PRJECT REPORT

ON

DIGITAL MAPPING OF INFRASTRUCTURAL FACILITIES OF PART OF ROYAL VALLEY ESTATE

AT KULENDE / AKEREBIATA ROAD, SANGO, ILORIN

ILORIN EAST LOCAL GOVERNMENT AREA

KWARA STATE

BY

ALAI ABDULLAH AKANNI

HND/23/SGI/FT/0105

SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF HIGHER NATIONAL DIPLOMA IN SURVEYING AND GEO-INFORMATICS TO THE DEPARTMENT OF SURVEYING AND GEO-INFORMATICS, KWARA STATE POLYTECHNIC ILORIN, KWARA STATE

JUNE, 2025

CERTIFICATE

I hereby certify that the information contained in this project report was obtained as a result of the observations and measurements made by me on the field and that the survey was done in accordance with survey rules, regulations, and departmental instructions.

ALAI ABDULLAH AKANNI	**HND/23/SGI/FT/0105**
NAME OF STUDENT	**MATRIC NUMBER**

CERTIFICATION

This is to certify that **ALAI ABDULLAH AKANNI** with matriculation Number **HND/23/SGI/FT/0105** has satisfactory carried out the survey duties contained in this project report under our direct supervision.

I hereby declare that He had conducted himself with due diligence, and honest on the project.

SURV. R.S. AWOLEYE
Project Supervisor

DATE

MR. A. I. ISSAU
Head of Department

DATE

………………………………………………….
Official Stamp

DEDICATION

This project is dedicated to Almighty God who has been there right from the beginning to this very point. Special dedication also to my ever supportive parents, **MR / MRS ALAI,** for their relentless support and compassion towards me and during the course of my study.

AKNOWLEDGEMENTS

The dream of becoming an achiever in life comes true, not only by one’s fortitude and hard work based on his knowledge, but it is also involving the positive influence of various factors and ideas of some people in the community.

First and foremost, all glory, honor and adoration is to Almighty God. I appreciate God for his grace upon my life, for keeping me safe since my advent in this school and most especially, during the execution of this project.

I sincerely wish to express my affectionate gratitude to my lovely and caring parent **MR&MRS. ALAI** whose toils and struggles have helped a lot in transforming my life for better may Almighty God grant them long life to enable her reap the fruits of their labor.

My next gratitude goes to my supervisor, **SURV. R.S. AWOLEYE** for his useful guidance, understanding, patience, and professional advice during the execution of this project that led to the successful completion of the exercise. I pray that God will continue to bless you (Amen). More so, my appreciation goes to my able HOD **MR. ISSAU** and other lecturers in the Department of Surveying and Geo-informatics most especially **SURV. BABATUNDE KABBIR AND SURV BELLO DIRAN FELIX** God bless you all (Amen).

More so, I seize this opportunity in acknowledging the efforts and contribution of my boss **SURV KAREM, MR SULAIMAN TIAMIYU** & **MADAM OLUWAYEMISI OLUWABUKOLA BECKLY** also known as (**YSJ LIMITED**) for their support morally, financially and for the impartation of knowledge in me that pertains to surveying and farming profession.

Finally, I thanks my family and friends like **UMU MARIAM, UMU HAJARA, ADETAYO ABDULRAHMAN (DEYINDE), ENITAN OLUWASEGUN (GENERAL), ABDULMUHEEZ OLADITI (ABYEM), AHMED TOYYIB(ZUGLOOL), ABDULAKEEM HAMID(ASWAD), IDOWU HABEEB (OGA), NAFISAT OPEYEMI (PHEENARH), POPOOLA BLESSING,** and all my classmates for their support, advice and encouragement and understanding throughout this journey, love I really appreciate you all.

My heartfelt thanks also go to all my group members for their cooperation and understanding during the project, I pray that we will never fail in our life (AMEN).

ABSTRACT

This paper shows a detailed methodology for creating 2D and 3D visual facility map of the campus. The purpose of this study work is to develop an interactive interface containing the 2 and 3-Dimensional features of all the facilities within the Royal Valley Estate. The spatial attributes of the facilities were collected with the aid of total stations. The most recent Google earth software was used as source of data to produce 2-dimensional facilities of the study area through digitization process. SRTM Digital elevation model image was downloaded from United State Geological Survey website to give the elevation data required for the 3-dimensional representation. All these data were processed with ArcGIS 10.2.1.

Table of Contents

CHAPTERONE

1.0 INTRODUCTION

In today's rapidly evolving technological landscape, digital mapping has emerged as a crucial tool for managing and maintaining infrastructural facilities. Digital mapping refers to the process of creating computer-based representations of geographical and structural features, allowing for efficient planning, monitoring, and management of infrastructure such as roads, bridges, water supply networks, electrical grids, and public buildings. R Rathnayake - 2020 - researchgate.net

This technology leverages Geographic Information Systems (GIS), remote sensing, and real-time data collection to provide accurate and up-to-date visualizations of infrastructure. Digital maps enable governments, engineers, and urban planners to optimize resource allocation, enhance decision-making, and improve the resilience of essential services.

With the integration of artificial intelligence (AI) and the Internet of Things (IoT), digital mapping can now incorporate real-time monitoring, predictive maintenance, and automated updates. This not only reduces operational costs but also minimizes risks associated with infrastructure failures.

In summary, digital mapping of infrastructural facilities is transforming the way societies plan and maintain essential services, ensuring sustainability, efficiency, and enhanced public safety.

1.1 BACKGROUND TO THE STUDY

The rapid expansion of urbanization and the increasing complexity of infrastructural systems have necessitated the adoption of advanced technologies for efficient planning, monitoring, and management. Traditional methods of mapping and managing infrastructure, such as paper-based records and manual inspections, have proven to be time-consuming, costly, and prone to errors. Consequently, the demand for digital solutions has grown significantly.

Digital mapping of infrastructural facilities has emerged as a transformative approach to address these challenges. It integrates Geographic Information Systems (GIS), remote sensing, and real-time data analytics to create accurate, interactive, and easily accessible representations of physical assets. These digital maps help governments, urban planners, and engineers visualize infrastructure networks, assess their condition, and plan for future expansions or maintenance.

The evolution of technologies such as satellite imaging, drones, artificial intelligence (AI), and the Internet of Things (IoT) has further enhanced the capabilities of digital mapping. These advancements enable real-time monitoring of infrastructure, predictive maintenance, and automated updates, leading to improved efficiency and sustainability.

As cities and rural areas continue to develop, digital mapping provides a crucial tool for ensuring that infrastructural facilities remain functional, resilient, and adaptable to changing demands. By leveraging digital mapping, stakeholders can make informed decisions, optimize resource allocation, and enhance service delivery, ultimately improving the quality of life for communities.

The management and maintenance of infrastructural facilities are critical for the socio-economic development of any nation. Infrastructure such as roads, bridges, water supply systems, electricity networks, and telecommunication facilities form the backbone of modern society. However, the traditional methods of managing these assets have often been inefficient, leading to poor service delivery, high maintenance costs, and frequent failures.

Historically, infrastructure mapping relied on paper-based records, manual surveys, and static geographic representations, which were often outdated and difficult to update. These methods made it challenging to monitor changes, predict failures, or plan for expansions effectively. As urban populations grow and infrastructure becomes more complex, the need for a more efficient, accurate, and dynamic mapping system has become evident.

The emergence of digital mapping technology has revolutionized the way infrastructure is managed. Digital mapping integrates Geographic Information Systems (GIS), remote sensing, Global Positioning Systems (GPS), and advanced data analytics to provide real-time, interactive, and highly detailed representations of infrastructural assets. This technology allows for better planning, monitoring, and decision-making in urban and rural development.

Furthermore, the integration of Artificial Intelligence (AI) and the Internet of Things (IoT) has significantly improved digital mapping capabilities. AI-powered predictive analytics can anticipate infrastructure failures before they occur, enabling proactive maintenance. IoT devices, such as smart sensors, can provide continuous updates on the status of facilities, reducing downtime and improving efficiency.

Governments, urban planners, and private organizations are increasingly adopting digital mapping as a strategic tool for infrastructure development. The technology is being used to optimize transportation networks, monitor environmental changes, enhance emergency response systems, and improve public utilities management.

As global challenges such as climate change, population growth, and urbanization continue to put pressure on infrastructure, digital mapping provides a sustainable solution for improving resilience and adaptability. This study explores the significance of digital mapping in infrastructural development, its benefits, and the challenges associated with its implementation.

Infrastructure plays a fundamental role in economic growth, social well-being, and overall national development. Roads, bridges, water supply systems, power grids, telecommunications networks, and other critical facilities support modern societies by ensuring seamless connectivity, resource distribution, and service delivery. However, managing these infrastructural facilities has long been a challenge, especially with increasing urbanization, aging infrastructure, and the growing demand for sustainable development.

Traditionally, infrastructural facilities have been monitored and maintained using manual inspections, paper-based records, and static maps. These conventional methods often result in inefficiencies such as outdated data, lack of real-time monitoring, difficulty in planning upgrades, and delays in responding to failures. The limitations of these traditional approaches have highlighted the need for more advanced and automated systems for mapping and managing infrastructure.

Emergence of Digital Mapping Technology

Digital mapping technology has emerged as a solution to these challenges by providing accurate, interactive, and real-time representations of infrastructural assets. This technology leverages Geographic Information Systems (GIS), Global Positioning Systems (GPS), satellite imagery, drones, and remote sensing to create detailed digital maps that can be easily updated and accessed. By integrating digital mapping into infrastructure management, stakeholders can enhance decision-making, improve maintenance efficiency, and optimize resource allocation.

The evolution of digital mapping has been further enhanced by the integration of Artificial Intelligence (AI) and the Internet of Things (IoT). AI-powered analytics can predict infrastructure failures, allowing for proactive maintenance and reducing costly repairs. IoT-enabled smart sensors can continuously monitor the status of infrastructural facilities, providing real-time updates on their condition. These advancements make digital mapping a powerful tool for governments, urban planners, engineers, and utility providers in managing and maintaining infrastructure efficiently.

Growing Importance in Urban and Rural Development

As cities expand and rural areas seek improved infrastructure, digital mapping has become essential for sustainable development. Urban planners use digital maps to design smart cities, optimize traffic flow, and monitor environmental changes. Rural development programs leverage digital mapping to expand access to clean water, electricity, and transportation networks. In disaster-prone areas, digital mapping aids in emergency preparedness, helping authorities identify vulnerable infrastructure and plan effective response strategies.

Challenges in Implementing Digital Mapping

Despite its numerous benefits, the adoption of digital mapping technology faces several challenges. High implementation costs, the need for skilled personnel, data security concerns, and technical complexities can hinder widespread adoption. Additionally, integrating digital mapping with existing infrastructure management systems requires careful planning and investment.

1.2 STATEMENT OF PROBLEM

Due to the challenge faced by governments, urban planners, and utility providers worldwide. Traditional methods of infrastructure mapping and monitoring, which rely on manual inspections, paper-based records, and static maps, have proven to be inefficient, time-consuming, and prone to inaccuracies. These outdated approaches often lead to poor decision-making, delays in maintenance, and increased operational costs, ultimately affecting service delivery and public safety. This study seeks to address these issues by exploring the role of digital mapping in infrastructure management, identifying its benefits and challenges, and providing recommendations for its effective implementation.

1.3 AIM AND OBJECTIVES

1.3.1Aim:

The study aims to determine how digital mapping can enhance decision-making, optimize resource allocation, and improve the long-term sustainability of infrastructural facilities of ROYAL VALLEY ESTATE.

1.3.2 OBJECTIVES:

The following objectives were considered in order to accomplish the above aim:

1 Project planning which include office planning and field reconnaissance

2 Monumentation

3 Data acquisition (geometric data with TOTAL STATION, Social survey through oral interview and pillar description inclusive).

4 Data processing: This include downloading and processing of data using appropriate software

5 Information presentation: It involved plotting of survey data on both soft copy and hard copy showing correct location of points.

