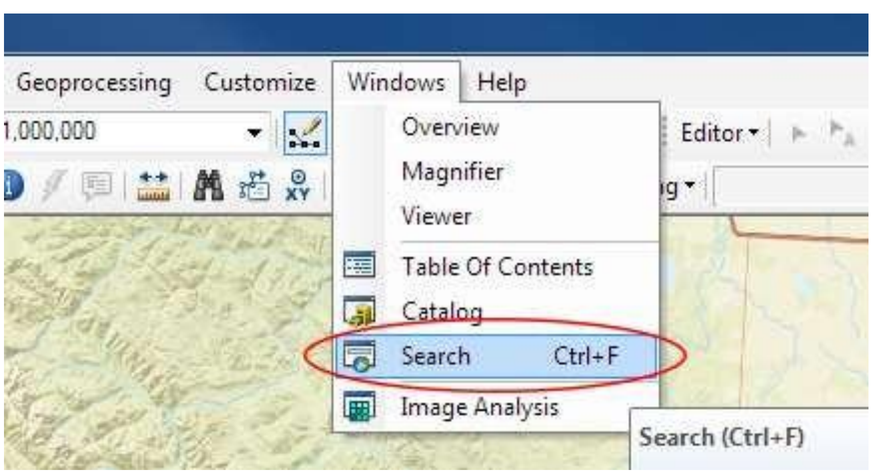
loadonto the table of content layer section



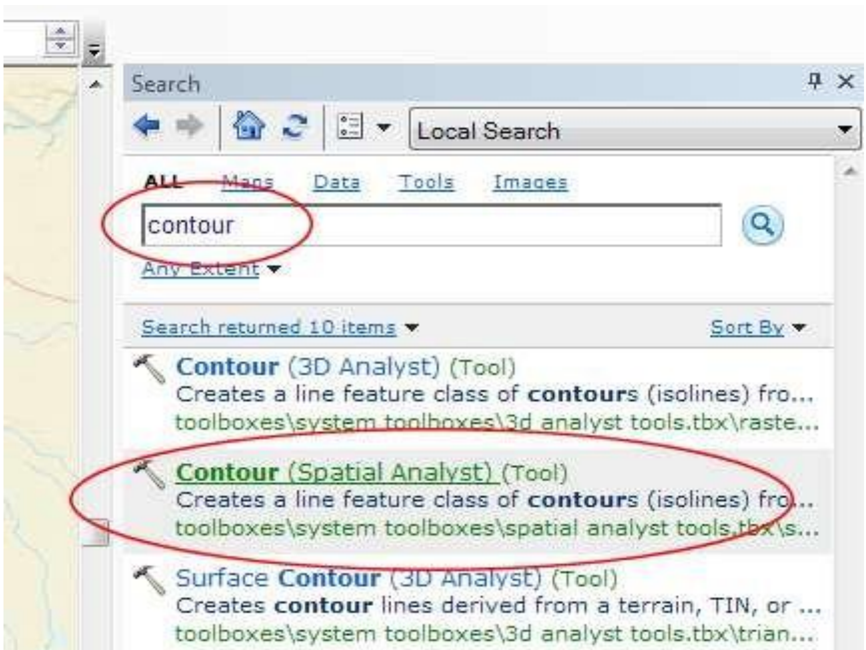
All drawing was exported to shape file. After the feature class has been creates, click onEditor to start Editing, and then click on the load object.

3.8.4 TOPOGRAPHICAL MAP

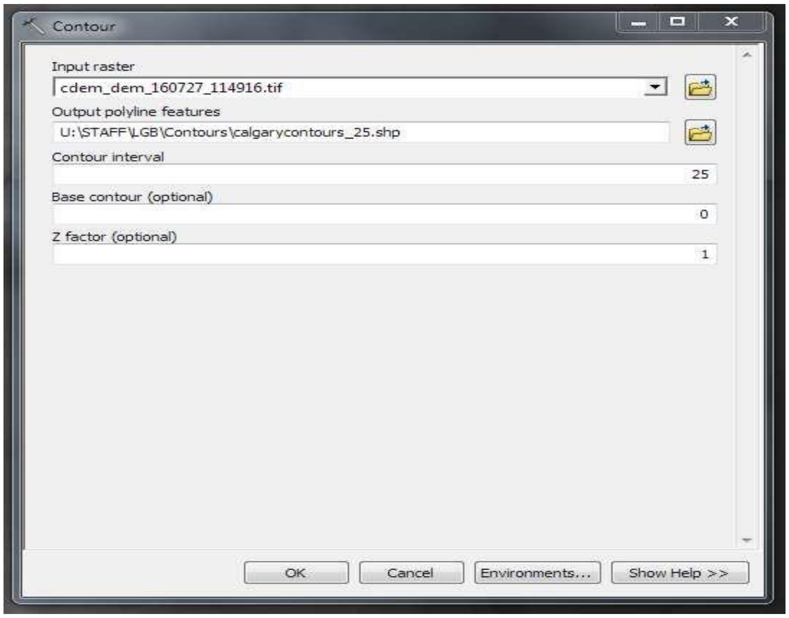
CRATING CONTOUR: Firstly DEM was created by searching in the search icon INTERPOLATION> NATURAL NEIGHBOR and selecting THE XYZ data for creation of DEM in respect to the boundary line as extent. In order to create contours, you will need to enable the Spatial Analyst toolbar, which can be found by going to Customize > Toolbars > Spatial Analyst or open the search bar. You can do this by clicking Windows > Search, or by clicking on the search icon.



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



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



The generated contours will automatically be added to the map.

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

- Click Add and Next, then select the Target layer you want it to be
- Load it into from the feature class created on the ARCGLS.
- Click on Next, then select "only the features that satisfy the

- Query” and click on Query Builder to query for the feature to be loud e.g. “layer” =Boundary”.
- Click on Next. ....Then finish

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

EDITING, CONVERTING AND MERGING GEODATABASE

- Remove all necessary features by right clicking on it and press "REMOVE"
- Convert some features that are not in their correct „features -type‟ like point, line, and polygon features etc.
- To convert a GEODATABASE FEATURE CLASS to another the following steps weretaken:
- FOR LINE FEATURE CLASS TO POLYGON FEATURE CLASS
- Go to WINDOW on the menu bar and select ARC Toolbox.
- Select DATA MANAGEMENT TOOLS, click on FEATURES, and then SelectFEATURE TO POLYGON.
- ON INPUT FEATURES, select feature to be converted, on OUTPUT FEATURE CLASS, then save on the GRP6C FOLDER, press OK and CLOSE.
- Then remove the converted feature class in the LAYER Menu and ARC CATALOGfiles.
- On INPUT DATASETS, select features to be merged, on OUTPUT DATASETS,then save on the GRP6C folder, press OK and CLOSE.
- Then remove the converted feature class in the LAYER Menu and ARC CATALOGfiles.

ADDING SPOT HEIGHTS DATA

- NOTE: STOP EDITING on the EDITOR MENU before adding data field,
- Go to FIELD ON THE MENU BAR, scroll to add Data and then ADD XYZ DATA

- Browse the EXCEL FILE for SPOT HEIGHTS, select EASTING VALUE on X - FIELD and NORTHING VALUE on Y - IELD and ELEVATION
- « Select DATA the EXPORT DATA, locate the folder created and give it name then YES AND OK, remove the previous layer by right clicking on it and select REMOVE.

TIN, ASPECT AND SLOPE CREATION USING ARCMAP

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

TO CREATE TIN

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

TO CHANGE THE FACE OF THE TIN ACCORDING TO ITS ELEVATION

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

TO CREATE ASPECT

- Click on 3D analyst arrow, select SPATIAL ANALYST TOOLS, SURFACE and THEN DOUBLE CLICK on ASPECT.
- Browse to where the raster format of all the acquired data created from the surfer was saved to.
- Browse to where you want the OUTPUT RASTER to be saved
- You can change the OUTPUT MEASUREMENT to Degree OR percent
- Click OK [then it displays on the data view screen], then Close.

