A PROJECT REPORT

ON

AS-BUILT SURVEY OF PART OF HONEYWELL ESTATE, OKE-OSE/OKE-OYI, ILORIN SOUTH LOCAL GOVERNMENT AREA, KWARA STATE.

BY

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HND/23/SGI/FT/0101

SUBMMITED TO:

THE DEPARTMENT OF SURVEYING AND GEO-INFORMATICS, INSTITUTE OF ENVIRONMENTAL STUDIES, KWARA STATE POLYTECHNIC ILORIN.

IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF HIGHER NATIONAL DIPLOMA IN SURVEYING AND GEO-INFORMATICS.

JUNE, 2025

CERTIFICATE

I hereby certified that the information given in this project was obtained as a result of the observation and measurement made by me and that the survey was carried out in accordance with survey laws, regulations and departmental instructions

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OBAMILA ODUNAYO FUNKE
Matric. No: HND/23/SGI/FT/0101

CERTIFICATION

This is to certify that this project was carried out by OBAMILA ODUNAYO FUNKE with Matric No.: HND/23/SGI/FT/0101 under my instruction and supervision for the award of Higher National Diploma in Surveying and Geo-informatics, Kwara State Polytechnic, Ilorin, Kwara State Nigeria. I hereby declared that she has conducted herself with due diligence and honesty on the said duties.

………………………………… ………………………………

SURV.A. AYUBA DATE

(Project Supervisor)

………………………………. …………………………

SURV. R.S. AWOLEYE DATE

(Project Coordinator)

……………………………… ………………………………

A.I ISAU DATE

Head of Department (H.O.D)
Surveying & Geo-informatics

……………………………….. ……………………………..

EXTERNAL EXAMINER *DATE*

DEDICATION

This project is dedicated to Almighty God, the author and the finisher of everything who gave me the grace and privilege to attain this stage in my education pursuit.

ACKWOLEDGEMENT

I give thanks and glory to my Creator for the privilege bestowed on me that resulted in the accomplishment of this project work and also a big thanks to the management of Kwara State Polytechnic for the privilege and opportunity given to me to study in their great institution.

A project of such scope as this could not have been done without the assistance of proven professionals, consultancies, advisors, well wishers, family and friends.

My sincere gratitude goes to my Head of Department (HOD); A.I Isau and my Supervisor; Surv. R.O. Asonibare for their support towards the success of this project, I really appreciate you sir.

To all the lecturers in the department of Surveying and Geo-informatics; Surv. A.I. Isau, Surv. A. Ayuba, Surv. Banji, Surv. Awoleye, Surv. A.G. Aremu, Surv. Kabir, Surv. Kazeem, Surv. Asonibare and Surv. Diran who has imparted their knowledge in me in one area or the other during my year of study, I am grateful for all your effort and support. May Almighty GOD bless you all (Amen).

I'm deeply grateful to my Mummy and my Grandma for their unconditional love, support, and wisdom. Their encouragement and sacrifices have been the driving force behind my endeavors. Thank you for being my pillars of strength and inspiration. I acknowledge this project to you, with love and appreciation.

Special thanks to my younger brother and my uncles; Bro. Sam and Bro. Samson for your unwavering love, care, and dedication that has shaped me into the person I am today. Your selfless love and your influence and values have guided me throughout this project, and I'm forever grateful for your presence in my life.

I would like to extend my heartfelt thanks to my friend; KAY and also my friends in hostel and my course mates who have supported me throughout this project.

May Almighty GOD bless you all (Amen).

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ABSTRACT

This project documents the ***as-built survey*** *of a designated section within Honeywell Estate, situated in Oke-Ose/Oke-Oyi, Ilorin South Local Government Area, Kwara State, Nigeria. The survey aimed to capture and verify the actual constructed conditions of infrastructure, plot boundaries, buildings, roads, drainage systems, and utilities against original design plans. Fieldwork utilized high-precision GNSS receivers and total stations to collect geospatial data, ensuring compliance with Nigerian Surveying Standards and accuracy tolerances (±10–20 mm). Key deliverables include georeferenced CAD drawings, digital terrain models (DTM), and a comprehensive report identifying deviations from approved designs. The survey establishes an authoritative spatial database for land administration, future development, dispute resolution, and infrastructure management within the estate. Results confirm critical discrepancies in plot dimensions and utility alignments, underscoring the necessity of as-built documentation for sustainable urban governance in rapidly developing regions like Kwara State.*

CHAPTER ONE

1.0 INTRODUCTION

As-built survey has been an essential element in the development of the human environment since the beginning of recorded history. It is performed to verify that a particular improvement on a parcel of land has been built according to the proposed design plans, specifications and setback requirement. It shows how any field change made during construction fit the overall design of the development. If this As-built data are not obtained, engineers, architect, land planners, clients and other may be misled in assuming that the construction work performed conforms perfectly to the original drawing .It is used to document the size or location of an improvement used to aid in the design of addition of buildings, extension, sewer and parking lot expansion. It helps landing institution to protect their interest, accurate decision making, updating of information and as a reference material for student ministry and individual.

The as-built survey is the set of geometric investigations conducted on a building during and after its construction, in order to produce a graphic processing (with 2D graphs and 3D models) that describes in an exhaustive the consistency of the artifact at that precise moment. The aim may also be to verify, through the as-built drawings, the correspondence between the approved project and what was actually built.

At the end of the verification survey, the as-built model is created. It is then completed and delivered to the client after the construction of the work (but updated as the work proceeds). The result is an information container that combines the 3D model with the data (geometric and not) related to the completed building (technical data sheets, manuals, photographic documentation, etc.).