1.4 SCOPE OF THE PROJECT

Based on the purpose and significance of this project, the scope includes;

1 Project planning

2 Station selection and Monumentation

3 Data Acquisition

4 Data downloading and Data processing

5 Data Analysis and information presentation.

1.5 PERSONEL

The under listed students of HND II 2024/2025 set are the personnel that participated in the execution of this project. They are: -

Table 1.1: Shows the group personnel involved in project

S/N	NAMES	MATRIC	REMARKS
1	ALAI ABDULLAH AKANNI	HND/23/SGI/FT/105	AUTHOR
2	POPOOLA BLESSING	HND/23/SGI/FT/094	MEMBER
3	ADEYEMO MARIAM O.	HND/23/SGI/FT/095	MEMBER
4	OGUNDEPO QUADRI O.	HND/23/SGI/FT/102	MEMBER
5	ADEKANBI ABIGEAL BIMBO	HND/23/SGI/FT/096	MEMBER
6	6. OKE TEMITOPE JOHN	HND/23/SGI/FT/103	MEMBER
7	ALADA TOLUWANI O.	HND/22/SGI/FT/0126	MEMBER
8	OLANREWAJU OLUWATOSIN D.	HND/22/SGI/FT/131	MEMBER

1.6 STUDY 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.

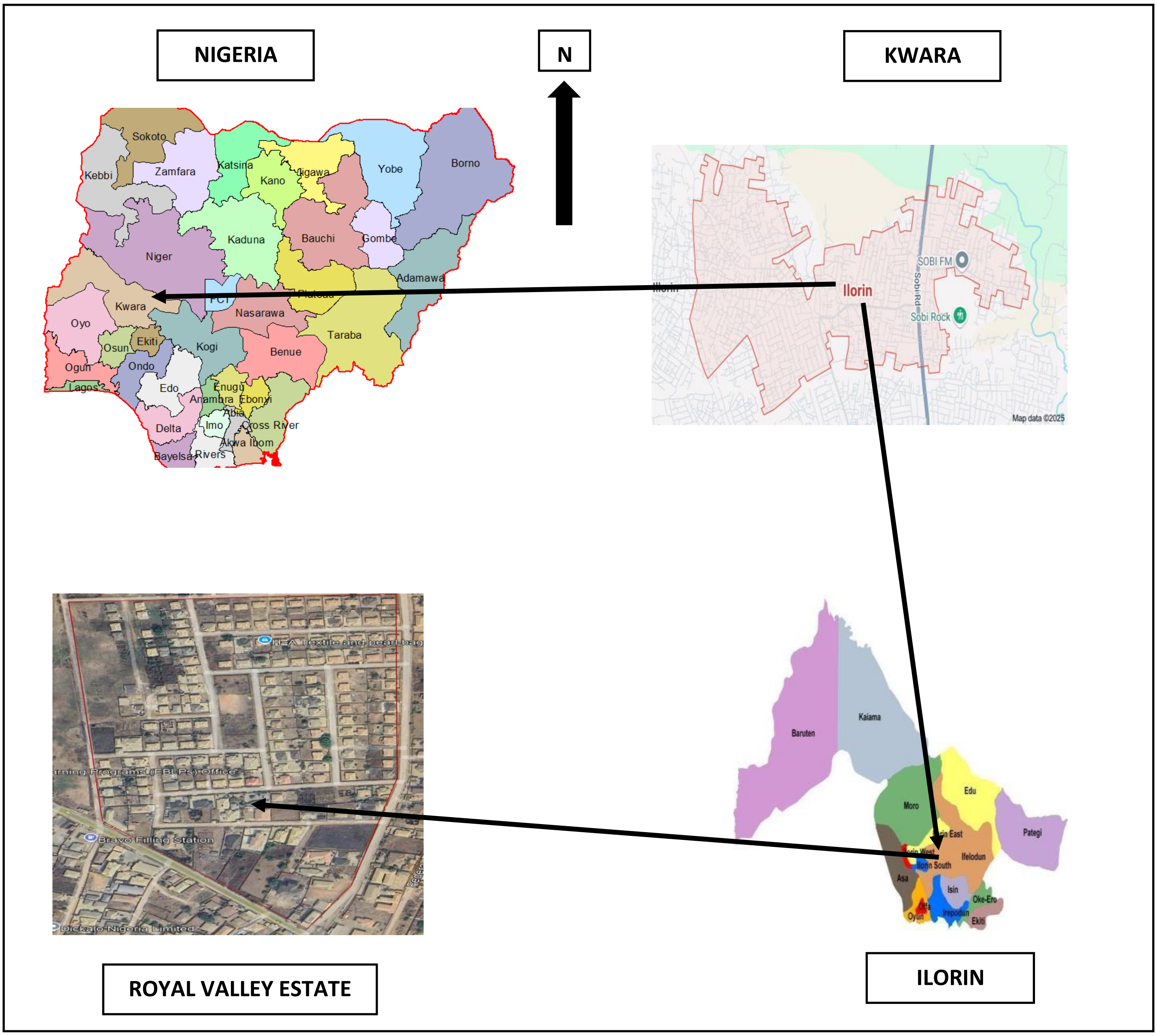


Figure 1.1: Map shows the study area of the project

1.7 SPECIFICATIONS

The project speciation were referenced to the speciation for land information system using total station which was sources from the Higher National Diploma. The specification includes the following:

i. Total station (YE00240)
ii. Minimum number of datum control required- three (3)
iii. Traverse should run between secondary or higher order control points.

CHAPTER TWO

2.0 LITERATURE REVIEW

The digital mapping of infrastructural facilities has gained significant attention in recent years due to its potential to improve planning, monitoring, and maintenance. This section reviews existing literature on digital mapping, its applications, benefits, challenges, and future prospects in infrastructure management.

2.1 Concept of Digital Mapping in Infrastructure Management

Digital mapping is the process of representing physical infrastructure using computerized systems, integrating data from sources such as Geographic Information Systems (GIS), remote sensing, and Global Positioning Systems (GPS). According to Goodchild (2020), digital mapping enhances spatial visualization and decision-making in urban planning and asset management. Traditional mapping methods, which rely on manual surveys and paper-based records, are increasingly being replaced by digital technologies that offer real-time and dynamic data visualization.

2.2 Applications of Digital Mapping in Infrastructure Management

Several studies have highlighted the diverse applications of digital mapping in different sectors of infrastructure:

2.2.1 Urban Planning and Transportation: Batty et al. (2019) emphasize that GIS-based digital mapping supports smart city development by optimizing road networks, traffic management, and public transport planning. Digital maps help city planners assess traffic flow, road conditions, and alternative routes to reduce congestion.

2.2.2 Water and Sanitation System's: Studies by Rajabifard et al. (2021) indicate that digital mapping is crucial in water resource management. By using remote sensing and GIS, water supply networks can be monitored for leaks, contamination, and maintenance needs.

2.2.3 Power and Energy Infrastructure: According to Zhang et al. (2022), GIS mapping is extensively used in electricity grid management to optimize power distribution, identify faults, and plan expansions in rural and urban areas.

2.2.4 Disaster Management and Emergency Response: Research by Cutter et al. (2018) highlights how digital mapping assists in disaster preparedness, response, and recovery. Digital maps provide real-time data on infrastructure conditions during natural disasters such as floods, earthquakes, and wildfires, enabling better coordination of emergency services.

2.3 Benefits of Digital Mapping in Infrastructure Development

The integration of digital mapping in infrastructure management provides multiple advantages, as noted by various scholars:

2.3.1 Improved Efficiency and Accuracy: Unlike traditional methods, digital mapping provides precise and real-time data, reducing errors in planning and maintenance (Goodchild, 2020).

2.3.2 Cost Reduction: Studies by Rajabifard et al. (2021) show that predictive maintenance using digital maps minimizes infrastructure failures, thus lowering repair costs and preventing service disruptions.

2.3.3 Enhanced Decision-Making: GIS-based maps allow stakeholders to analyze spatial data, assess risks, and make informed decisions regarding infrastructure projects (Batty et al., 2019).

2.3.4 Sustainability and Environmental Management: Digital mapping supports green infrastructure planning by identifying areas for renewable energy projects, monitoring deforestation, and tracking pollution levels (Zhang et al., 2022).

2.4 Challenges in Implementing Digital Mapping for Infrastructure

Despite its numerous advantages, digital mapping faces several challenges, as identified in the literature:

2.4.1 High Implementation Costs: Initial costs for acquiring mapping software, satellite data, and training personnel can be expensive (Rajabifard et al., 2021).

2.4.2 Technical Complexity: Successful implementation requires expertise in GIS, AI, and data analytics, which may not be readily available in developing countries (Zhang et al., 2022).

2.4.3 Data Security and Privacy Concerns: Research by Cutter et al. (2018) highlights that the digital storage of infrastructure data is vulnerable to cyber threats, requiring robust cybersecurity measures.

2.4.4 Integration with Existing Systems: Many infrastructure sectors still use traditional record-keeping methods, making the transition to digital mapping a challenge (Goodchild, 2020).

2.5 Future Prospects of Digital Mapping in Infrastructure Management

The future of digital mapping is promising, with emerging technologies enhancing its capabilities. Advances in Artificial Intelligence (AI) and the Internet of Things (IoT) are expected to improve real-time data collection and predictive analytics for infrastructure maintenance. Block chain technology could enhance data security in digital mapping systems, while drone and satellite imaging will further refine data accuracy (Zhang et al., 2022).

The role of digital mapping in infrastructure management has been extensively studied in recent years due to its impact on planning, monitoring, and maintenance. This section reviews relevant literature on the concept of digital mapping, its applications across various infrastructural sectors, its benefits, challenges, and the future outlook of its adoption.

2.6 Concept of Digital Mapping in Infrastructure Management

Digital mapping is the process of using technology to represent geographic and infrastructural features in an interactive, real-time format. This technology incorporates Geographic Information Systems (GIS), remote sensing, Global Positioning Systems (GPS), and Artificial Intelligence (AI) to create, store, analyze, and visualize spatial data (Goodchild, 2020).

According to Batty et al. (2019), traditional methods of infrastructure mapping—such as paper-based blueprints, manual surveys, and static maps—have limitations in accuracy, efficiency, and scalability. Digital mapping, by contrast, offers a dynamic, real-time approach that allows for continuous updates and enhanced decision-making. The integration of AI and the Internet of Things (IoT) further enhances digital mapping by enabling predictive maintenance and automated monitoring of infrastructure assets (Zhang et al., 2022).

2.7 Applications of Digital Mapping in Infrastructure Development

2.7.1 Urban Planning and Smart Cities

Digital mapping plays a crucial role in modern urban development. Batty et al. (2019) highlight that GIS-based mapping supports smart city initiatives by enabling efficient transportation planning, land-use management, and environmental monitoring. Through digital mapping, urban planners can visualize traffic patterns, identify congestion hotspots, and design more sustainable transportation networks.

2.7.2 Road and Transportation Infrastructure

Several studies emphasize the importance of digital mapping in road infrastructure planning and maintenance. According to Smith et al. (2021), GIS and drone technology can be used to monitor road conditions, identify damage, and schedule repairs more effectively. Additionally, digital mapping aids in the design and construction of new road networks by assessing topographical and environmental factors in real time.

2.7.3 Water Supply and Sanitation Systems

Research by Rajabifard et al. (2021) indicates that digital mapping is critical in managing water resources. GIS technology enables the tracking of underground pipelines, detection of leaks, and optimization of water distribution networks. Digital mapping also assists in predicting water demand patterns and improving sanitation infrastructure in growing urban areas.

2.7.4 Electricity and Power Infrastructure

In the energy sector, digital mapping enhances the management of power grids, as noted by Zhang et al. (2022). GIS-based mapping of electrical networks allows energy providers to detect faults, plan grid expansions, and integrate renewable energy sources. The use of AI-driven digital maps also facilitates predictive maintenance of power infrastructure, reducing outages and operational costs.

2.7.5 Disaster Management and Emergency Response

Cutter et al. (2018) emphasize the role of digital mapping in disaster preparedness and emergency response. GIS-based maps help authorities identify vulnerable infrastructure, map evacuation routes, and deploy emergency resources effectively. During natural disasters such as floods or earthquakes, digital mapping provides real-time updates on infrastructure conditions, enabling faster and more efficient response efforts.

2.8 Benefits of Digital Mapping in Infrastructure Management

The adoption of digital mapping in infrastructure planning and management offers numerous advantages:

2.8.1 Improved Accuracy and Real-Time Data: Unlike static maps, digital mapping provides up-to-date, accurate representations of infrastructure, reducing errors in planning and maintenance (Goodchild, 2020).

2.8.2 Cost Savings and Resource Optimization: Rajabifard et al. (2021) found that predictive maintenance using digital mapping minimizes infrastructure failures, thereby lowering repair costs and preventing service disruptions.