3.8.5 FACILITY MAP PRODUCTION

The buildings were digitized from the downloaded Google earth image using ArcGIS 10.2.1. Shape files for the facilities were created in Arc Catalogue. The created shape files were added to Arc Map and editor was started to digitize out to facilities. The road network, buildings are extracted using polyline and polygon respectively while street lights and trees are represented by point data for 3D map production the generated 2D map is shown in Figure 3.6, Figure 3.7 shows the old 2D CAD map of the study area..

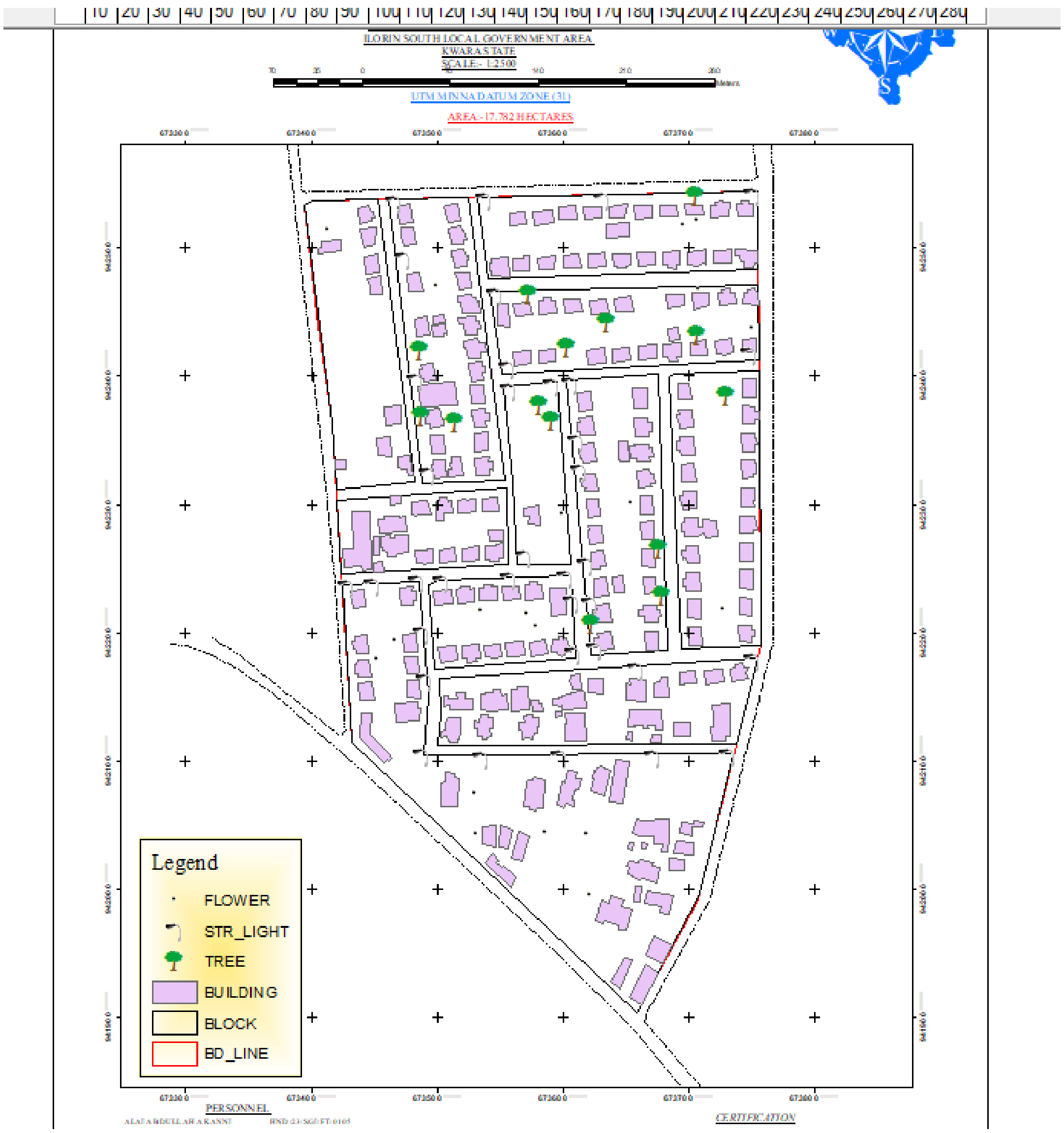


Figure 3.6 showing the 2D facility map of the study area.

3.8.6 3D MAP PRODUCTION

The 3D image was done Arc Scene using the created DEM; the created DEM was added to Arc Scene 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 was made to float on DEM to have a true land representation.

The created DEM was also added to Arc Scene, The height of the buildings gotten from the field was added to the already created height field in the attribute table of each of the facility shape file in Arc Map. Arc Scene 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.

3.8.7 FINDINGS

This study has demonstrated a capability of GIS in facility mapping with different visualizations techniques i.e. 2D and 3D visualization, Figure 3.6 shows the generated 2D map while Figure 4(a) and Figure 4(b) show cross-sections of the generated 3D map of the campus. All the facilities were geo-located with the aid of total station and imported into ArcGIS 10.2, the facilities were also digitized from the Google earth image downloaded for the study area. 3D topographic maps of the study areas were created from the point data gotten from field-work and also from the downloaded SRTM DEM image downloaded from USGS, Figure 5 shows the 2D Topographic map generated from the point data gotten from the field using Total station while Figure 6 shows the 3D topographic map generated using the same data source. Figure 7 shows the 2D topographic map generated from SRTM 30 m while Figure 8 shows the 3D topographic map generated using the same data source. The 2D facility map was produced by digitizing all the facilities out as features from the Google earth image downloaded using Google downloader. The 3D model of the campus was produced by exporting all the features created in Arc Map to Arc Scene for extrusion; the extruded features were made to float on the 3D topography map created through interpolation using Kriging method. The 3D visualization gives the study area a near real life view.