In general, an as-built model shows the exact position of the structural, mechanical, hydraulic, electrical and architectural elements to reconstruct a complete picture of the building as is at the time of the survey.

The process of creating an as-built model starts with the geometric survey of the building and the collection of information to be included in the model and ends with the delivery of the BIM model to the client. Essentially, it is the *reverse engineering* of what usually happens in a traditional BIM workflow in which the 3D model is made to describe the project in detail and support the works to be carried out.

To obtain the 3D as-built model 2 paths can be followed:

- Modify the project's BIM model according to the works actually carried out on site;
- Proceed with the acquisition of the geometry of the existing building with special survey tools and techniques (laser scanner, photogrammetry, etc.).

The survey can be carried out with different instruments, from traditional and manual tools, such as measuring tapes, to the most technologically advanced devices (total stations, laser scanners, drones, geoslam, etc.).

1.2 BACKGROUND TO THE STUDY

1.2.1 HISTORICAL BACKGROUND

As-built surveying has a long history rooted in the need to document existing structures and infrastructure accurately. Ancient civilizations, like the Egyptians, used surveying for construction, as seen in the Great Pyramid of Khufu. Over time, surveying techniques have evolved from basic compasses and chains to modern technologies like GPS and laser scanning, allowing for more precise and comprehensive as-built documentation.

Here's a more detailed look at the background:

Early Surveying Methods:

- Ancient Civilizations:

Surveying had its roots in ancient civilizations, with evidence of its use in construction and land management in places like ancient Egypt. The Great Pyramid of Khufu, for example, demonstrates a remarkable understanding of surveying principles.

- Roman Civilizations:

The Romans used different border stones and directions/distances to link them, with examples documented in the Ascanius manuscripts, showing the use of surveying for mapping and land division.

- Colonial Era:

In the colonial era and early 1800s, surveyors primarily used a transit or compass and a "chain" for measurements. The most common chain was 66 feet long, divided into 100 links, and these units are still referenced in older deeds.

Evolution of Surveying Techniques:

- Introduction of Instruments:

The development of surveying instruments like theodolites and levels significantly improved accuracy and efficiency.

- Modern Technology:

Modern surveying employs technologies like GPS and laser scanning, allowing for high-precision data collection and detailed as-built documentation.

Purpose and Importance of As-Built Surveys:

- Accurate Documentation:

As-built surveys create a detailed record of the existing physical conditions and dimensions of a structure or property.

- Maintenance and Modifications:

They provide a valuable historical record for maintenance, repairs, and future modifications.

- Design and Construction:

As-built surveys are crucial for understanding the site's topography, soil conditions, and potential obstacles during construction.

- Legal and Regulatory Compliance:

They help ensure compliance with building codes and regulations.

In essence, as-built surveying has evolved from rudimentary techniques to sophisticated methods, driven by the need for accurate and comprehensive documentation of the built environment.

Why carrying out as-built surveys for the construction project?

Carrying out as-built surveys is essential for the creation of the building’s 3D model.

These operations allow designers to:

- have a precise and reliable model of the work for future renovation, expansion, and maintenance projects;
- have a detailed model for future uses, including the asset’s management phase;

- draw up a maintenance plan;
- carry out accurate energy or structural analyses;
- estimate the costs of the interventions;
- draw up building practices;
- implement the documentation relating to the surveyed situation;
- provide detailed information on the site layout;
- have a template for viewing existing conditions;
- create a BIM model that is the digital twin of the existing building;
- Verify the correspondence between the work carried out and that planned in the project.

1.3 STATEMENT OF THE PROBLEM

In the construction and infrastructure development sector, discrepancies often exist between design drawings and the actual structures constructed on-site. These variations may result from changes made during construction, design errors, unforeseen site conditions, or poor documentation practices. As a result, relying solely on design or construction drawings can lead to significant issues in facility management, future modifications, or expansions.

An As-Built Survey is essential to accurately capture the true positions, dimensions, and features of a completed structure or project as it exists on the ground. However, many construction projects—especially in developing regions—lack comprehensive as-built documentation due to limited awareness, technical expertise, or inadequate resources. These deficiencies lead to problems such as:

❖ Increased costs and delays in subsequent project phases.

- Legal disputes due to encroachments or boundary issues.
- Inaccurate or incomplete records for future planning or maintenance.
- Difficulty in verifying compliance with design specifications.
- Inaccurate or missing As-Built data can result in land disputes, especially in shared facilities, roads, or drainage systems that affect multiple property owners or government right-of-way.

1.4 AIM AND OBJECTIVES OF THE PROJECT

1.4.1 AIM OF THE PROJECT

The aim of this project was to produce an As-built plan of HONEYWELL ESTATE opposite Government cemetery along Saare-Oja-Oba Ilorin, kwara state, Ilorin East local government area, Kwara State for the purpose of ascertaining variations of detail as constructed on the ground and design specification.

1.4.2 OBJECTIVES OF THE PROJECT

- Establishing the perimeter using traverse of the project location.
- Measurement of relative position of the detail within the study area.
- To explore the power of computer application software especially in the plan production.
- Preparation of an overlay plan which facilitated the comparison.

1.5 SIGNIFICANCE OF THE STUDY

Production of As-built survey plan of medium density layout will be significant in the following ways:

- For accurate decision making during physical planning and further development and expansion of the estate.

- To facilitate quick update and retrieval of information for environmental management.
- As a reference material for student, ministry and individual for further research work.
- Enhance the knowledge of the student in the area of As-built survey.