2.8.3 Enhanced Decision-Making and Planning: GIS-based data analysis helps stakeholders assess risks, optimize land use, and plan infrastructure expansion projects more efficiently (Batty et al., 2019).

2.8.4 Increased Sustainability and Environmental Protection: Digital mapping supports eco-friendly infrastructure development by identifying environmentally sensitive areas and optimizing resource use (Zhang et al., 2022).

2.9 Challenges in the Implementation of Digital Mapping

Despite its benefits, the adoption of digital mapping in infrastructure management faces several challenges:

2.9.1 High Implementation Costs

One of the biggest barriers to widespread adoption is the high initial cost of acquiring digital mapping software, remote sensing technologies, and skilled personnel (Rajabifard et al., 2021). Developing countries, in particular, may struggle to invest in the necessary infrastructure.

2.9.2 Technical Complexity and Skills Gap

The successful deployment of digital mapping requires expertise in GIS, AI, and big data analytics, which may not be readily available in all regions (Zhang et al., 2022). Training professionals to handle these technologies is a crucial but often overlooked aspect of implementation.

2.9.3 Data Security and Privacy Concerns

Cutter et al. (2018) highlight the risks associated with digital mapping, particularly in terms of cybersecurity. Storing infrastructure data digitally makes it vulnerable to hacking, data breaches, and unauthorized access. Governments and organizations must implement strong cybersecurity measures to protect sensitive information.

2.9.4 Integration with Existing Systems

Many infrastructure sectors still rely on outdated record-keeping methods, making the transition to digital mapping a complex process (Goodchild, 2020). Ensuring compatibility between traditional and modern systems requires careful planning and investment.

2.10 Future Prospects of Digital Mapping in Infrastructure Management

As technology advances, the role of digital mapping in infrastructure development is expected to grow. Several key trends will shape the future of digital mapping:

2.10.1 Artificial Intelligence (AI) and Machine Learning (ML): AI-driven digital mapping will improve predictive analytics for infrastructure maintenance, helping detect faults before they lead to failures (Zhang et al., 2022).

2.10.2 Internet of Things (IoT) Integration: IoT-enabled sensors will provide real-time data on infrastructure conditions, allowing for automated monitoring and early warning systems (Rajabifard et al., 2021).

2.10.3 Blockchain for Data Security: Blockchain technology could enhance the security of digital mapping systems by providing tamper-proof records of infrastructure data (Smith et al., 2021).

2.10.4 Drone and Satellite Imaging: Advances in drone and satellite technology will enhance the accuracy of digital maps, particularly in hard-to-reach or rapidly changing environments (Cutter et al., 2018).

The adoption of digital mapping in infrastructure management is revolutionizing how assets are planned, monitored, and maintained. The literature on this subject highlights its significance, applications, benefits, challenges, and future prospects. This expanded review provides deeper insights into the theoretical foundations and technological advancements shaping digital mapping.

2.11 Theoretical Framework for Digital Mapping in Infrastructure Management

Digital mapping is rooted in several theoretical and technological frameworks:

Geographic Information Systems (GIS) Theory: GIS is a core technology in digital mapping, enabling spatial analysis, data integration, and decision-making for infrastructure management (Goodchild, 2020). GIS theory emphasizes the spatial relationships between physical assets, environmental factors, and human activities.

2.11.1 Remote Sensing and Spatial Data Infrastructure (SDI): Rajabifard et al. (2021) discuss how remote sensing and SDI frameworks support digital mapping by providing high-resolution imagery and standardized data-sharing protocols. These frameworks ensure that mapping data is accurate, accessible, and interoperable.

2.11.2 Smart City and Systems Theory: Batty et al. (2019) argue that digital mapping is integral to smart cities, where interconnected infrastructure and data-driven planning enhance efficiency, sustainability, and resilience.

2.11.3 Big Data and Artificial Intelligence (AI) Integration: Zhang et al. (2022) highlight the role of AI in analyzing vast amounts of infrastructure-related data, improving decision-making through machine learning algorithms.

These theoretical perspectives provide a foundation for understanding how digital mapping improves infrastructure planning and management.

2.12 Advanced Applications of Digital Mapping in Infrastructure Development

Digital mapping has applications across multiple infrastructure sectors. The following advanced use cases demonstrate its impact:

2.12.1 Digital Twins for Infrastructure Monitoring

A digital twin is a virtual replica of a physical infrastructure asset that updates in real time using sensor data. According to Smith et al. (2021), digital twins improve asset performance monitoring, predictive maintenance, and disaster response. For example, digital twins of bridges and highways can detect structural weaknesses before they become critical failures.

2.12.2 3D Mapping for Construction and Urban Development

The construction industry increasingly relies on 3D digital mapping for project planning, site analysis, and building design. Recent research (Ghaffarian & Samavati, 2020) suggests that Building Information Modeling (BIM) integrated with GIS allows for real-time updates and visualization of construction projects, reducing errors and improving efficiency.

2.12.3 Predictive Analytics for Infrastructure Maintenance

AI-powered digital mapping enables predictive analytics, which helps detect potential failures in infrastructure before they occur. Studies by Zhang et al. (2022) show that AI-driven GIS applications in road networks can predict pothole formation and suggest optimal repair schedules, reducing long-term maintenance costs.

2.12.4 Satellite and Drone-Based Mapping for Rural Infrastructure Development

Rajabifard et al. (2021) emphasize the importance of satellite imagery and drone-based mapping in remote and rural areas where infrastructure data is often scarce. These technologies enable governments and agencies to plan road networks, water supply systems, and energy distribution more effectively.

2.12.5 Smart Infrastructure and IoT-Based Mapping

The Internet of Things (IoT) plays a significant role in modern digital mapping by integrating real-time sensor data into maps. Cutter et al. (2018) discuss how IoT-enabled infrastructure, such as smart grids and intelligent water systems, uses real-time digital mapping to improve efficiency and sustainability.

2.13 Comparative Analysis of Digital Mapping vs. Traditional Mapping Methods

Table 2.1 shows the comparative analysis of digital mapping vs traditional

Aspect	Traditional Mapping	Digital Mapping
Data Collection	Manual surveys, paper-based records	Real-time GPS, satellite, and drone data
Accuracy	Prone to human errors	High precision, real-time updates
Cost Efficiency	High long-term costs due to maintenance inefficiencies	Lower costs due to predictive analytics and optimized planning

Decision-Making Speed	Slow	Fast, AI-driven insights
| Integration Capabilities	Limited	Easily integrates with GIS, AI, IoT, and smart city systems
Data Accessibility	Static, difficult to share	Cloud-based, accessible from multiple platforms

Studies (Goodchild, 2020; Zhang et al., 2022) confirm that while digital mapping requires an initial investment, it provides significant long-term savings and efficiency improvements compared to traditional methods.

2.14. Key Benefits of Digital Mapping in Infrastructure Management

The advantages of digital mapping go beyond efficiency and cost reduction:

2.14.1 Enhanced Environmental Impact Assessment (EIA): Digital mapping helps identify the environmental impact of infrastructure projects and supports sustainable development initiatives (Ghaffarian & Samavati, 2020).

2.14.2 Optimized Energy Distribution: GIS-based mapping aids in power grid expansion, renewable energy site selection, and real-time fault detection in power infrastructure (Zhang et al., 2022).

2.14.3 Improved Public Safety and Disaster Management: Digital maps assist emergency responders by providing up-to-date infrastructure status reports and evacuation route planning (Cutter et al., 2018).

2.15. Challenges Hindering the Adoption of Digital Mapping

Despite its advantages, digital mapping faces barriers to adoption:

2.15.1. Financial Constraints

Implementing digital mapping technology is capital-intensive. Infrastructure organizations in developing nations struggle with funding constraints, limiting widespread adoption (Rajabifard et al., 2021).

2.15.2. Lack of Skilled Workforce

The expertise required for GIS, remote sensing, AI, and IoT-based mapping is scarce, leading to a knowledge gap in infrastructure management (Smith et al., 2021).

2.15.3. Data Privacy and Security Risks

With increasing cyber threats, the risk of unauthorized access to critical infrastructure data is a major concern. Cutter et al. (2018) recommend stronger data encryption and blockchain integration to enhance security.

2.15.4. Resistance to Change

Many infrastructure organizations still rely on traditional methods and resist transitioning to digital solutions due to concerns about complexity and retraining costs (Goodchild, 2020).

2.16. Future Prospects of Digital Mapping in Infrastructure Management

The future of digital mapping will be driven by advancements in technology:

2.16.1AI-Driven Smart Infrastructure: AI algorithms will enhance predictive maintenance, reducing downtime and improving efficiency (Zhang et al., 2022).

2.16.2 Cloud-Based and Blockchain Secured Mapping: Cloud platforms will make digital mapping data more accessible, while blockchain will enhance security and data integrity (Smith et al., 2021).

2.16.3 Autonomous Vehicles and Infrastructure Mapping: Self-driving cars will rely on high-precision digital maps for navigation and real-time decision-making (Ghaffarian & Samavati, 2020).

2.16.4 Augmented Reality (AR) and Virtual Reality (VR) for Infrastructure Planning: AR and VR technologies will provide immersive simulations for urban planners and engineers, enhancing infrastructure visualization before implementation (Batty et al., 2019).

2.17. Digital mapping has revolutionized the management and planning of infrastructural facilities, providing real-time, data-driven insights for decision-making. This technology integrates Geographic Information Systems (GIS), Artificial Intelligence (AI), remote sensing, Internet of Things (IoT), and cloud computing to create, update, and analyze spatial data efficiently. Recent studies have explored digital mapping's impact on urban planning, transportation systems, utilities management, disaster resilience, and smart infrastructure. This literature review delves into the theoretical foundations, technological advancements, practical applications, benefits, challenges, and future directions of digital mapping in infrastructure development

2.18 Theoretical Foundations of Digital Mapping

2.18.1. Geographic Information Systems (GIS) Theory

GIS technology underpins digital mapping, allowing for the spatial analysis and visualization of infrastructure. Goodchild (2020) explains that GIS provides structured layers of geospatial data, enabling infrastructure managers to assess relationships between physical assets, environmental factors, and human activities. GIS-based mapping enhances land-use planning, road network optimization, and utility management.

2.18.2. Remote Sensing and Spatial Data Infrastructure (SDI)

Rajabifard et al. (2021) discuss how remote sensing technologies, including satellites, LiDAR, and UAVs (drones), facilitate the real-time collection of infrastructural data. These technologies feed into Spatial Data Infrastructure (SDI) frameworks, ensuring data standardization and interoperability for infrastructure stakeholders.

2.18.3. Smart Cities and Systems Theory

Batty et al. (2019) argue that digital mapping is a fundamental component of smart city development, where interconnected infrastructure systems leverage real-time data for optimal functionality. This approach enhances energy distribution, traffic management, and emergency response efficiency.

2.18.4. Big Data and AI-Driven Predictive Analytics

Advancements in AI and machine learning (ML) enable predictive analytics for infrastructure maintenance. Zhang et al. (2022) demonstrate how AI-powered GIS applications forecast structural failures in bridges, water pipelines, and road networks, allowing for proactive maintenance strategies.

2.19. Digital Mapping Technologies and Methodologies

2.19.1. Geographic Information Systems (GIS)

GIS-based mapping provides a spatial database for infrastructure assets, integrating multiple layers of information, including terrain, utility networks, and demographic data (Smith et al., 2021). ArcGIS, QGIS, and Google Earth Engine are widely used GIS platforms for infrastructure mapping.

2.19.2. Remote Sensing and LiDAR (Light Detection and Ranging)

LiDAR technology offers high-resolution mapping of urban and rural environments. According to Rajabifard et al. (2021), LiDAR-based digital mapping has improved road design, flood risk assessment, and railway track monitoring.

2.19.3. IoT-Enabled Infrastructure Mapping

IoT sensors embedded in infrastructure provide real-time condition monitoring. Cutter et al. (2018) highlight how smart water systems use IoT and GIS to detect leaks, manage supply, and predict demand fluctuations.

3.4. Blockchain for Secure Infrastructure Data Management

Blockchain technology ensures the security and integrity of digital mapping data. Smith et al. (2021) discuss blockchain-based land registries, which prevent unauthorized modifications and fraudulent land transactions.

2.20. Applications of Digital Mapping in Infrastructure Development

2.20.1. Urban Planning and Land Use Management

Digital mapping supports sustainable urban development by optimizing land use, zoning regulations, and green space management (Batty et al., 2019). Real-time mapping enables dynamic city planning, reducing congestion and environmental degradation.