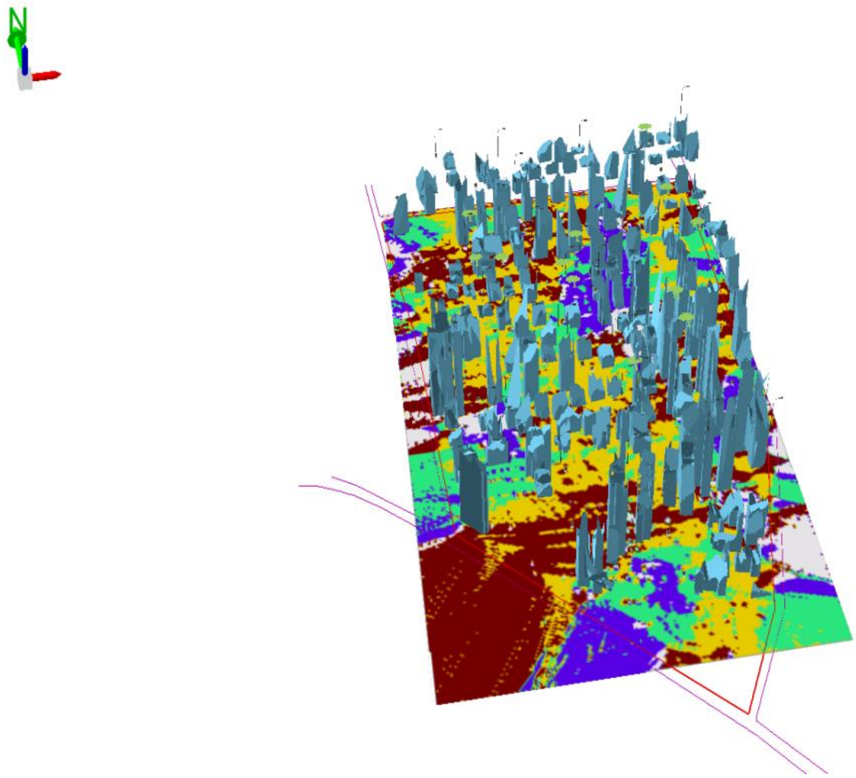


Figure 3.7 Showing 3D model of the study area are

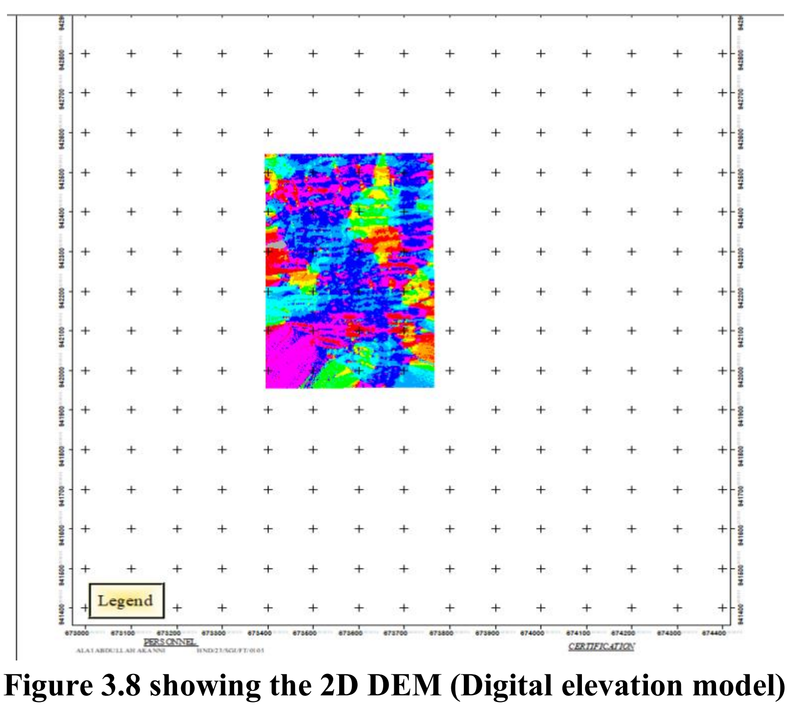


Figure 3.8 showing the 2D DEM (Digital elevation model) of the study area (derived from the field data).

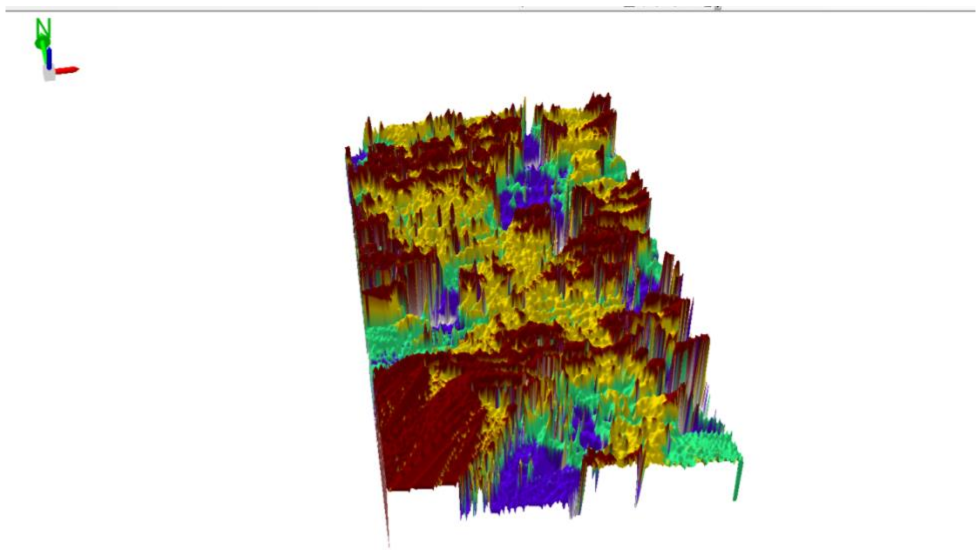


Figure 3.9 Showing 3D DEM (Digital Elevation Model) of the study area (derived from the field data).

3.8.8 ATTRIBUTE DATA CREATION

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

- Right click on the feature class, then select OPEN ATTRIBUTES TABLE click onOPTIONS and select ADD FIELD.

- Give it FIELD NAME, click on TYPE and select [SHORT INTEGER or LONGINTEGER for SHORT or LONG WHOLE VARIABLES or DOUBLE FOR DECIMAL VARIABLES OR TEXT variable or DATE for DATE], then enter precision or LENGTH for text width and scale for DECIMAL PLACES, and then click OK

- To input variables on the ATTRIBUTE TABLE, go to the EDITOR on Menu bar, select START EDITING,

- Click on ATTRIBUTE on menu bar [behind the TARGET], click on the features on the DATA VIEW display, and then input the variables of data acquired through SOCIAL SURVEY or DATA ACQUIRED ON THE FIELD.

- Save it after the input by selecting SAVE EDITS on the editor menu. To switch to other layers, select STOP EDITING on the EDITOR menu. Then repeat the above step to create other fields. Populate the table and save.
-

Table 3.10: Building

ENTITY	FIELD ALIAS	DATA TYPE	FIELD SIZE
B_ID	Building Identification	Numeric	-
B_name	Building Name	Text	10
B_Area	Building Area	Numeric	-
B_E	Building Easting	Numeric	-
B_Northing	Building Northings	Numeric	-

Table 3.11: Road

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

Table 3.12: Trees

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

Table 3.13: Electric Poles

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

3.8.9 DATABASE IMPLEMENTATION

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

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

3.8.10 DATABASE MANAGEMENT SYSTEMS

Database management is a collection of software for creating, storing, manipulating, updating, organizing and querying of information in a database (Kufoniyi, 1998). It is a software package whose function is to manipulate a database on behalf of the user.

A good DBMS must provide the following functions:

- Storage and retrieval of data.
- Access to by several users at a time.
- A standardized interface between database and application programmed.
- Standardized access to data and separation of data storage and retrieval functions fromthe program using the data.
- Maintenance of data security and integrity.

3.8.11 DATABASE MAINTENANCE

Having created the database, proper maintenance practice was made to meet its stated objectives. The ability to include more data and remove irrelevant data was possible by way of maintenance. There is every need for the data to be updated regularly because of the physical changes that may occur on the landscape with time. Both security and integrity were also exercised to ensure maintenance and to meet its stated objectives.

Proper observance, updating and management of database ensure its currency and quality to stand a profound chance in Spatial Decision Support System (SDSS). The quality of any database depends on the currency and fitness for use as a decision support system (SDSS). The quality of database depends on its ability to generally fit and use as a decision system (DSS). The storage media should be from time to time justified if otherwise could necessitate data inaccessibility or physical deterioration of the storage media. Also care must be taken during populating any database system, as a database is only good as the data supplied. In archiving stable media should be used. Examples of these are:-

- Computer compatible tape reader
- Magnetic tape
- Optical disc and compact disc

3.8.12 AREA COMPUTATION TABLE

Table 3.14: shows area computation

	A	B	C	D	E
1	STATION			NORTHING	EASTHING
2	PT1			673432.2	942113.78
3	PT2	-28.25	334.19	673403.95	942447.97
4	PT3	-9.51	84.96	673394.44	942532.93
5	PT4	5.48	3.7	673399.92	942536.63
6	PT5	354.5	6.58	673754.42	942543.21
7	PT6	32.15	-353.52	673757.24	942189.69
8	PT7	-32.15	73.28	673725.09	942064.55
9	PT8	-17.82	-73.28	673707.27	941991.27
10	PT9	-48.37	-87.43	673658.9	941903.84
11	PT1				
12			AREA	177816.4103	
13					
14			HECTARES	17.78164103	
15					
16					

CHAPTER FOUR

4.0 SPATIAL DATA PROCESSING, ANALYSIS AND INFORMATION PRESENTATION

4.1 DATA PROCESSING

Data processing is the work done on acquired data before it is f+ for analysis and presentation. It involves the use of various software's used in redefining the data before it can come to a finished product.