1.6 SCOPE

The scope of this work encompasses detailed procedures for the development of a land information system for a perimeter layout. It involves the creation of a functional database reflecting the current state of the project area. The system will display digital information including ownership, parcel data, block no, land use and status, alongside other relevant non spatial information. These entities and attributes will serve as the foundation for the database design and creation, ensuring comprehensive and accurate data visualization.

In reckoning with aim and objectives of the project, the scopes include;

1. Project planning:
    - I. Office recce.
    - II. Field recce.
2. Demarcation and emplacement of property beacon (with minimum area of the not less than 5 hectares for Higher National Diploma).
3. Data acquisition:
    - I. Geometric or spatial data through perimeter traversing.
    - II. Attribute through oral interview.
4. Data processing using appropriate formula and software such Autocad and ArcGIS.
5. Information visualization and result analysis.
6. Complex report writing.

1.7 PERSONNEL

The following were the personnel who participated in the execution of the project.

NAME	MATRIC NO	REMARKS
1. OBAMILA ODUNAYO FUNKE	HND/23/SGI/FT/0101	AUTHOR
2. DADA OLUWAFRANMI. N.	HND/23/SGI/FT/0122	MEMBER
3. TOMOYE PELUMI FAVOUR	HND/23/SGI/FT/0119	MEMBER
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7. IDRIS OLONA	HND/23/SGI/FT/0108	MEMBER
8. ADEYINKA GRACE TOSIN	HND/23/SGI/FT/0098	MEMBER

1.8 PROJECT LOCATION

The project location is situated at HONEYWELL ESTATE opposite Government cemetery along oke oyi/oke ose road, Ilorin East local government area, Kwara State. Nigeria. It lies approximately within latitude 8° 33' 23.443"N and longitude 4° 40' 15.384"E with an approximate area of 7.18 hectares.