2.20.2. Transportation and Road Infrastructure

GIS-based digital mapping improves the design, monitoring, and maintenance of transportation networks. Smith et al. (2021) highlight how AI-driven traffic models analyze congestion patterns, reducing travel time and fuel consumption.

2.20.3. Water Resource and Utility Management

Rajabifard et al. (2021) emphasize the role of GIS in managing water distribution networks, detecting pipeline leaks, and optimizing water allocation. Smart water grids use real-time digital mapping for efficient resource management.

2.20.4. Power and Energy Infrastructure

GIS and digital twins enhance energy infrastructure planning by optimizing power distribution networks and renewable energy site selection (Zhang et al., 2022). Smart grids use AI-driven mapping to predict electricity demand and detect faults.

2.20.5. Disaster Management and Climate Resilience

Cutter et al. (2018) discuss how digital mapping enhances disaster response strategies by identifying vulnerable infrastructure and mapping evacuation routes. GIS-based early warning systems for floods, wildfires, and earthquakes save lives and reduce economic losses.

2.20.6. Smart Cities and Autonomous Vehicles

The future of autonomous vehicles (AVs) relies on high-resolution digital maps. AI-powered mapping systems ensure precise navigation, obstacle detection, and traffic management (Ghaffarian & Samavati, 2020).

2.21. Benefits of Digital Mapping in Infrastructure Management

Table 2.2 shows the benefits of digital mapping in infrastructure management

Benefit	Description
Enhanced Decision-Making	Real-time spatial analysis aids in optimizing infrastructure planning and resource allocation.
Cost Reduction	Predictive analytics minimizes maintenance costs and infrastructure failures.
Improved Public Safety	GIS-based emergency response mapping enhances disaster resilience.

Improved Public Safety	GIS-based emergency response mapping enhances disaster resilience.
Environmental Sustainability	Smart mapping promotes green infrastructure development and energy efficiency.
Data Accessibility & Transparency	Cloud-based GIS platforms enable multi-agency collaboration.

2.22. Challenges in Implementing Digital Mapping

2.22.1. High Initial Costs

The integration of GIS, IoT, and AI-based mapping requires significant financial investment(Rajabifard et al., 2021).

2.22.2. Technical Complexity and Skill Gaps

There is a lack of trained professionals in GIS analytics, AI-driven mapping, and remote sensing (Smith et al., 2021).

2.22.3. Data Security and Privacy Concerns

Infrastructure data is vulnerable to cyber threats. Cutter et al. (2018) recommend blockchain and AI-driven cybersecurity measures for digital mapping applications.

2.22.4. Resistance to Change

Many government agencies and industries still rely on traditional mapping methods, delaying digital adoption (Goodchild, 2020).

2.23. Future Trends and Innovations in Digital Mapping

2.23.1. AI-Powered Predictive Mapping

Machine learning algorithms will refine digital mapping for real-time infrastructure monitoring (Zhang et al., 2022).

2.23.2. Augmented Reality (AR) and Virtual Reality (VR) Mapping

AR and VR will allow city planners and engineers to visualize infrastructure projects before construction begins (Batty et al., 2019).

2.23.3. Blockchain-Based Land Management Systems

Blockchain-powered GIS systems will enhance land ownership transparency and reduce land disputes (Smith et al., 2021).

2.23.4. 6G and Edge Computing for Real-Time Mapping

Future 6G networks will support ultra-fast real-time data transmission for autonomous vehicles and smart city planning (Ghaffarian & Samavati, 2020).

2.24. Conclusion

The literature confirms that digital mapping is a transformative tool for infrastructure management. It enhances urban planning, resource efficiency, disaster resilience, and public safety. However, financial constraints, skill gaps, and cybersecurity risks must be addressed to maximize adoption. Future advancements in AI, IoT, blockchain, and 6G networks will further enhance the role of digital mapping in sustainable infrastructure development.

CHAPTER THREE

3.0 METHODOLOGY

This stage involves the methods and procedure used in planning, data acquisition, data processing, 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, Football pitch, Streams.

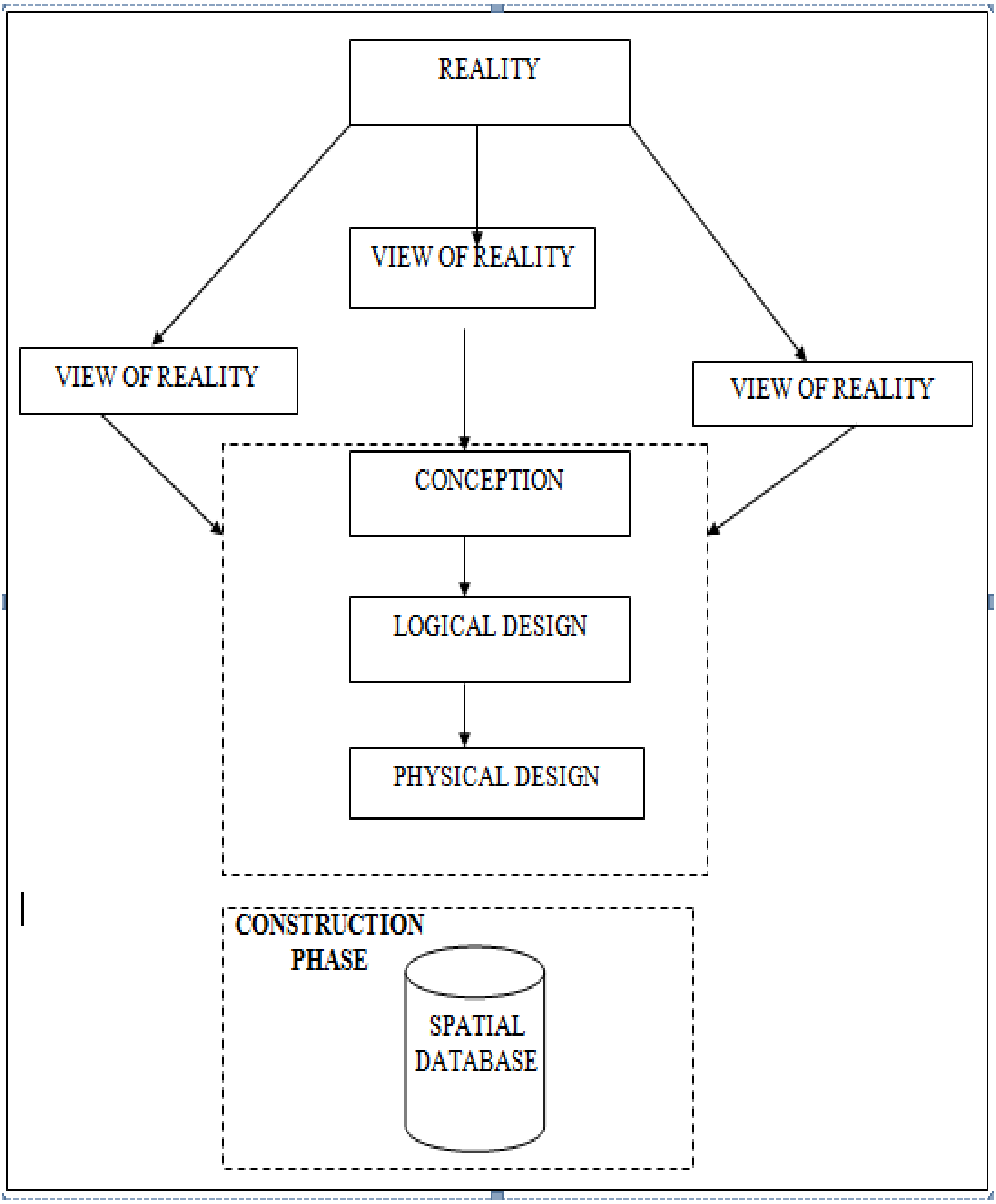


Fig. 3.1 Design and Construction Phases in Spatial Database

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)

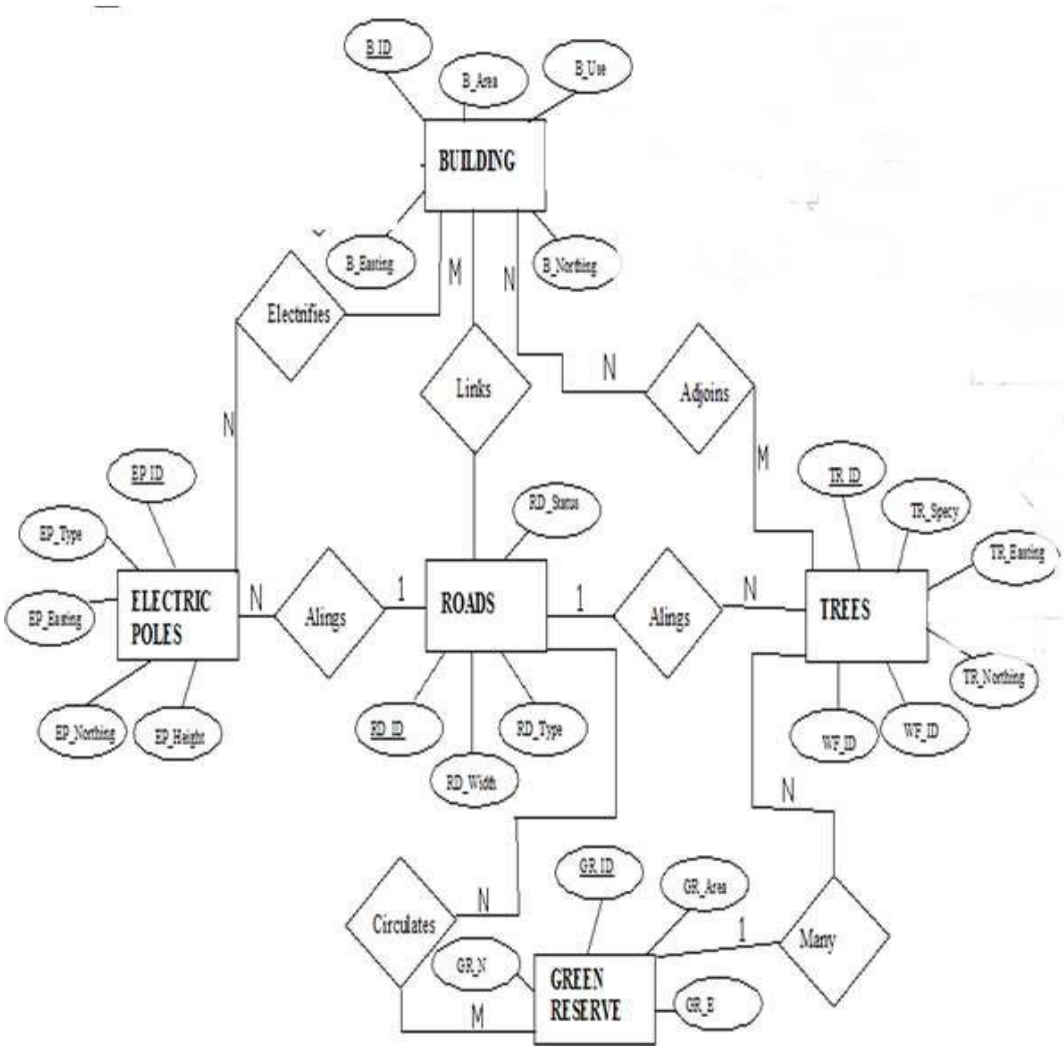


Fig. 3.2.: E-R Diagram (Entity relationship diagram)

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 data manipulation 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.