The software's used include:

- AutoCAD
- ArGIS
- Microsoft word
- Microsoft excel
- Notepad

The various work involved in data processing includes:

- Plotting
- Typing

4.1.1 DATABASE CREATION

Database is an organized integrated collection of data stored so as to be capable of use by relevant

application with data being accessed by different logical paths. This is the construction phase where database was created. After the table has been populated via the keyboard, some attributes such as area,

4.2 SPATIAL ANALYSIS

Spatial analysis is a specialized function that distinguishes GIS from other information systems. It entails the examination of spatial and attributes characteristics of geographic features that are within the database to establish relationships from which spatial problems can be tackled. In this project work, spatial analyses were performed to select, combine, and/or intersect existing geospatial data-sets in order to generate new information suitable for answering specific spatially-related questions.

The results from these analyses can be shown i a number of ways depending on the required output format. Where attribute information about map features are required, they can be presented as tables containing such values as are needed from the query analysis. They can also be presented as maps with legend information. showing the queried features and their topological relationships with other features shown on the map.

4.3.1 TESTING OF DATABASE

This is carried out to ascertain the quality of the database created, it was necessary to tryout the database so as to determine if information could be readily retrieved from it as required. Testing the database was important to determine whether the established relationships between features and their characteristic

attributes are so represented on the database.

4.3.2 QUERY OPERATION AND OUTPUT PRODUCTS

Spatial queries, otherwise known as spatial search, can be described as an operation which defines attributes within a database to answer generic questions. The spatial database was searched or interrogated.

Basically, this involved extracting of information from the already created database of the study area.

Queries were generated to provide the answers to the application, the result displayed in a hard copy plan.

The operation linked the database and the composite plan of the area to solve spatial problem of the area the queries to be executed was designed ahead of time, so as to reduce the time spent with the computer system.

4.4 ANALYSIS OF RESULT AND DISCUSSION

This is the analysis of result, operation formulae; result extracted and was arranged accordingly as the observation was held.

operation	Formula	result expected	result obtained
treasurer	$30''\surd$		
angular accuracy			
linear accuracy	$(\Delta n)^2 + (\Delta e)^2$		

4.5 RESULT OF THE ANALYSIS

This is the main traverse result extracted from the processed data. This is shown on the appendix

4.6 BACK COMPUTATION

Stn.	Bearing	Distance	Δ East	Δ North	Easting	Northing	Stn.
					675605.928	938052.240	A
A	073° 10' 02''	110.05	-57.891	-254.551	675548.031	937793.689	B
B	185° 19' 46''	120.54	-150.574	34.798	675397.457	937832.487	C
C	254° 09' 58''	110.78	103.191	-23.065	675500.648	937809.422	D

D	345˚ 16' 25''	121.66	105.280	242.819	675605.928	938052.240	A

4.7PERIMETER PLAN

The perimeter of the project area was traversed for the purpose of coordinating the boundary points. The total station was setup on the first control point SC/KWI.333R, orientation was taken to another control point SC/KWI.332R after which the entire boundary was coordinated and this process were used for all other subsequent points.

4.8 DETAIL MAP

Detailing as the process of representing the physical features that are present on the area of land to be surveyed features includes building, roads, rivers, etc. are also important in topographic surveying details. After covering the perimeter survey of the area, detailing was the next instep to follow, picking out the detail that is present in the field.

4.9 SPOT HEIGHTENING

Since the ground survey techniques was used for the data acquisition, the direct survey method which can also be referred to as control tracing was adopted to determine the variation in spot height. This method is performed by using total station instrument after the instrument was set up, the height of the instrument was established and uses the telescope to bisect the upper part of the prism to obtain the various height of point all crossed the study area. This was repeated throughout the study area to capture all the heights.

4.10 PRODUCT APPLICATION

4.10.1 Uses of Digital Map

- Digital map is used by the town planners to plan the city and villages
- Digital map reveals the features of earth and thereby enhancing effective planning and designing of construction project like miners, agriculture practitioners, engineer and military personnel's

4.10.2 USES OF DETAIL PLAN

- Detail plan is regularly used when designing for roads, buildings, extension and other new infrastructure
- It is used to show the location and height of any number of varieties of features of an area.