DIAGRAM OF THE PROJECT AREA

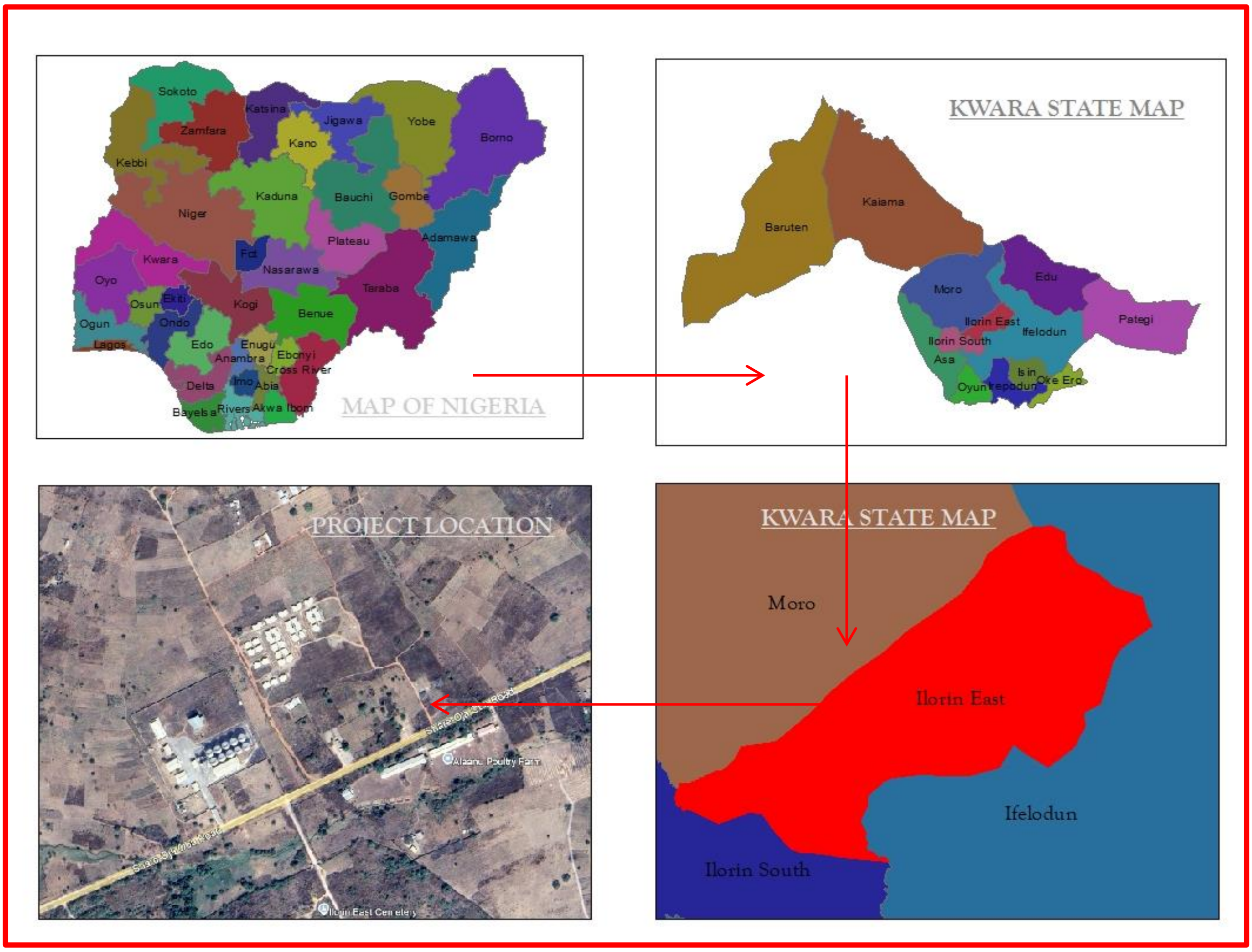


Figure 1.0: Map showing project location

CHAPTER TWO

2.0 LITERATURE REVIEW

Geodetic as-built surveys are a critical component in the life cycle of construction projects, serving as the final verification step that ensures structures are built according to approved plans and are safe for occupancy. This survey captures the actual spatial position and geometry of constructed features, allowing comparison with the original design for compliance and documentation. Upon completion of construction, a geodetic as-built inventory must be conducted. This step is a legal requirement for obtaining an occupancy permit (Dybeł and Kampczyk, 2018). As-built measurements provide the true condition of the completed facility and supply vital data to update the national Terrain Information System databases (Grochowska, 2014; Lewińska and Pargieła, 2018). These surveys confirm the building's position relative to plot boundaries and development plans (Przewięźlikowska and Krzyżek, 2016). Furthermore, the surveyor's report influences subsequent phases of the construction and investment process.

In Poland, the participation of a licensed surveyor is essential in the implementation of any construction project that requires a building permit. According to Mierzejowska (2017), surveyors are involved from the very beginning of a project. One of their first responsibilities is preparing an up-to-date map for design purposes, which forms the foundation of the construction design process (Kampczyk, 2015). During the actual construction, surveyors carry out the setting-out of structures and provide geodetic supervision to ensure accuracy and compliance with design specifications.

Accuracy in as-built surveys is critical to ensure the reliability of spatial data. Research by Kala (2009) and Karabin et al. (2021) emphasizes the need for stringent accuracy standards during field data collection, especially in utilities surveying and underground infrastructure mapping. The acceptable limits of deviation must be defined and enforced by national geodetic regulations, which in turn affect the reliability of updates to national geoinformation systems.

Comparative studies by Klein et al. (2011, 2012) and Taha & Ibrahim (2021) demonstrate that photogrammetric methods, while faster, may lack the precision of traditional geodetic tools in complex or obstructed terrains, making a case for hybrid or complementary techniques.

With advancements in spatial technologies, traditional as-built surveys are evolving into automated, data-rich models using LiDAR, UAV photogrammetry, 3D laser scanning, and Building Information Modeling (BIM). Studies such as Tang et al. (2010) and Son et al. (2015) describe workflows that allow engineers to generate 3D models automatically from scanned point clouds, improving accuracy, reducing field time, and providing better visualization for engineers and clients.

The integration of as-built BIM models supports facilities management, allowing construction firms and clients to monitor asset performance, conduct renovations, and manage maintenance throughout the building lifecycle (Dore & Murphy, 2014; Lin et al., 2018; Jung et al., 2018). Prokop et al. (2021) emphasized that 3D as-built documentation not only supports project verification but also provides the foundation for digital twins used in smart cities and digital infrastructure development.

The role of the surveyor is not limited to boundary marking or property division. In modern construction, surveyors are involved from the planning phase (e.g., producing maps for design) to field staking, through to monitoring construction progress and ultimately verifying the as-built condition of the structure (Kampczyk, 2015; Mierzejowska, 2017).

The collection and analysis of data on the three-dimensional (3D) as-built status of large-scale civil infrastructure – whether under construction, newly put into service, or in operation – has been receiving increasing attention on the part of researchers and practitioners in the civil engineering field. Such collection and analysis of data is essential for the active monitoring of production during the construction phase of a project and for the automatic 3D layout of built assets during their service lives. This review outlines recent research efforts in this field and technological developments that aim to facilitate the analysis of 3D data acquired from as-built civil infrastructure and applications of such data, not only to the construction process per se but also to facility management – in particular, to production monitoring and automated layout. This review also considers prospects for improvement and addresses challenges that can be expected in future research and development. It is hoped that the suggestions and recommendations made in this review will serve as a basis for future work and as motivation for ongoing research and development.

Hyojoo Son , Frédéric Bosché, Changwan Kim (2015) Advancements in on-site spatial survey technologies (e.g., photo/video-grammetry and terrestrial laser scanning) enable more efficient acquisition of 3D data on as-built civil infrastructure (hereinafter referred to as "as-built data") than is possible with traditional manual techniques. In this review, the term *as-built* refers to either the actual state of an entire facility or one of its constituent components at the completion of construction, or to the actual state of a built asset at any time during its life cycle, particularly during its service life. Three-dimensional as-built data acquired from civil infrastructure have been used to establish geometric properties of entire facilities and their constituent components. More recently, such data have come to be regarded as a tool to be utilized for managerial purposes at various points in the life cycle of a project: during construction, upon completion of construction, and during operational and maintenance phases relevant to the civil engineering field.

For purposes of on-site dimensional quality control, progress tracking, and inspection, one particularly important application of as-built data in the construction phase is production monitoring, which entails making comparisons of the actual ("as-built") state of a project with the "as-designed" state defined in the contractual agreement. Examples of research studies in this area include proactive on-site tracking of the physical progress of construction activities by comparing 3D as-built data acquired on the site of a facility under construction with the design information embedded in the building information model (BIM). There are several reasons why it is so important – indeed, vital – for researchers and practitioners to develop new methods and technologies for use in production monitoring. For starters, the design documents may not provide complete details of a planned facility, leaving some aspects thereof to the owner and the contractor to decide later. Because of such delayed decisions, it can be difficult if not impossible to adequately record the as-built condition of an entire facility or of one of its constituent components within the as-built documentation. Such situations are particularly common in the case of mechanical, electrical, and plumbing (MEP) systems that are not fully designed (e.g., those whose characteristics are specified in only rudimentary form, such as via line sketches). In addition, it is sometimes difficult to adequately track and record (within the as-built documentation) changes based on conscious decisions that are made during construction and hence could yield a final product that deviates from the as-designed state. Finally, it can be even more difficult to adequately track and record (in the as-built documentation) deviations that are more subtle and are not the results of conscious decisions (e.g., deviations due to poor workmanship).