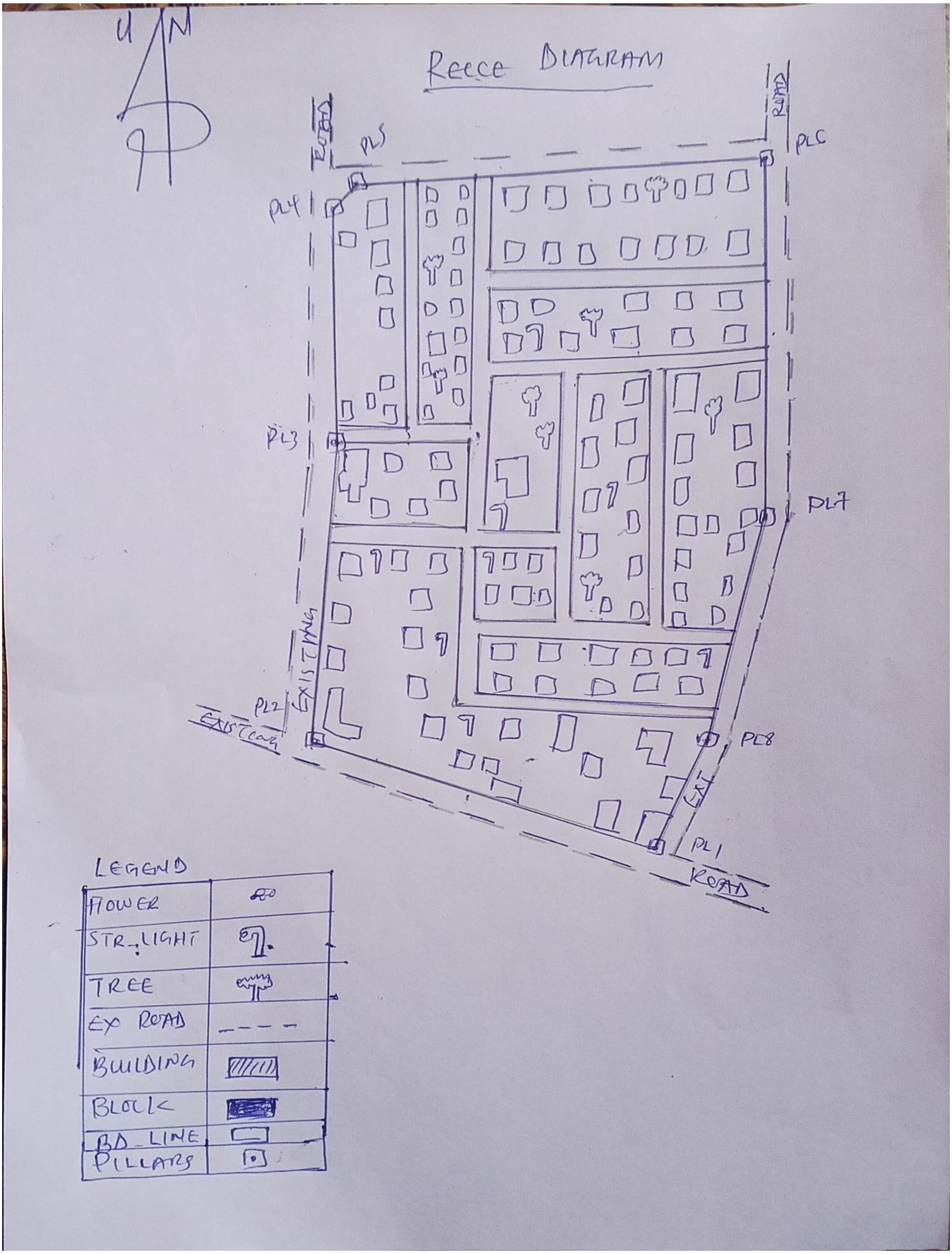


Fig. 3.3: Recce diagram of the study area (not drawn to scale).

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). A vertical 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.

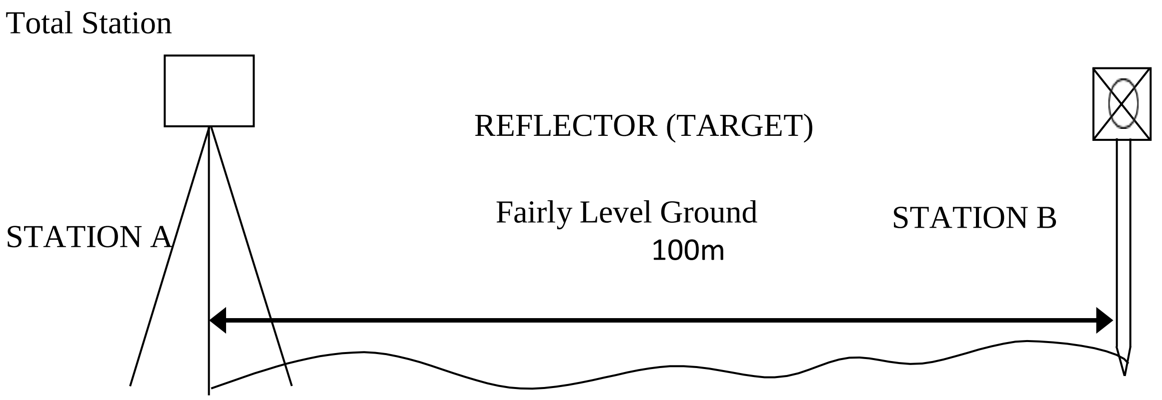


Fig 3.4: Horizontal Collimation and Vertical Index error test.

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)	∆N	∆E	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" andthe 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

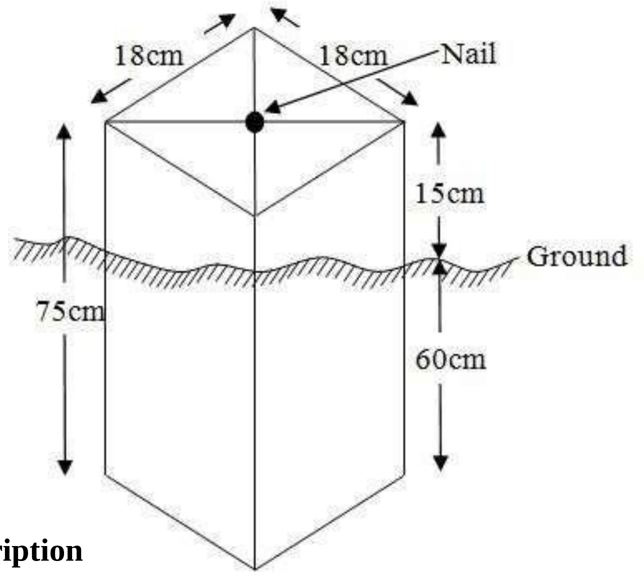


Fig. 3.5: Pillar Description

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 conspicuouspoints within the study area .

SECONDARY DATA SOURCE

An imagery of the area was acquired through Updated Google earth; this was used toascertain 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 procedures were 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 subsequentobservation 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 itwas 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.

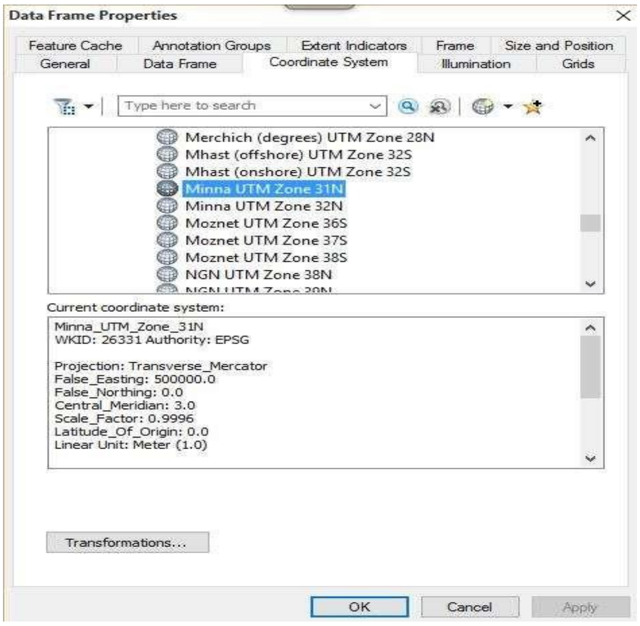
3.8.2 DATA PROCESSING AND DATA EDITING

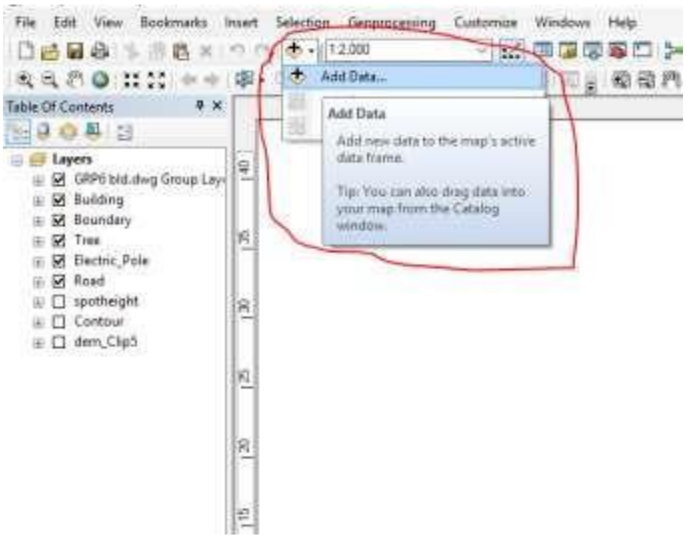
The geometric data downloaded were further processed in order to convert it to a useful format and to enhance its accuracy. The output coordinates, were edited and exported in *.txt, *.xls and *.pdf format. Thereafter, they were imported into Arc GIS 10.3 for further operations and to carry out spatial 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 ZONE 31N 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 load onto the table of content layer section

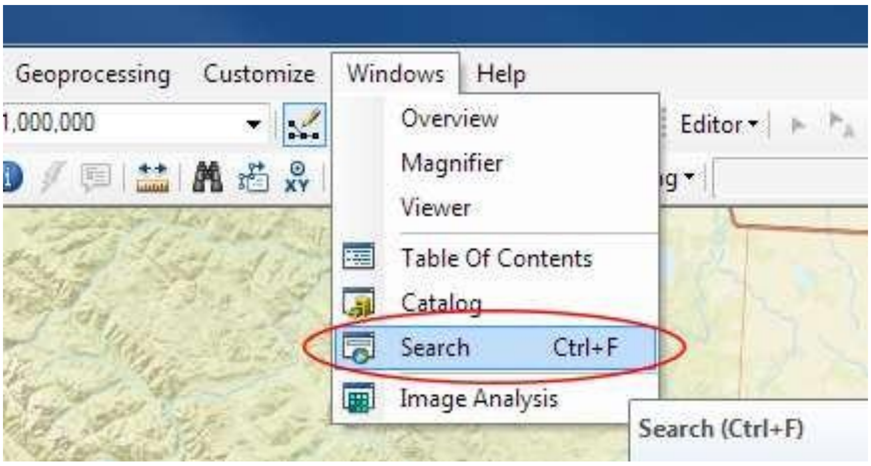




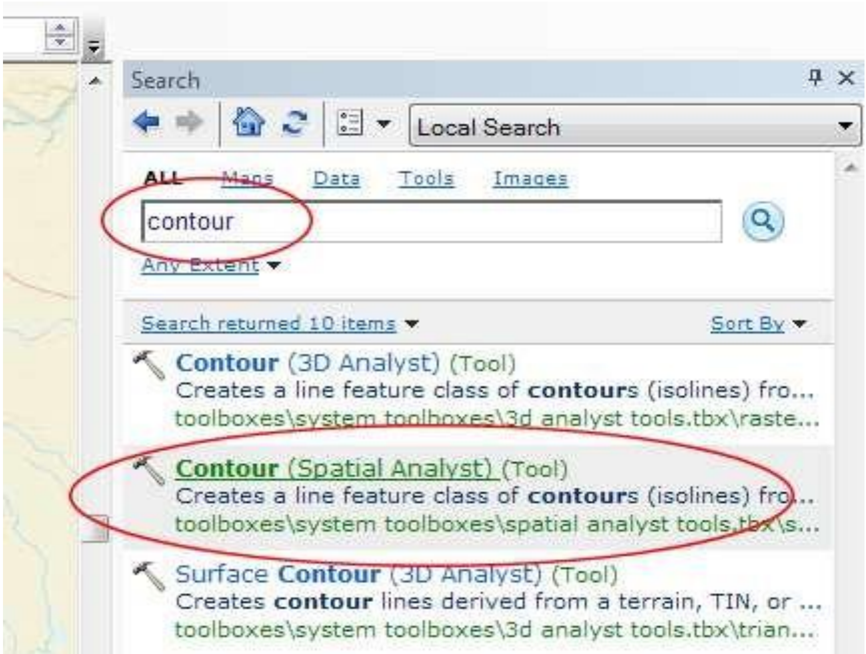
All drawing was exported to shape file. After the feature class has been creates, click on Editor to start Editing, and then click on the load object.