SINGLE SELECTION CRITERION

Query 1: shows the completed building

SELECT* **FROM** Building **WHERE** "BLD_STATUS" LIKE COMPLETED

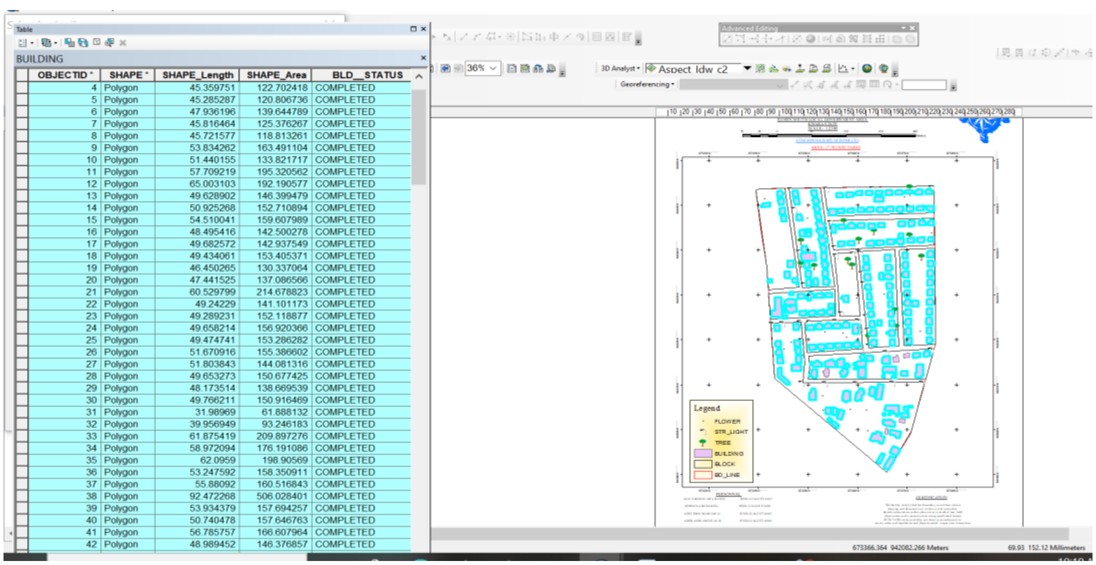
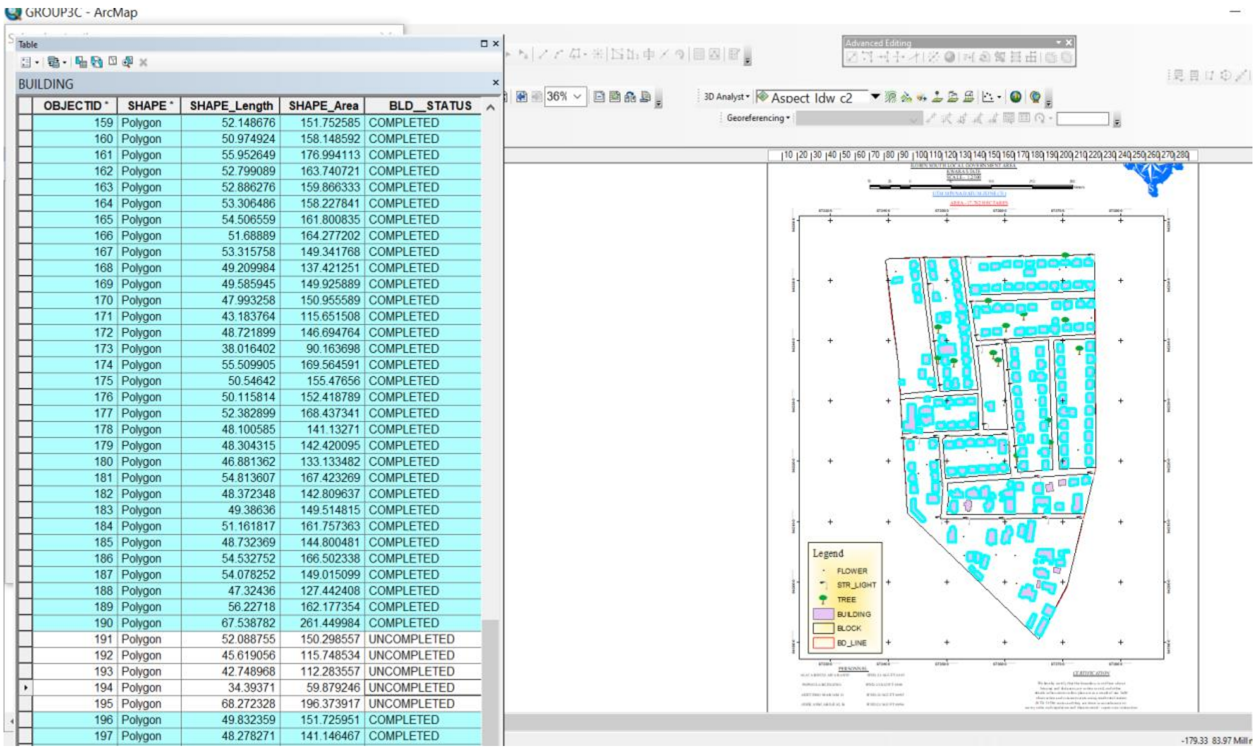
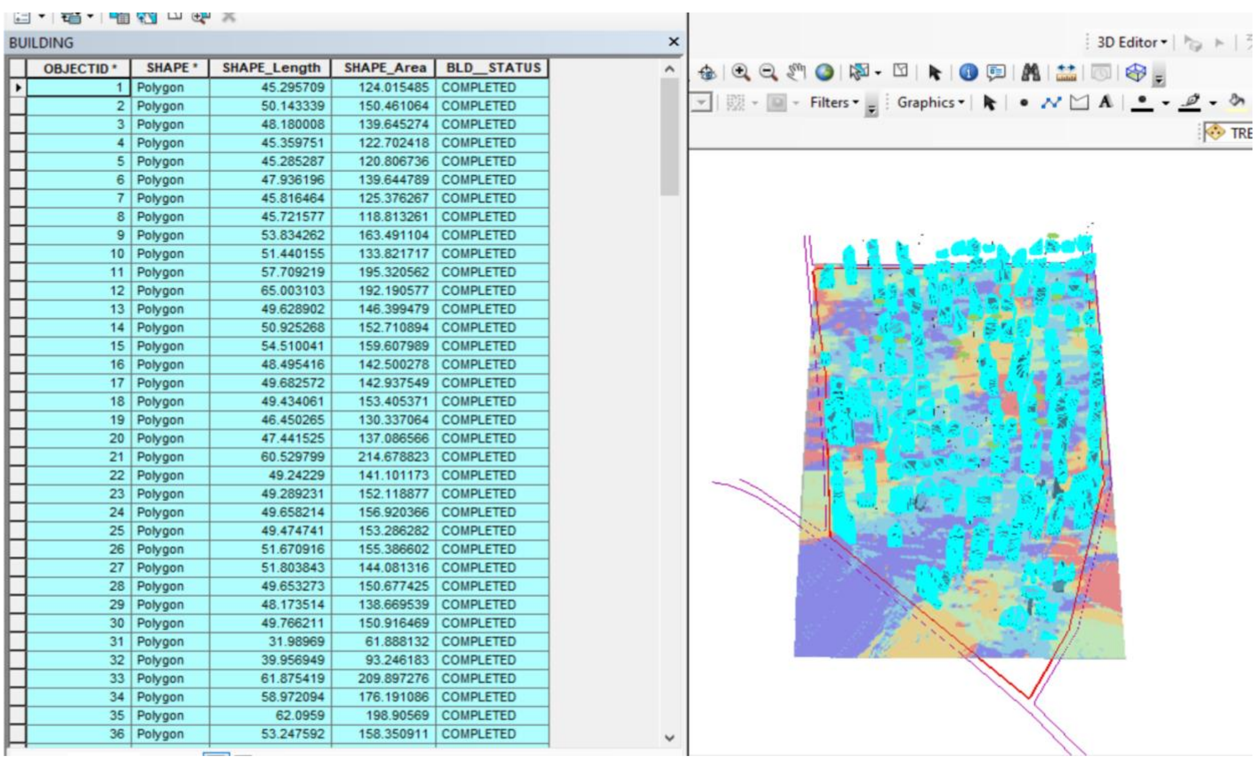


Fig 4.1: shows the completed building



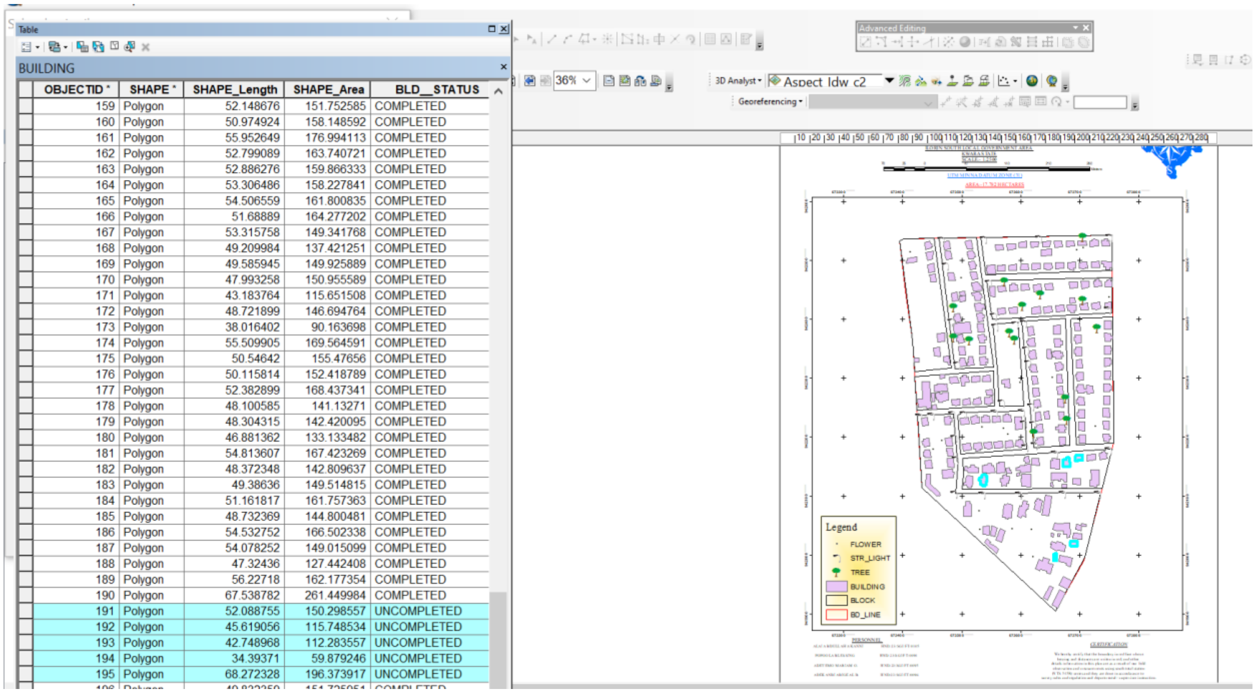
OBJECTID *	SHAPE *	SHAPE_Length	SHAPE_Area	BLD__STATUS
159	Polygon	52.148676	151.752585	COMPLETED
160	Polygon	50.974924	158.148592	COMPLETED
161	Polygon	55.952649	176.994113	COMPLETED
162	Polygon	52.799089	163.740721	COMPLETED
163	Polygon	52.886276	159.866333	COMPLETED
164	Polygon	53.306486	158.227841	COMPLETED
165	Polygon	54.506559	161.800835	COMPLETED
166	Polygon	51.68889	164.277202	COMPLETED
167	Polygon	53.315758	149.341768	COMPLETED
168	Polygon	49.209984	137.421251	COMPLETED
169	Polygon	49.585945	149.925889	COMPLETED
170	Polygon	47.993258	150.955589	COMPLETED
171	Polygon	43.183764	115.651508	COMPLETED
172	Polygon	48.721899	146.694764	COMPLETED
173	Polygon	38.016402	90.163698	COMPLETED
174	Polygon	55.509905	169.564591	COMPLETED
175	Polygon	50.54642	155.47656	COMPLETED
176	Polygon	50.115814	152.418789	COMPLETED
177	Polygon	52.382899	168.437341	COMPLETED
178	Polygon	48.100585	141.13271	COMPLETED
179	Polygon	48.304315	142.420095	COMPLETED
180	Polygon	46.881362	133.133482	COMPLETED
181	Polygon	54.813607	167.423269	COMPLETED
182	Polygon	48.372348	142.809637	COMPLETED
183	Polygon	49.38636	149.514815	COMPLETED
184	Polygon	51.161817	161.757363	COMPLETED
185	Polygon	48.732369	144.800481	COMPLETED
186	Polygon	54.532752	166.502338	COMPLETED
187	Polygon	54.078252	149.015099	COMPLETED
188	Polygon	47.32436	127.442408	COMPLETED
189	Polygon	56.22718	162.177354	COMPLETED
190	Polygon	67.538782	261.449984	COMPLETED
191	Polygon	52.088755	150.298557	UNCOMPLETED
192	Polygon	45.619056	115.748534	UNCOMPLETED
193	Polygon	42.748968	112.283557	UNCOMPLETED
194	Polygon	34.39371	59.879246	UNCOMPLETED
195	Polygon	68.272328	196.373917	UNCOMPLETED
196	Polygon	49.832359	151.725951	COMPLETED
197	Polygon	48.278271	141.146467	COMPLETED