Another important aspect of the construction, operation, and maintenance phases of civil infrastructure is automated layout. The Oxford English Dictionary defines *layout* as "the way in which the parts of something are arranged or laid out." The Collins English Dictionary defines *layout*, in its technical sense, as "a drawing showing the relative disposition of parts in a machine, etc." In this review, the term *automated layout* is used to mean the process of automatically determining geometric properties (dimensions, shape, and 3D position (location and orientation)) and other semantic (real-world) attributes of individual components of a structure, as well as the relationships between them, from 3D as-built data.

Automated layout is used for documentation purposes, such as in the preparation of a contractual agreement that must be delivered by the contractor to the owner – that is, a package that contains all the pertinent as-built information, particularly CAD drawings. Automated layout is also used for purposes of facility management, to record and update the status of the built assets. Some studies have focused on transforming 3D as-built data acquired from a facility into 3D structured or object representations, such as CAD models, in order to better illustrate the as-built conditions). Such representations or models can then be used as the basis for making managerial decisions (e.g., on repairs and maintenance).

Recording of information on the as-built status of individual components of a facility is needed, because the as-designed state, such as CAD drawings or early component selections made by the design team, may not correspond to the infrastructure actually produced. This could be due to contractors (for the initial construction or for subsequent add-ons or modifications) either not adequately and fully capturing the state of the facility as built, not building precisely to design, or handing over the design documentation without fully communicating that the asset was not built as designed. Regardless of the reason for discrepancies between the as-built state and the as-designed state, an aggravating factor is the owner's potential lack of control over the as-built information. Even if an accurate 3D as-built layout of the facility is produced – whether after the construction phase, in the case of new construction; or after a renovation, upgrade, or remodeling of part/all of the facility; or after replacement of one or more of its constituent components – the original as-built layout must be modified on a timely basis to reflect and update the state of the facility.

Situations such as the ones described above have created a need for methods and technologies that enable the robust, efficient, and cost-effective acquisition of as-built data on demand, and subsequent processes for the extraction of the valuable as-built information by construction professionals and facility managers. For this reason, methods for acquisition of such data through on-site surveys and the extraction of valuable information – to be used for production monitoring during the construction phase, and for automated layout during the construction, operational, and maintenance phases – have been investigated by researchers and practitioners in the civil engineering field.

The opinion or report issued by the surveyor during the as-built stage carries legal and administrative significance. It can determine whether the constructed facility complies with local zoning laws, development plans, and land use policies. In many jurisdictions, surveyor-certified as-built maps are necessary to legalize occupancy or register newly developed land parcels (Przewięźlikowska & Krzyżek, 2016).

If at any time during the progress of the works any error shall appear or rise in the position levels dimensions or alignment of any part of the works the contractor on being required so to do by the engineers shall at his own cost rectify such error to the satisfaction of the engineer or the engineer's representative in which case the cost of rectifying the same shall be borne by the employer (Uren & Price, 2010).

Jorg Blakenbach (2018) Building surveying is an important element for as-built documentation as well as for planning and construction in existing contexts. In connection with BIM, however, building surveying faces new challenges. In the past, the results of surveying were typically two-dimensional CAD drawings depicting floor plans, sections, and views. BIM, in contrast, relies on digital three-dimensional building models based on an object-oriented modeling paradigm including semantics, descriptive data, and relationships of building elements. This holistic building modeling approach also impacts the surveying workflow for building measurement as well as the data processing. Nevertheless, the basis for building measurement are geodetic surveying techniques with single-point methods (manual surveying, tacheometry) or aerial measurement methods (photogrammetry, laser scanning) in combination with appropriate surveying software. Also, new developments in context of spatial data capturing (UAVs, multi sensor and mobile mapping systems) rely on these basic methods.

The as-built project information represents how construction is performed (Zubair, 2006).

Construction managers need to keep track of design and construction changes and as-built information to control and monitor construction progress. As-built surveys are required by many agencies to prove the location of a structure at a point in time.This process is required to record variations of points from original engineering plans to what is built, and the final set of drawings produced after a construction project (Kaamin, Sarif, Husin, Supar, Razali, Sahat, & Mokhtar, 2019)

In Turkey, where seismic activity poses a higher risk, building inspection is even more critical. The Building Inspection Law, effective nationwide since January 1, 2011, plays a key role in ensuring safe construction (Meydan Yıldız, 2019). Geomatics engineers in Turkey are responsible for conducting as-built assessments as part of construction applications. The process begins with one engineer authorized for the building application and ends with another engineer, under the oversight of a building inspection firm, verifying and registering the final construction. These activities are carried out within the GRS 8 Ellipsoid and ITRF 96 coordinate system framework.

Ukraine has also initiated reforms to its construction regulations, particularly during the 2020–2021 periods, when the country attempted to deregulate and reorganize its State Architectural and Construction Inspectorate. However, these changes were delayed due to the

COVID-19 pandemic (Ivanchenko, 2021; Turovets, 2021). Given these ongoing changes, the Polish model of legislative and technical regulation may offer valuable insights for Ukraine.