3.8.4 Topographical Map (DEM)

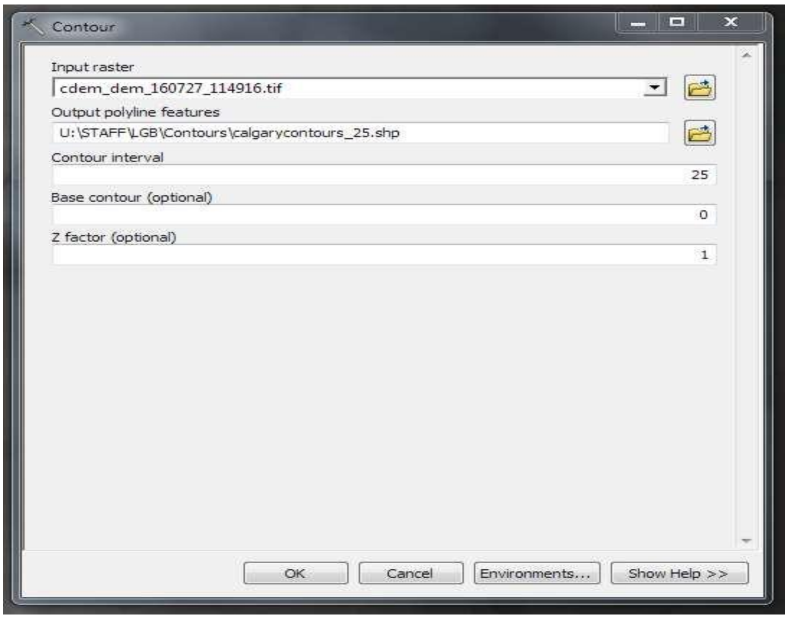
CRATING CONTOUR: Firstly DEM was created by searching in the search icon INTERPOLATION> NATURAL NIGHBOR and selecting THE XYZ data for creation of DEM in respect to the boundary line as extent. In order to create contours, you will need to enable the Spatial Analyst toolbar, which can be found by going 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 the feature.

EDITING, CONVERTING AND MERGING GEODATABASE

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

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, then click TOOLBARS and MARK the 3D Analyst EXTENTION Then X, Y Data

TO CREATE TIN

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

TO CHANGE THE FACE OF THE TIN ACCODING TO ITS ELEVATION

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

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 campus.

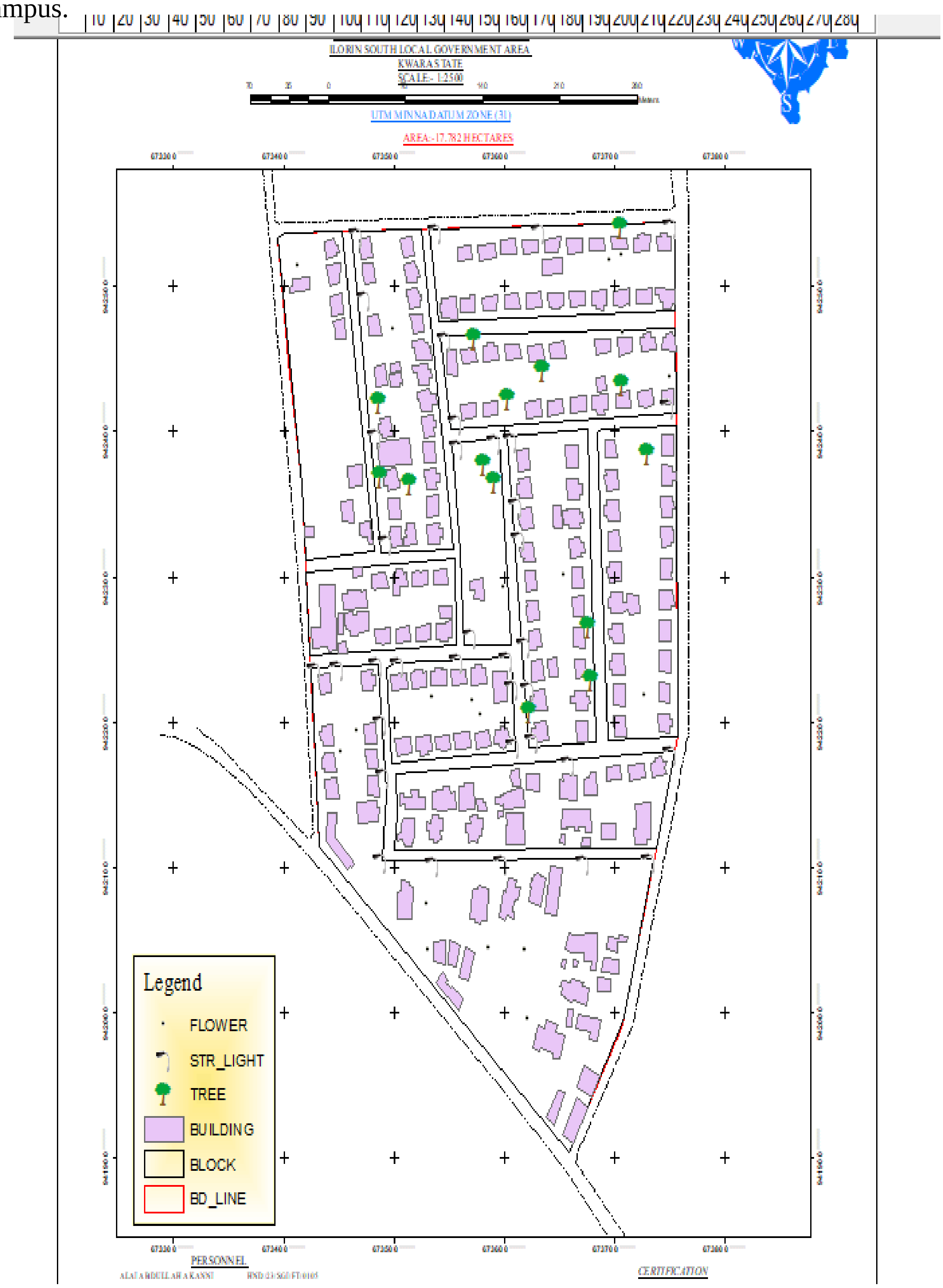


Figure 3.6 showing the 2D facility map of the study area.

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.

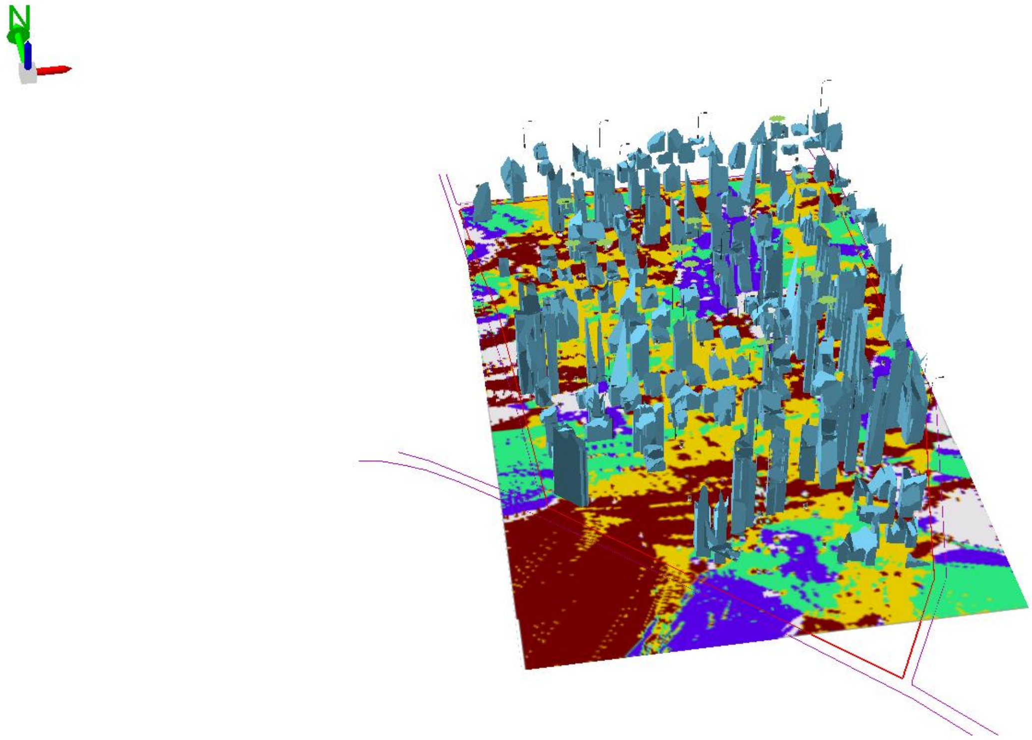


Figure 3.7 (a) Showing 3D model of the study area area

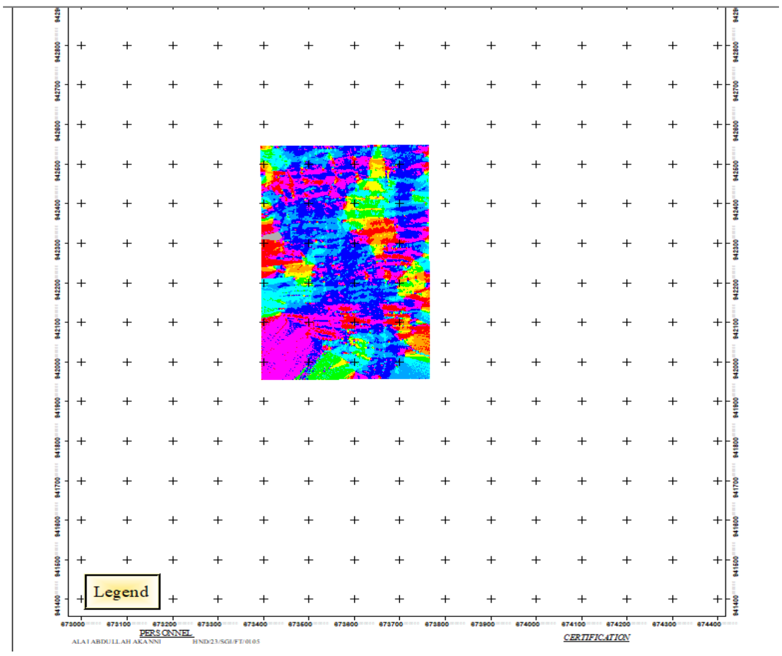


Figure 3.8 showing the 2D DEM (Digital elevation model) of the study area (derived from the field data).

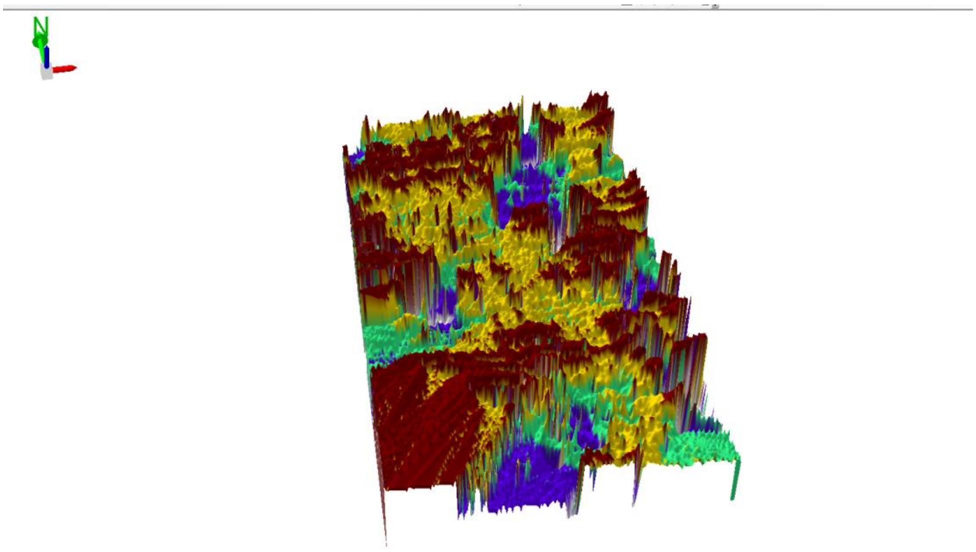


Figure 3.9 Showing 3D DEM (Digital Elevation Model) of the study area (derived from the field data).

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 on OPTIONS and select ADD FIELD.
- Give it FIELD NAME, click on TYPE and select [SHORT INTEGER or LONG INTEGER for SHORT or LONG WHOLE VARIABLES or DOUBLE FOR DECIMAL VARIABLES OR TEXT variable or DATE for DATE], then enter precision or LENGTH for text width and scale for DECIMAL PLACES, and then click OK
- To input variables on the ATTRIBUTE TABLE, go to the EDITOR on Menu bar, select START EDITING,
- Click on ATTRIBUTE on menu bar [behind the TARGET], click on the features on

the DATA VIEW display, and then input the variables of data acquired through SOCIAL SURVEY or DATA ACQUIRED ON THE FIELD.