Fig 4.2: shows the 2D completed building



OBJECTID *	SHAPE *	SHAPE_Length	SHAPE_Area	BLD__STATUS
1	Polygon	45.295709	124.015485	COMPLETED
2	Polygon	50.143339	150.461064	COMPLETED
3	Polygon	48.180008	139.645274	COMPLETED
4	Polygon	45.359751	122.702418	COMPLETED
5	Polygon	45.285287	120.806736	COMPLETED
6	Polygon	47.936196	139.644789	COMPLETED
7	Polygon	45.816464	125.376267	COMPLETED
8	Polygon	45.721577	118.813261	COMPLETED
9	Polygon	53.834262	163.491104	COMPLETED
10	Polygon	51.440155	133.821717	COMPLETED
11	Polygon	57.709219	195.320562	COMPLETED
12	Polygon	65.003103	192.190577	COMPLETED
13	Polygon	49.628902	146.399479	COMPLETED
14	Polygon	50.925268	152.710894	COMPLETED
15	Polygon	54.510041	159.607989	COMPLETED
16	Polygon	48.495416	142.500278	COMPLETED
17	Polygon	49.682572	142.937549	COMPLETED
18	Polygon	49.434061	153.405371	COMPLETED
19	Polygon	46.450265	130.337064	COMPLETED
20	Polygon	47.441525	137.086566	COMPLETED
21	Polygon	60.529799	214.678823	COMPLETED
22	Polygon	49.24229	141.101173	COMPLETED
23	Polygon	49.289231	152.118877	COMPLETED
24	Polygon	49.658214	156.920366	COMPLETED
25	Polygon	49.474741	153.286282	COMPLETED
26	Polygon	51.670916	155.386602	COMPLETED
27	Polygon	51.803843	144.081316	COMPLETED
28	Polygon	49.653273	150.677425	COMPLETED
29	Polygon	48.173514	138.669539	COMPLETED
30	Polygon	49.766211	150.916469	COMPLETED
31	Polygon	31.98969	61.888132	COMPLETED
32	Polygon	39.956949	93.246183	COMPLETED
33	Polygon	61.875419	209.897276	COMPLETED
34	Polygon	58.972094	176.191086	COMPLETED
35	Polygon	62.0959	198.90569	COMPLETED
36	Polygon	53.247592	158.350911	COMPLETED

Figure 4.3 shows the 3D of completed building



BUILDING

OBJECTID *	SHAPE *	SHAPE_Length	SHAPE_Area	BLD__STATUS
159	Polygon	52.148676	151.752585	COMPLETED
160	Polygon	50.974924	158.148592	COMPLETED
161	Polygon	55.952649	176.994113	COMPLETED
162	Polygon	52.799089	163.740721	COMPLETED
163	Polygon	52.886276	159.866333	COMPLETED
164	Polygon	53.306486	158.227841	COMPLETED
165	Polygon	54.506559	161.800835	COMPLETED
166	Polygon	51.68889	164.277202	COMPLETED
167	Polygon	53.315758	149.341768	COMPLETED
168	Polygon	49.209984	137.421251	COMPLETED
169	Polygon	49.585945	149.925889	COMPLETED
170	Polygon	47.993258	150.955589	COMPLETED
171	Polygon	43.183764	115.651508	COMPLETED
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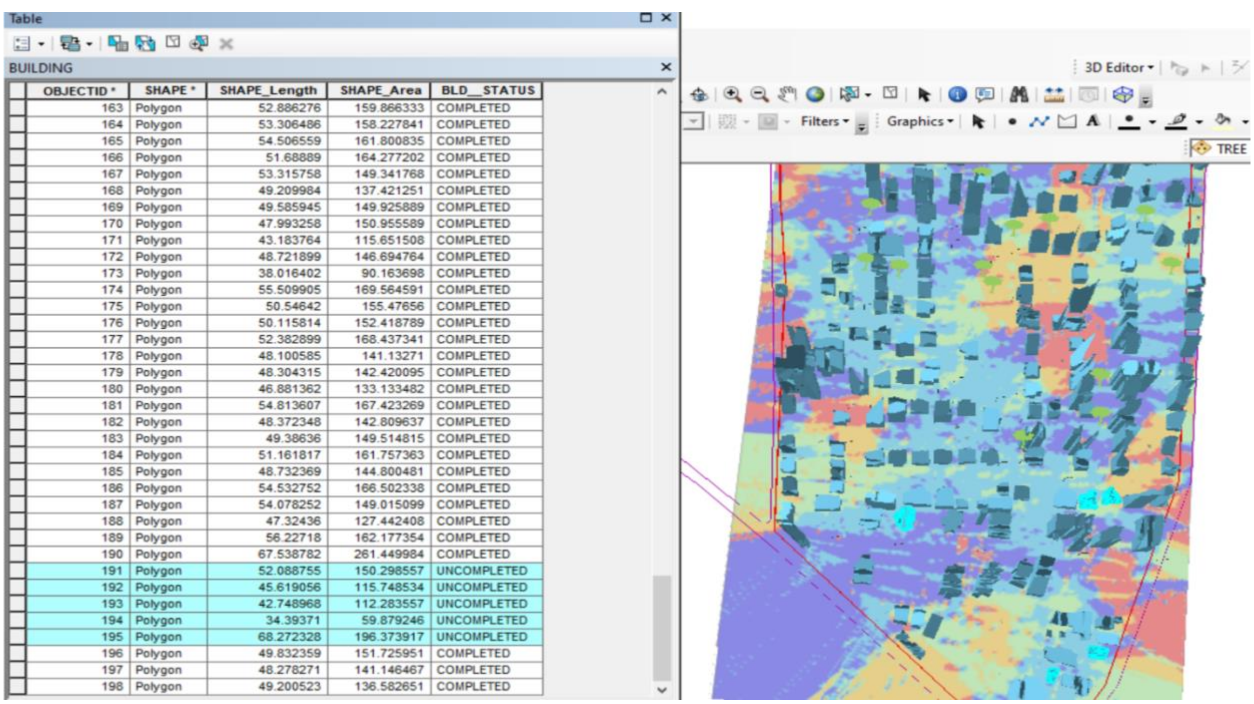
173	Polygon	38.016402	90.163698	COMPLETED
174	Polygon	55.509905	169.564591	COMPLETED
175	Polygon	50.54642	155.47656	COMPLETED
176	Polygon	50.115814	152.418789	COMPLETED
177	Polygon	52.382899	168.437341	COMPLETED
178	Polygon	48.100585	141.13271	COMPLETED
179	Polygon	48.304315	142.420095	COMPLETED
180	Polygon	46.881362	133.133482	COMPLETED
181	Polygon	54.813607	167.423269	COMPLETED
182	Polygon	48.372348	142.809637	COMPLETED
183	Polygon	49.38636	149.514815	COMPLETED
184	Polygon	51.161817	161.757363	COMPLETED
185	Polygon	48.732369	144.800481	COMPLETED
186	Polygon	54.532752	166.502338	COMPLETED
187	Polygon	54.078252	149.015099	COMPLETED
188	Polygon	47.32436	127.442408	COMPLETED
189	Polygon	56.22718	162.177354	COMPLETED
190	Polygon	67.538782	261.449984	COMPLETED
191	Polygon	52.088755	150.298557	UNCOMPLETED
192	Polygon	45.619056	115.748534	UNCOMPLETED
193	Polygon	42.748968	112.283557	UNCOMPLETED
194	Polygon	34.39371	59.879246	UNCOMPLETED
195	Polygon	68.272328	196.373917	UNCOMPLETED