Poland's geodetic and cartographic practices are governed by the Geodesic and Cartographic Law Act (GCL) (Noszczyk, 2018). This legislation outlines the structure and responsibilities of the national geodetic and cartographic services, as well as the management of land and building records, utility networks, and the real estate information system. It also establishes professional qualification requirements and standards for surveying practices. The Act mandates the performance of as-built measurements and defines the facilities subject to this requirement (Kończak, 2022).

Eddy M. Roja, Carrie Sturts Dossick and other (2009). There is a lack of intelligent digital data for effective support of improvements and/or maintenance of existing United States Army facilities. The move by the Corps of Engineers in mandating the use of Building Information Modeling (BIM) is the first step towards getting intelligent as-built engineering data into the hands of the installation's Directorate of Public Work (DPW). However, this only addresses new facilities, which represent a very small portion of the DPW's facility information needs. The real need is to find the most efficient method of capturing existing facility as-built information so that the DPW can maintain its daily operations and maintenance as well as real property asset management activities. This paper presents a comparative analysis of alternative technologies for capturing as-built information for existing facilities at Fort Lewis in Washington State. Field surveys were performed on four buildings over a period of four weeks to capture facilities data based on the COBIE (Construction Operations Building Information Exchange) standard. Data was captured using (1) paper forms and computer data entry, (2) laptop computers, (3) digital pens, and (4) handheld computers. Hand-held computers were determined to be the most efficient technology (cost and time) under the experimental conditions of the study. However, the most important findings of this study do not reside in the specific issues related to each technology, but in the lessons learned regarding three major challenges that uncovered during the experimental process: logistical issues, operational issues, and user interface issues.

Pingbo Tang, Daniel Huber and others (2010) creation of an as-built BIM involves measuring the geometry and appearance of an existing facility and transforming those measurements into a high-level, semantically rich representation. The goals of this article are threefold: 1) to document the state-of-the-art methods for creating as-built BIMs, which are primarily manual processes; 2) to survey existing techniques within the relevant fields of civil engineering and computer science and evaluate their suitability for automating the as-built BIM creation process; and 3) to identify technology gaps and barriers to automating the process. BIMs incorporate many aspects of a facility's components, such as material characteristics, cost, and behavioral properties. In this article, we focus primarily on methods to model the geometry and functional properties of the components in a facility. The processes described in the remainder of this section are a synthesis of interviews conducted with professional laser scanning service providers, discussions with representatives of laser scanning hardware vendors and BIM creation software vendors, and formal collaborations with domain experts within government agencies, including the General Services Administration (GSA) and the National Institute of Standards and Technologies (NIST).

According to Kruk (2011), the as-built map is essential for notifying authorities about the completion of a building and applying for an occupancy permit. The legal basis for these measurements is detailed in regulations by Cienciała and Florek-Paszkowski (2019), which define what must be measured, the required accuracy, and how data should be organized. The final documentation must be submitted as a technical report to the national geodetic database.

All geodetic works in Poland must comply with the national spatial reference system (Doskocz and Rejchel, 2016). This system is physically realized through geodetic networks, whose setup and maintenance are also strictly regulated (Alsabry et al., 2017). The results of as-built inventories are used to update geospatial databases, a requirement enforced by regulations such as MRPiT (2021a, 2021b).

Research on as-built surveys has been carried out in several domains. Some focus on accuracy (Kala, 2009; Usmani et al., 2020; Karabin et al., 2021), while others explore automation and model generation (Tang et al., 2010; Son et al., 2015; Shrestha and Jeong, 2017). There are also studies comparing field-based and image-based methods (Klein et al., 2011, 2012; Taha and Ibrahim, 2021), and research into 3D as-built models and Building Information Modeling (BIM) systems (Bhatla et al., 2012; Prokop et al., 2021; Lin et al., 2018; Dore and Murphy, 2014; Jung et al., 2018; Uchański and Karsznia, 2018; Jírová and Pešík, 2021).

Turkey offers a contrasting example where seismic risk plays a vital role in construction law. Since the introduction of the nationwide Building Inspection Law in 2011, geomatics engineers are involved not only in setting out but also in inspecting and validating as-built structures under regulated frameworks. The process is standardized on the GRS80 ellipsoid and ITRF96 coordinate systems (Meydan Yıldız, 2019). This dual-engineer system—where one initiates construction documentation and another verifies as-built compliance—ensures objectivity and accuracy in data reporting.

The graphical representation of what a building will look like after construction has become a criterion today before any form of construction is done. This is produced in form of a plan which is tagged building plan. The architects are the major professionals saddled with the responsibility of producing such a plan. Although the building plans are used by builders and contractors to construct buildings of all kinds based on the design, also the quantifiers otherwise called quantity surveyors use this plan to estimate how much the building project will cost and to prepare a bill of quantity. However, before a building plan can be produced the size, location, title of the land, etc. has to be known, in order to have proper dimensioning and orientation, this is presented in a plan called the cadastral (Perimeter) survey plan, done by a surveyor (Sahely, Halla, Kennedy, 2019).

The implementation of building plans is done when building construction starts, however, for on-site dimension standard control, update follow-up and comparison, is majorly the reason for employing as-built data gathered in the construction stage which I tag progress monitoring, this also involves making a similarity check between the on-site (‘’as-built’’) state of construction with the ‘’as-designed’’ state stated in the contractual agreement. Rabanni T., and van den Heuvel F. (2006), used as-built data for dynamic onsite documentation of the visual progress state of construction work by comparing three-dimensional asbuilt data captured on the construction site of a facility with the design plan attached in the building information model (BIM). Clayton., Mark, Robert Johnson, and Yunsik Song (2016), different from other land surveys, done before infrastructures were constructed on land, an As-built survey is engaged while a facility construction is on, during, and after the completion of construction has been achieved. As requested by clients, As-built shows the infrastructural state and extent of the land, as they appear at the time of observation.