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

Table 3.10: 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	-
	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 ANALYSES AND PRESENTATION

GIS is distinct among other information system because of its spatial analytical capability; especially overlay operation, buffering, spatial search, topographic operation, and neighborhood and connectivity operations. GIS uses this spatial analytical capability to answer fundamental generic question of location, condition, trend, routing, pattern and modeling by the manipulation and analysis of input data. The major analyses performed in this project were overlay operations, topographic operations and spatial search.

4.1 TESTING OF DATABASE

This is the test carried out to determine whether there exists a relationship between data modeled about entities in a spatial database as well as putting into test its retrieval capabilities. This was done by designing a sample query with certain conditions attached andthe query will be ran to see if desired result is achieved.

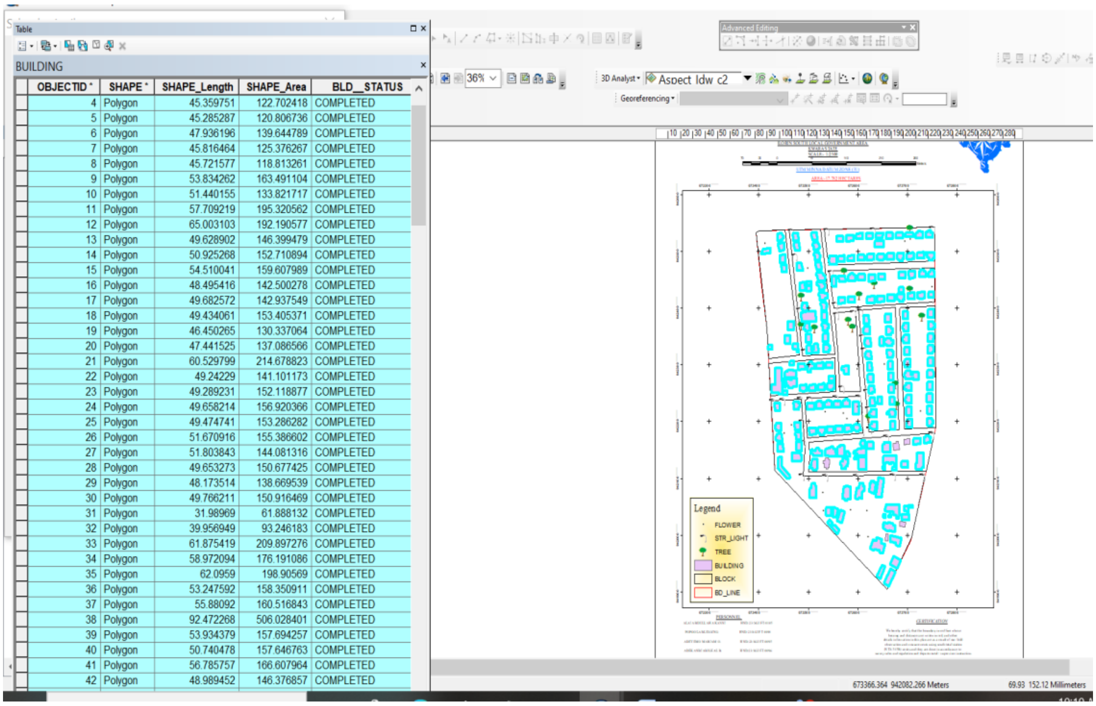
4.11 ANALYSIS OF RESULT

The contour whose value is greater or equal to 350 meters depicts the likelihood that such area may not be prone to flood in the project area as shown in Fig. 4.5(Query 1). This represents the elevation of points that are greater than to 350m. The displayed attribute table confirmed that North-East part of the institute had the highest elevation. Height is an important factor when considering the surface or slope of the terrain. The South-west part of the school had the lowest elevation which is very prone to erosion. Buildings that will besited in that region must have a very high foundation above the ground level. The result of the query will afford the school management to decide concisely the terrain characteristics andthe kind of building that should build in every region of the project area looking critically at the terrain of the area.

SINGLE SELECTION CRITERION

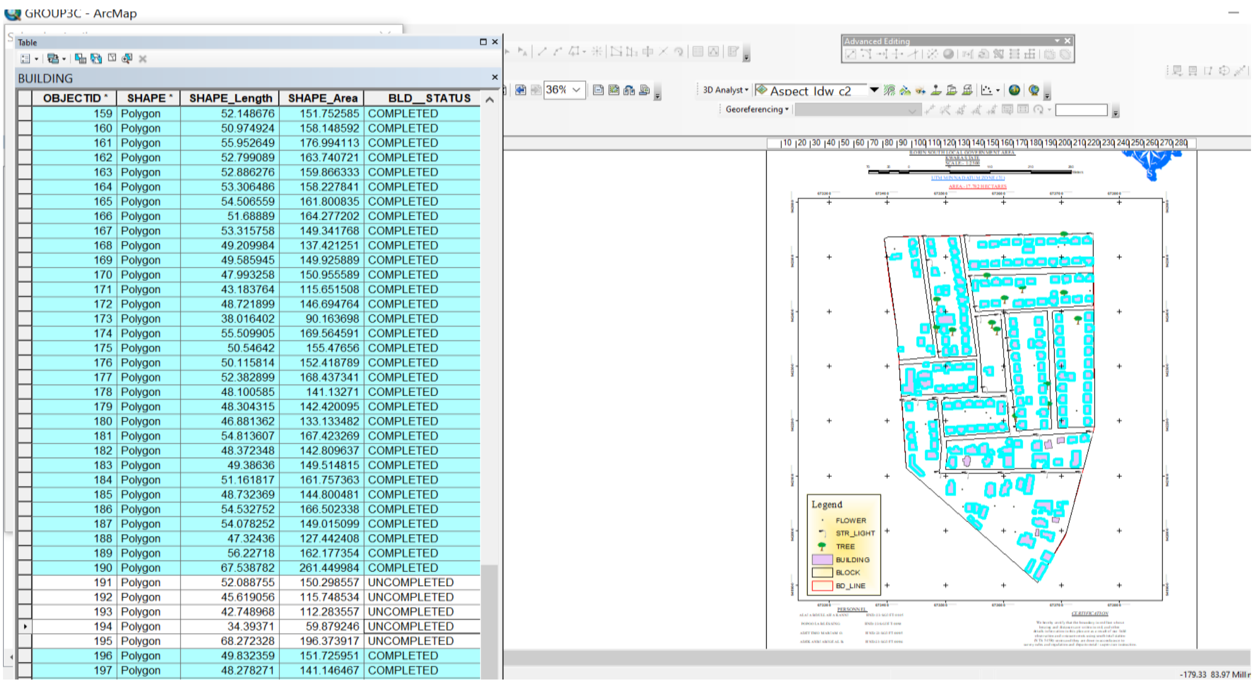
Query 1: shows the completed building

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



OBJECTID *	SHAPE *	SHAPE_Length	SHAPE_Area	BLD_STATUS
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
37	Polygon	55.88092	160.516843	COMPLETED
38	Polygon	92.472268	506.028401	COMPLETED
39	Polygon	53.934379	157.694257	COMPLETED
40	Polygon	50.740478	157.646763	COMPLETED
41	Polygon	56.785757	166.607964	COMPLETED
42	Polygon	48.989452	146.376857	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