Fig 4.4 Query shows the 2D of uncompleted building



BUILDING

OBJECTID *	SHAPE *	SHAPE_Length	SHAPE_Area	BLD__STATUS
163	Polygon	52.886276	159.866333	COMPLETED
164	Polygon	53.306486	158.227841	COMPLETED
165	Polygon	54.506559	161.800835	COMPLETED
166	Polygon	51.68889	164.277202	COMPLETED
167	Polygon	53.315758	149.341768	COMPLETED
168	Polygon	49.209984	137.421251	COMPLETED
169	Polygon	49.585945	149.925889	COMPLETED
170	Polygon	47.993258	150.955589	COMPLETED
171	Polygon	43.183764	115.651508	COMPLETED
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193	Polygon	42.748968	112.283557	UNCOMPLETED
194	Polygon	34.39371	59.879246	UNCOMPLETED
195	Polygon	68.272328	196.373917	UNCOMPLETED
196	Polygon	49.832359	151.725951	COMPLETED
197	Polygon	48.278271	141.146467	COMPLETED
198	Polygon	49.200523	136.582651	COMPLETED

Figure 4.5 shows the 3D of uncomplted building

CHAPTER 5

5,0 SUMMARY, COSTING, PROBLEMS ENCOUNTERED, CONCLUSION AND RECOMMENDATIONS

5.1 SUMMARY

The aim of this project is to map out infrastructural facilities as they exist on polytechnic land with
the view of identifying their spatial location to solve geo-spatial problems in the area for proper physical planning and decision making. And to produce plan of part of Kwara State Polytechnic Ilorin, Ilorin, Kwara State.

This project dealt with the digital mapping of part of Kwara State Polytechnic Ilorin, Ilorin, Kwara State. The project involved the following survey operations such as reconnaissance (recce), perimeter traversing, detailing, and spot height. Processing of acquired data was done using softwares which includes: AutoCad, ArGIS, Microsoft excel, Microsoft word, Notepad, and spss. The various task involves in the process includes: Plotting, database creation, Graphical and numerical representation.

Producing the plan to a suitable scale showing the demarcated boundary and details within the project area and finally report written was made.

5.2 COSTING

Costing is act of estimating or assessing how much money is to be charged as professional fee for
survey serves.

5.2.1 CONCEPT OF COSTING

- Earn reasonably
- Perform their duties effectively
- Maintain a high standard of professionalism
- Embrace containing professional development

5.2.1.1 PROJECT COSTING

This is the total fund needed to complete the project or work that consist of a direct or indirect cost which is an expenditure made or estimated to be made or monetary obligations incurred or estimated to be incurred to complete the project which are listed in the project baseline.

5.2.1.2 REASONS FOR COSTING

The information issued by a costing system is used by management for a variety of purposes, including:

- Fine-tuning operations to generate higher profitability
- Deciding where to cut costs in the event of a business downturn
- Matching actual costs incurred against budgeted cost levels for control purposes
- Creating strategic and tactical plans for future operations.

5.2.2 METHOD OF COSTING

5.2.2.1 CONSULTANCY FEE: This allows surveyors to charge consultancy fees as a percentage of cost of the land or project.

5.2.2.2 DIRECT FIELD COST: This allows surveyors to charge for the cost of the survey work, in addition to the consultancy. It includes cost for:

- Personnel
- Equipment
- Transportation
- Beacons

For this project, direct cost was adopted.

Features of the surveyor's scale of fees the correct scale of fees for surveyors is the one updated by the Nigeria Institute of Surveyors in 2006. It is based on the Federal Government approved scale of fees for consultants in the industry, updated for inflation.

The costing of this project was done using the Nigeria Institution of Surveyors (NIS) professional scale of fees for Consultant in the construction industry. The project component and their direct costs were as follows.

RECONNAISSANCE

S/N	PERSONNEL	QTY	DAILY RATE	NO OF DAYS	REMARK
1	Group leader	1	5,000	1	5,000
2	Ass group leader	1	2,500	1	2,500
3	Basic equipment	1	25,000	1	25,000
4	Transportation	1	3,000	1	3,000
	TOTAL				35,500

MONUMENTATION

S/N	PERSONNEL	QTY	DAILY RATE	NO OF DAYS	REMARK
1	Group leader	1	5,000	1	5,000
2	Ass group leader	1	2,500	1	2,500
4	Basic equipment	1	25,000	1	25,000
5	Transportation	1	7,500	1	3,000
	TOTAL				35,500

TRAVERSE AND DETAILING

S/N	PERSONNEL	QTY	DAILY RATE	NO OF DAYS	REMARK
1	Group leader	1	5,000	5	25,000
2	Ass group leader	1	2,500	5	12,500
4	Transportation	1	3,000	5	15,000
	Basic Equipment	1	25,000	5	125,000
	TOTAL				177,500

DATA EDITING AND PROCESSING

S/N	PERSONNEL	QTY	DAILY RATE	NO OF DAYS	REMARK
1	Surveyor	1	10,000	7	70,000
2	Group leader	1	5,000	7	35,000
3	Ass group leader	1	2,500	7	17,500
4	Standard set		15,000	7	105,000
5	Computer accessories	1	10,000	7	70,000
	TOTAL				297,500

PLAN AND MAP PRODUCTION

S/N	PERSONNEL	QTY	DAILY RATE	NO OF DAYS	REMARK
1	Supervisor	1	10,000	2	20,000
2	Group leader	1	5,000	2	10,000
3	Ass group leader	1	2,500	2	5,000
5	Standard Set		10,000	3	30,000
6	Computer Accessories	1	25,000	3	75,000
	TOTAL				140,000

TECHNICAL REPORT

S/N	PERSONNEL	QTY	DAILY RATE	NO OF DAYS	REMARK
1	Group leader	1	10,000	1	10,000
2	Ass group leader	1	5,000	1	5,000
3	Computer	1	15,000	1	15,000
4	Generator and fuel	1	10,000	1	10,000
5	Consumables		10,000	1	10,000
	TOTAL				50,000

Sum total = **736,000.00**

$$\textbf{Contingency allowance} = \frac{736{,}000.00 \times 5}{100} = 36{,}800$$

$$\textbf{VAT} = \frac{736{,}000.00 \times 7.5}{100} = 55{,}200$$

$$\textbf{MOB/DEMB} = \frac{736{,}000.00 \times 10}{100} = 73{,}600$$

SUMMARY OF THE COST RATE

ITEM	PROJECT QUANTITY	UNIT RATE (N)
1	Reconnaissance	35,500
2	Monumentation	35,500
3	Traverse and detailing	177,500
4	Data editing and processing	297,500
5	Plan and map production	140,000
6	Technical report	50,000
7	Contingency 5%	36,800
8	VAT 7.5%	55,300
9	Mobilization/Demobilization 10%	73,600
	TOTAL	901,700

TABLE 5.1 COST IMPLICATION OF THE DIGITAL MAPPING OF ROYAL VALLEY ESTATE

5.3 PROBLEMS ENCOUNTERED

The following are the problems encountered:

- Atmospheric condition which leads to rainfall and causes disturbance. This add to the numbers of days spent on the project site.
- No provision of survey equipment from the department which cost much human effort and money.
- Disturbance from the domestic animal (dog).
- Disturbance from bees.
- Due to the time spent each day which is long, this cause run down of battery used at the master.