C. Ghilani and P. Wolf (2012), an As-built survey plan shows the precise end positions and layout of engineering constructions and record any design changes that may have been updated in the construction, 2 which may include additional constructions such as a walkway, soakaway, mast location, generator house, etc. These are particularly important when underground facilities are constructed, so their positions are accurately known for maintenance/ repair purposes. Therefore, As-built survey designs are utilized for remodeling a structure for the purpose of expansion, retrofitting, refurbishing renovation, or visualization. The main purpose or importance of plan updates is to know what development or reestablishment made on land. Since natural and artificial events are continually causing changes to the appearance of objects on the earth's surface, such as updates are growing because they are concentrated on existing structures and urban development. K.Jeyapalan & D.Bhagawati (2000), explained a database as a progressive collection of data. They support electronic storage and manipulation of data, in order to make data management easy. A database is an organized collection of information, usually with one central topic. In a computer database (as opposed to a paper database), the program that you use to enter and manipulate the data is either a database program or a database management system (DBMS).

Ukraine has taken steps toward reforming its construction monitoring systems by deregulating certain aspects of its State Architectural and Construction Inspectorate. However, due to the COVID-19 pandemic, these reforms were delayed. Scholars like Ivanchenko (2021) and Turovets (2021) suggest that Ukraine could benefit from adopting elements of Poland’s legal and technical framework, particularly in its use of centralized geospatial databases and legal mandates for post-construction surveys.

As-built surveys also play a crucial role in updating cadastral and utility records. The regulation by Cienciała and Florek-Paszkowski (2019) outlines the specific elements to be measured, the minimum required precision, and the standardized format for submitting survey results. These regulations align with international practices aimed at integrating spatial data into national geoinformation systems (Doskocz & Rejchel, 2016; Alsabry et al., 2017).

The role of as-built surveys has been widely explored in academic literature. Kala (2009) and Karabin et al. (2021) emphasize accuracy in geodetic measurement techniques, while Tang et al. (2010) and Shrestha & Jeong (2017) focus on automated model generation and LiDAR-based as-built documentation. Klein et al. (2011, 2012) compare manual field methods with photogrammetric techniques, highlighting efficiency and accuracy trade-offs. Other studies explore the integration of as-built surveys with BIM and 3D modeling platforms, facilitating better asset management and visualization (Dore & Murphy, 2014; Lin et al., 2018; Jung et al., 2018).

Bhatla et al. (2012) and Prokop et al. (2021) further explore how 3D as-built models support construction verification and facilities management. The integration of BIM with geospatial data is becoming a growing trend in developed countries, offering improved interoperability and lifecycle data management.

In Nigeria and other Sub-Saharan countries, the integration of as-built surveys into formal planning and documentation is still evolving. Studies have identified a lack of regulatory enforcement, limited technical capacity, and low awareness among construction stakeholders as significant barriers (Okolie & Okeke, 2013; Ajayi & Akinpelu, 2017). As Nigeria modernizes its urban infrastructure, strengthening geodetic practices and adopting international standards will be critical for sustainable development and compliance with global best practices.

M Kaamin, A S Sarif, N A M Husin and others (2025) As-built surveys are needed to record variations from original Engineering plans to what is actually built and the final set of drawings produced at the completion of a construction project. As-built surveys are required by many agencies to prove the location of a structure at a point in time. These are especially important for maintenance and future development of the site. To handle this task conventionally, total station was used, but it is more costly, time consuming and more skilled surveyors are required to conduct a total station survey. Purpose of this study is to investigate the Unmanned Aerial Vehicles (UAV) system for comparison of the proposed drawing of UTHM Pagoh Campus with the as-built orthomosaic images and to carry out the mapping based on imaged by UAV. Therefore, a method of mapping by UAV, the application of camera-equipped for visually monitoring construction and operation of buildings was used to collect all the information directly on the site which is on the study area. It is also to carry out the mapping based on imaged by UAV. The data collections show that method to earn all information required for this study is by using UAV equipment, Pix4D and Global Mapper software to generate the images. The result of the study is proved that the ability of the UAV in production of as-built survey mapping is can be achieved and it also ease the as-built survey work due to saving time and skilled surveyors are not required. Thus, UAV is very suitable for engineering work purposes

The project aimed at to producing an As-built survey plan of honeywell estate opposite Government cemetery along oke oyi/oke ose road, Ilorin East local government area, Kwara State for the purpose of ascertaining variations of detail as constructed on ground with the design specification. The study includes the full scope of field measurements, data processing, preparation of the final as-built documentation, and submission of the technical report speaking to analysis in the correlation as built on ground and design specification.

CHAPTER THREE

3.0 METHODOLGY

The methodology adopted for this as-built survey project is structured into several interrelated stages to ensure precision, compliance with surveying standards, and the production of accurate deliverables. The stages include reconnaissance, equipment preparation and testing, connection to existing control, field data acquisition, data processing, and plan production. The survey was carried out using a total station as the primary instrument.