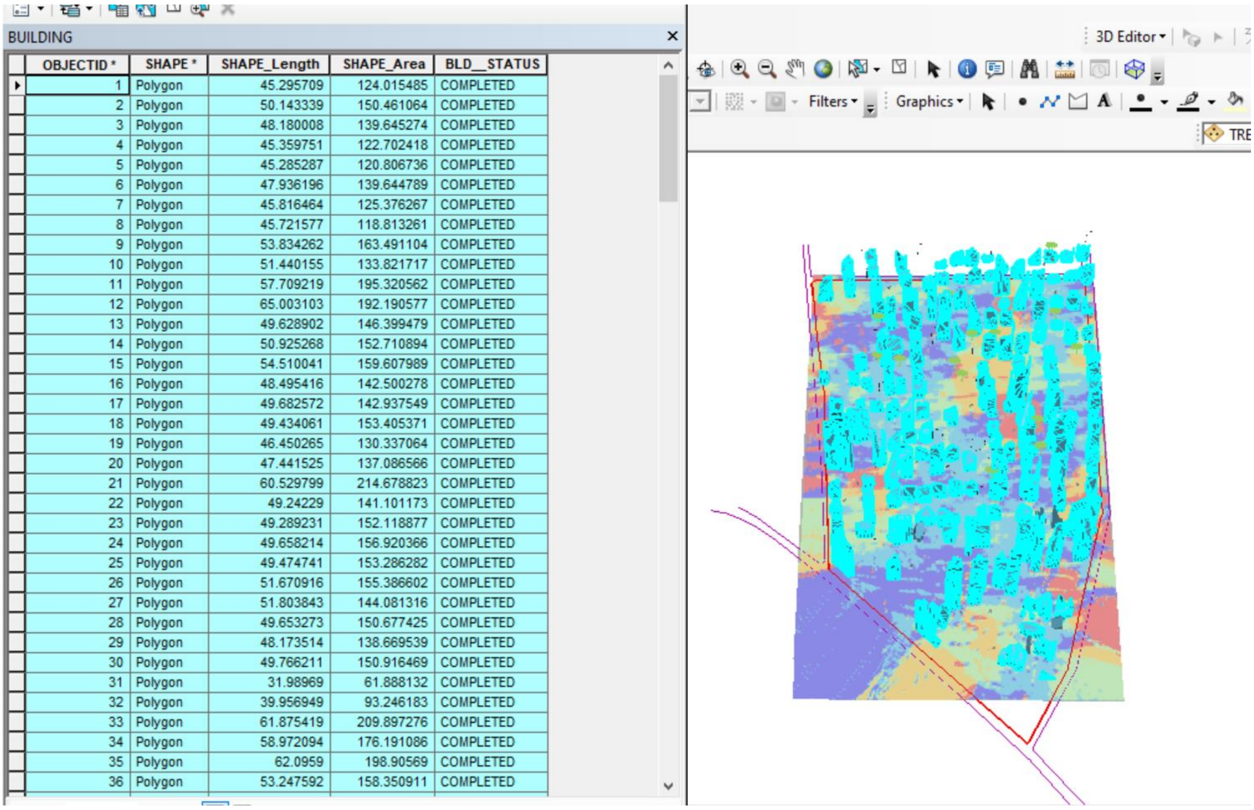


Figure 4.3 shows the 3D of completed building

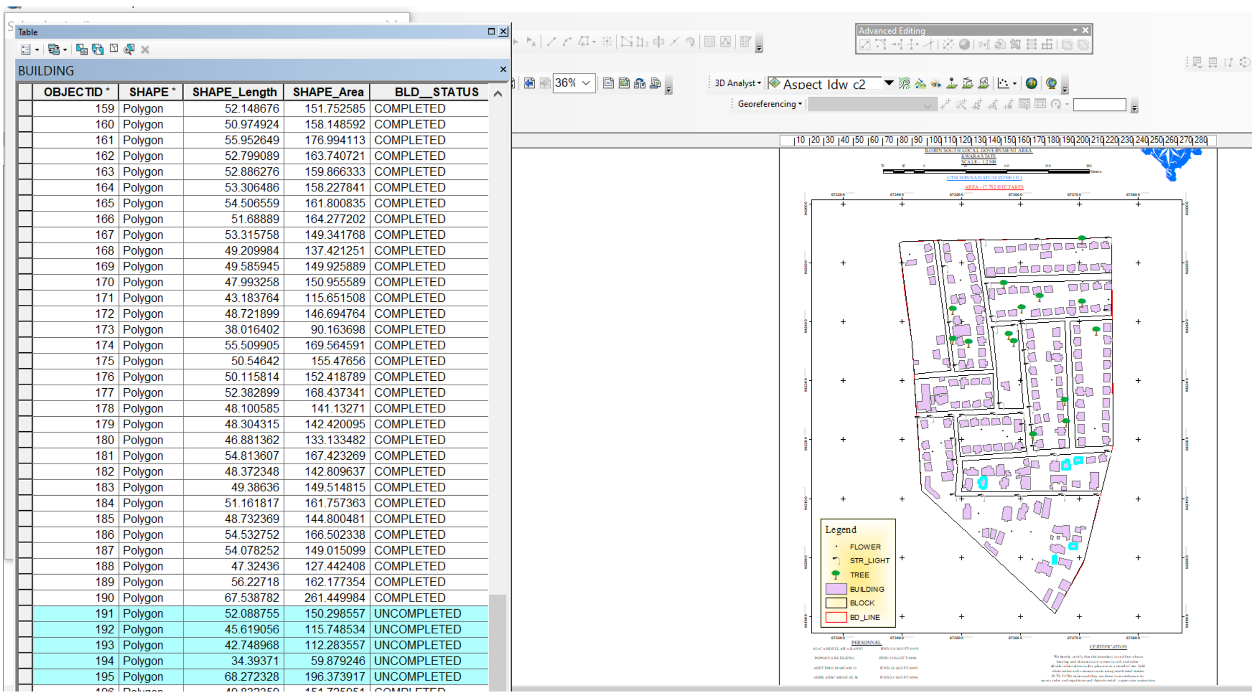
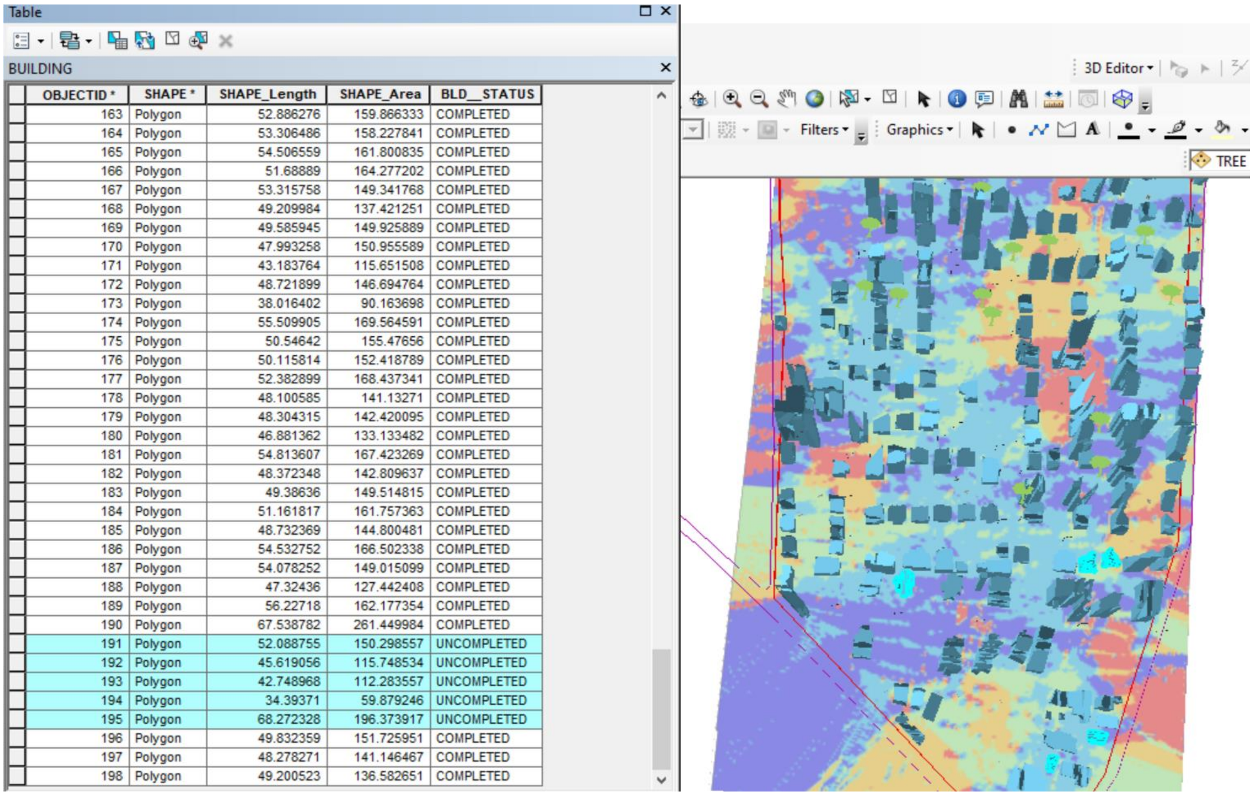


Fig 4.4 Query shows the 2D of uncompleted building



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
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
198	Polygon	49.200523	136.582651	COMPLETED

Figure 4.5 shows the 3D of uncomplted building

CHAPTER FIVE

5.0 Costing Estimation, Summary, Conclusion, Recommendation and Problem Encountered

5.1 Costing Estimation

RECCONNAISSANCE

S/N	PERSONNEL	QTY	DAILY RATE	NO OF DAYS	REMARK
1	Group leader	1	5000	1	5000
2	Ass group leader	1	2500	1	2500
3	Basic equipment	1	25000	1	25000
4	Transportation	1	3000	1	3000

Subtotal = #35,500

Monumentation

S/N	PERSONNEL	QTY	DAILY RATE	NO OF DAYS	REMARK
1	Group leader	1	5000	1	5000
2	Ass group leader	1	2500	1	2500
3	Skilled labor	3	1500	1	4500
4	Basic equipment	1	25000	1	25000
5	Transportation	1	7500	1	3000

Subtotal = #40,000

Beaconing

S/N	PERSONNEL	QTY	DAILY RATE	NO OF DAYS	REMARK
1	Group leader	1	5000	1	5000
2	Ass group leader	1	2500	1	2500
3	Basic equipment	1	5000	1	5000
4	Transportation	1	3000	1	3000

Subtotal = #5,500

Beacon

S/N	PERSONNEL	QTY	DAILY RATE	NO OF DAYS	REMARK
1	Group leader	1	5000	1	5000
2	Ass group leader	1	2500	1	2500
3	Beacon	10	1000	1	10,000
4	Transportation	1	3000	1	3000

Subtotal = #19,500

Traversing

S/N	PERSONNEL	QTY	DAILY RATE	NO OF DAYS	REMARK
1	Supervisor	1	6000	1	6000
2	Group leader	1	5000	1	5000
3	Ass group leader	1	2500	1	2500

4	Skilled labour	6	1500	1	10,000
5	Basic equipment	1	25000	1	5000
6	Transportation	1	10,500	1	10,500

Subtotal = #43,500

Spot Height

S/N	PERSONNEL	QTY	DAILY RATE	NO OF DAYS	REMARK
1	Supervisor	1	6000	2	12,000
2	Group leader	1	5000	**2**	10,000
3	Ass group leader	1	2500	2	5000
4	Skilled labor	6	1500	2	20,000
5	Basic equipment	1	25000	1	5000
6	Transportation	1	10,500	2	21,000

Subtotal = #73,000

Data processing

S/N	PERSONNEL	QTY	DAILY RATE	NO OF DAYS	REMARK
1	Group leader	1	5000	1	5000
2	Ass group leader	1	2500	1	2500
3	Basic equipment	1	10,000	1	10,000
4	Generator and fuel	1	10,000	1	10,000

Subtotal = #27,500

Technical report

S/N	PERSONNEL	QTY	DAILY RATE	NO OF DAYS	REMARK
1	Group leader	1	5000	1	5000
2	Ass group leader	1	2500	1	2500
3	Basic equipment	1	10,000	1	10,000
4	Generator and fuel	1	10,000	1	10,000

Subtotal = #27,500

Sum total = 271,500.00

Contingency allowance = 271,500.00 X 5 / 100 = 13,575

VAT = 271,500.00 X 7.5 / 100 = 20,362.5

ACCOMODATION = 271,500.00 X 1.5 / 100 = 4,072.5

MOB/DEMB = 271,500.00 X 10 = 27,150

GLEARANCE TAX =65,159.5

5.2 Summary

The project title digital mapping was carried out at Federal royal valley estate Sango Kulende area, Ilorin Kwara State. The project was carried out in accordance with third order specifications, the reconnaissance [office and field] was properly carried out and this enhanced proper planning of the operations by locating initial controls for proper orientation, the instrument to be used, and selection of total station were put into consideration and finally drawing of sketched diagram of the area to be surveyed. This project covered the aspect of traversing, perimeter, leveling, detailing and spot heights by using Total Station as main instrument.

Traversing was done to determine the coordinate [Northing and Easting] of the stations while heights of the stations were obtained from the perimeter, leveling, tachometry was used to obtain the values of position of new points. Thereafter, data processing was done and the plan was produced in analysis [manual] and digital format title plan showing perimeter and details of all project area. Finally, a comprehensive report was written on how the entire project was executed.

5.3 Conclusion

In conclusion, the project exercise has been successfully executed since the result of the above operation agreed the requirement and accuracy of third order job and adequate data acquired, processed and represented in plans, all necessary computation was carried out to a specification given and in accordance with the survey rules and departmental instructions.

5.4 Recommendations

Having participated in this practical work and due to the experience, I had acquired during this project and products generated, I hereby make the following recommendations.

1. The Government should use this plan available for decision making regarding the premises and as well fence the school premises because the school is bounded by many roads.
2. The Government should give proper supervision to the available resource such as borehole, chairs and table as well as staff.
3. Application of computer programming should be fully implemented so as to make the students carry out the data processing exercise more efficiently and faster.
4. This project is available for review

5.5 Problems Encountered

The problem encountered on the site were unavoidable especially the movement of vehicles and the students of our site project were disturbing when working. Also, the total station battery was also getting weak time to time, so it consumes us more battery and stress before getting another battery.

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APPENDIX I

X	Y	Z
673600.438	941983.025	276.220
673637.669	941983.025	277.121
673674.900	941983.025	278.747
673525.976	942042.384	278.114
673563.207	942042.384	278.710
673600.438	942042.384	278.979
673637.669	942042.384	278.763
673674.900	942042.384	280.876
673712.131	942042.384	283.762
673451.515	942101.744	266.618
673488.745	942101.744	269.367
673525.976	942101.744	273.829
673563.207	942101.744	277.300
673600.438	942101.744	278.296
673637.669	942101.744	279.061
673674.900	942101.744	282.202
673712.131	942101.744	282.125
673451.515	942161.103	268.553
673488.745	942161.103	269.884
673525.976	942161.103	271.088
673563.207	942161.103	274.072
673600.438	942161.103	276.247
673637.669	942161.103	278.609

673674.900	942161.103	281.156
673712.131	942161.103	281.510
673749.362	942161.103	281.406
673451.515	942220.463	272.935
673488.745	942220.463	272.234
673525.976	942220.463	272.351
673563.207	942220.463	274.732
673600.438	942220.463	277.163
673637.669	942220.463	278.960
673674.900	942220.463	281.069
673712.131	942220.463	281.847
673749.362	942220.463	280.344
673451.515	942279.822	269.658
673488.745	942279.822	271.526
673525.976	942279.822	273.285
673563.207	942279.822	274.836
673600.438	942279.822	277.669
673637.669	942279.822	279.143
673674.900	942279.822	278.853
673712.131	942279.822	280.052
673749.362	942279.822	282.081
673451.515	942339.181	269.774
673488.745	942339.181	272.749
673525.976	942339.181	274.613
673563.207	942339.181	277.079

673600.438	942339.181	277.257
673637.669	942339.181	276.780
673674.900	942339.181	276.112
673712.131	942339.181	277.247
673749.362	942339.181	280.669
673414.284	942398.541	268.295
673451.515	942398.541	271.799
673488.745	942398.541	273.377
673525.976	942398.541	275.910
673563.207	942398.541	278.784
673600.438	942398.541	278.851
673637.669	942398.541	278.010
673674.900	942398.541	276.922
673712.131	942398.541	278.194
673749.362	942398.541	279.940
673414.284	942457.900	267.983
673451.515	942457.900	268.641
673488.745	942457.900	271.766
673525.976	942457.900	272.732
673563.207	942457.900	276.328
673600.438	942457.900	279.393
673637.669	942457.900	279.382
673674.900	942457.900	278.970
673712.131	942457.900	279.948
673749.362	942457.900	282.942

673414.284	942517.260	268.275
673451.515	942517.260	268.192
673488.745	942517.260	271.061
673525.976	942517.260	273.349
673563.207	942517.260	273.776
673600.438	942517.260	277.162
673637.669	942517.260	279.188
673674.900	942517.260	278.834
673712.131	942517.260	280.717
673749.362	942517.260	282.616