5.4 RECOMMENDATIONS

I would like to recommend that

I. The field project topics should be provided to the students long before they begin their project so that they can have enough time for research.

II. The school authority should provide adequate and sufficient instrument for the execution of the project.

III. There is need for GIS laboratory where data can be stored, retrieved for proper maintenance and management of infrastructural facilities for any future use.

5.5 CONCLUSION

Digital mapping of the project was analyzed in this report using the advanced trends in technology and the need for spatial information in digital format, the acquisition and management of topographic information is a basic necessity. The use of automated equipment and GIS applications have become an veritable tool to be used by all and sundry if the needed for high accuracy spatial information system must be provided for spatial decision making. This will in turn aid physical and economic development; hence sustainability of the landscape in question and the environment at large is ascertained and for future decision making.

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APPENDIX 1

ID	EASTINGS	NORTHINGS
B1	666472	937402.5
B2	666484.9	937400.9
B3	666483.2	937390.2
B4	666470	937391.8
B5	666488.5	937412
B6	666516	937406.7
B7	666514.7	937395
B8	666486.5	937399.9
B9	666493.4	937431.3
B10	666505.4	937428.8
B11	666501.4	937411.7
B12	666489	937414.4
B13	666502.4	937464.7
B14	666512.1	937462.9
B15	666505.4	937428.8
B16	666495.4	937431.5
B17	666496.1	937473.4
B18	666501.2	937472.2
B19	666499.9	937465.1
B20	666494.2	937467
B21	666502.1	937480.3
B22	666555	937468.8
B23	666553.3	937459.1
B24	666501	937470.5
B25	666556	937468.2
B26	666563.7	937466.8
B27	666560.9	937455.8
B28	666553.1	937457.4

B29	666536.1	937394
B30	666550.7	937457.5
B31	666563.2	937454.9
B32	666548.6	937390.6
B33	666520.1	937405.8
B34	666536.3	937403.6
B35	666534.7	937393.3
B36	666516.3	937395.6
B37	666516.6	937401.6
B38	666519.4	937401.4
B39	666512.5	937495.1
B40	666559	937484.2
B41	666556.4	937472
B42	666509.4	937484.4
B43	666508.3	937512.3
B44	666546	937503.8
B45	666541.7	937489.7
B46	666505.1	937499.1
B47	666512.5	937530.7
B48	666550.1	937522.3
B49	666546	937506.4
B50	666508.8	937514.8
B51	666552.2	937521.6
B52	666564	937518.3
B53	666556.3	937489.5
B54	666545.2	937493.2
B55	666566.8	937517.6
B56	666577.2	937515
B57	666569.7	937485.5
B58	666559.1	937489.6
B59	666574.3	937526

B60	666604	937520
B61	666601.9	937508.7
B62	666572.4	937516.2
B63	666612.9	937520.2
B64	666617.9	937519.7
B65	666617.2	937510.3
B66	666611.8	937511.1
B67	666612.3	937503
B68	666617	937502.6
B69	666615.9	937491.5
B70	666611.5	937492
B71	666470.8	937486.2
B72	666474.4	937486.1
B73	666474.1	937481.5
B74	666470.7	937481.7
B75	666473.3	937500.4
B76	666476.9	937500.3
B77	666476.9	937497.6
B78	666473	937497.8
B79	666472.1	937517.6
B80	666476.4	937517.2
B81	666475.8	937510.8
B82	666471.9	937511.4
B83	666472.7	937535
B84	666478.9	937534.7
B85	666478.1	937526.2
B86	666472.2	937526.3
B87	666479.4	937539.6
B88	666485.9	937539.1
B89	666485.9	937535.6
B90	666479.2	937536.3

B91	666495	937536.2
B92	666508	937534
B93	666505.6	937519.6
B94	666492.6	937522.1
PL1	666472.2	937540.7
PL2	666618.3	937521.3
PL3	666607.4	937371.4
PL4	666468.4	937392
RD 1	666651	937536.1
RD2	666470.5	937557.3
RD3	666469.8	937584.6
RD 4	666651.8	937521.6
RD 5	666469.2	937545.7
RD 6	666463.1	937332.5
RD 7	666445.1	937341.2
RD 8	666452.1	937584.6
RD 9	666464.5	937381.6
RD 10	666609.9	937359.6
RD 11	666464.5	937381.6
RD 12	666609.9	937359.6
RD 13	666624.2	937525.6
RD 14	666608.8	937346.4
RD 15	666637.5	937523.5
RD 16	666619.4	937345.5

APPENDIX 2

X	Y	Z
1. 673600.438	941983.025	276.220
2. 673637.669	941983.025	277.121
3. 673674.900	941983.025	278.747
4. 673525.976	942042.384	278.114
5. 673563.207	942042.384	278.710
6. 673600.438	942042.384	278.979
7. 673637.669	942042.384	278.763
8. 673674.900	942042.384	280.876
9. 673712.131	942042.384	283.762
10. 673451.515	942101.744	266.618
11. 673488.745	942101.744	269.367
12. 673525.976	942101.744	273.829
13. 673563.207	942101.744	277.300
14. 673600.438	942101.744	278.296
15. 673637.669	942101.744	279.061
16. 673674.900	942101.744	282.202
17. 673712.131	942101.744	282.125
18. 673451.515	942161.103	268.553
19. 673488.745	942161.103	269.884
20. 673525.976	942161.103	271.088
21. 673563.207	942161.103	274.072
22. 673600.438	942161.103	276.247
23. 673637.669	942161.103	278.609
24. 673674.900	942161.103	281.156
25. 673712.131	942161.103	281.510
26. 673749.362	942161.103	281.406
27. 673451.515	942220.463	272.935
28. 673488.745	942220.463	272.234

29. 673525.976	942220.463	272.351
30. 673563.207	942220.463	274.732
31. 673600.438	942220.463	277.163
32. 673637.669	942220.463	278.960
33. 673674.900	942220.463	281.069
34. 673712.131	942220.463	281.847
35. 673749.362	942220.463	280.344
36. 673451.515	942279.822	269.658
37. 673488.745	942279.822	271.526
38. 673525.976	942279.822	273.285
39. 673563.207	942279.822	274.836
40. 673600.438	942279.822	277.669
41. 673637.669	942279.822	279.143
42. 673674.900	942279.822	278.853
43. 673712.131	942279.822	280.052
44. 673749.362	942279.822	282.081
45. 673451.515	942339.181	269.774
46. 673488.745	942339.181	272.749
47. 673525.976	942339.181	274.613
48. 673563.207	942339.181	277.079
49. 673600.438	942339.181	277.257
50. 673637.669	942339.181	276.780
51. 673674.900	942339.181	276.112
52. 673712.131	942339.181	277.247
53. 673749.362	942339.181	280.669
54. 673414.284	942398.541	268.295
55. 673451.515	942398.541	56. 271.799
57. 673488.745	942398.541	58. 273.377
59. 673525.976	942398.541	275.910
60. 673563.207	942398.541	278.784

61. 673600.438	942398.541	278.851
62. 673637.669	942398.541	278.010
63. 673674.900	942398.541	276.922
64. 673712.131	942398.541	278.194
65. 673749.362	942398.541	279.940
66. 673414.284	942457.900	267.983
67. 673451.515	942457.900	268.641
68. 673488.745	942457.900	271.766
69. 673525.976	942457.900	272.732
70. 673563.207	942457.900	276.328
71. 673600.438	942457.900	279.393
72. 673637.669	942457.900	279.382
73. 673674.900	942457.900	278.970
74. 673712.131	942457.900	279.948
75. 673749.362	942457.900	282.942
76. 673414.284	942517.260	268.275
77. 673451.515	942517.260	268.192
78. 673488.745	942517.260	271.061
79. 673525.976	942517.260	273.349
80. 673563.207	942517.260	273.776
81. 673600.438	942517.260	277.162
82. 673637.669	942517.260	279.188
83. 673674.900	942517.260	278.834
84. 673712.131	942517.260	280.717
85. 673749.362	942517.260	282.616