3.1 PROJECT PLANNING

Effective planning is essential before initiating any survey assignment. This process begins with a thorough analysis of the project area, allowing the researcher to gain a clear understanding of the site prior to commencing fieldwork known as “RECONNAISSANCE”. Reconnaissance typically consists of two main components:

(i) Office Planning (ii) Field Reconnaissance

Effective surveying begins with comprehensive project planning, a systematic process that establishes the foundation for accurate data collection. This preparatory stage involves:

- Thorough research on the target land parcel
- Clear definition of survey objectives and deliverables
- Precision assessment to determine methodology and equipment.

3.1.1 OFFICE RECONNAISSANCE

Purpose: To gather all available intelligence before field deployment

Key Activities:

✔ Document Review:

- Examine existing cadastral plans, Structural and Architectural plan

  ✔ Regulatory Compliance Check:

- Confirm survey requirements with local authorities (e.g., Surveyor-General's office)
- Identify any special permitting needs

  ✔ Resource Planning:

- Select appropriate instruments based on required accuracy
- Develop preliminary timeline and budget

  ✔ Risk Assessment:

- Identify potential obstacles (e.g., terrain challenges, legal disputes)
- Plan mitigation strategies

3.1.2 FIELD RECONNAISSANCE

Field Reconnaissance (Site Investigation)

Purpose: To ground-truth office research and establish practical parameters

Execution Protocol:

1. Physical Inspection:

- Verify accessibility and terrain conditions
- Identify natural/man-made features affecting measurements

2. Control Network Assessment:

- Locate and evaluate existing survey monuments
- Plan optimal control point placement

4. Preliminary Measurements:

- Conduct test shots to verify instrument performance
- Establish initial baselines

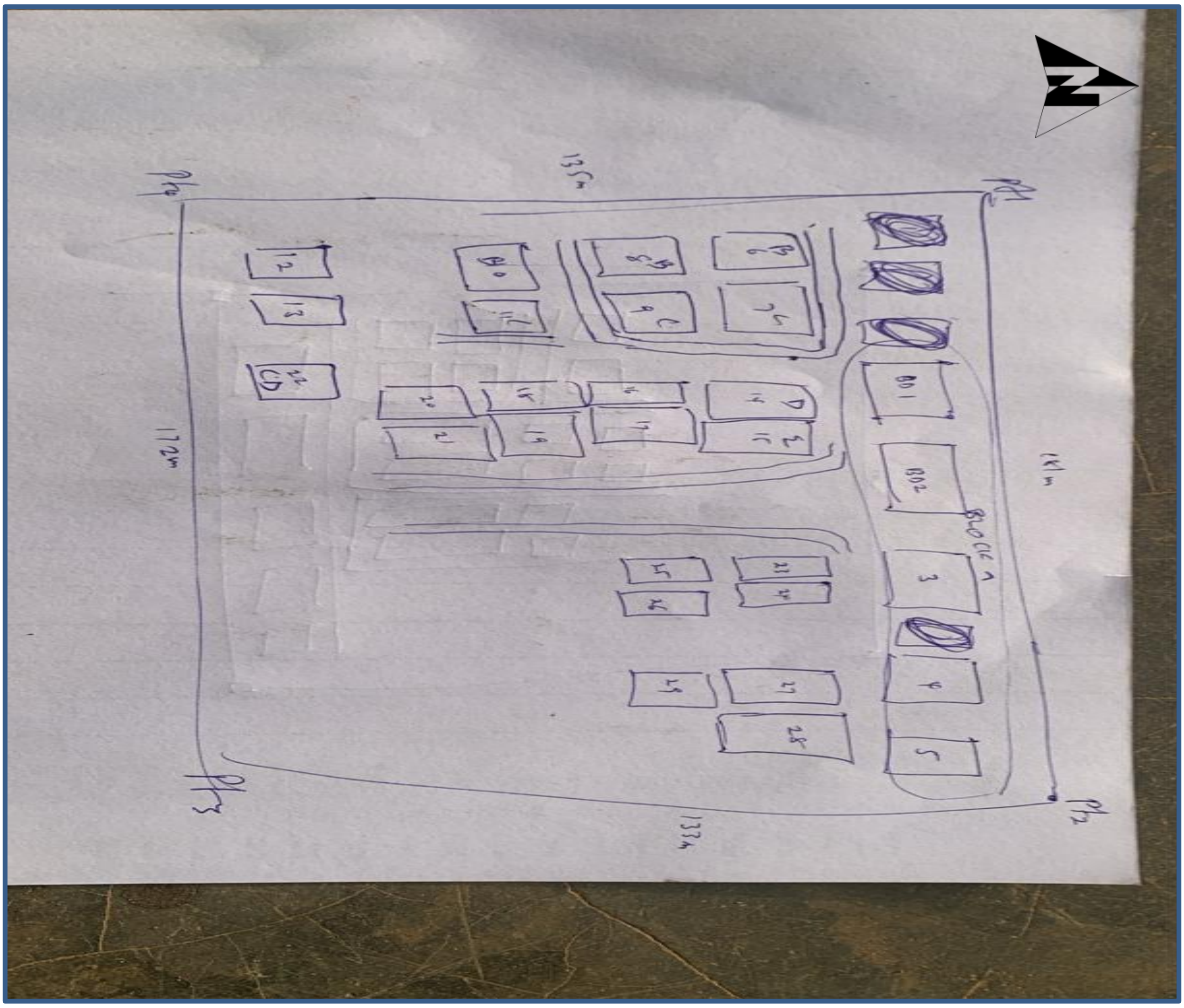


Figure 3.1: RECCE Diagram

3.2 DELIVERABLES FROM RECONNAISSANCE

- Working Diagram: Initial site sketch with key features
- Methodology Report: Approved techniques and equipment list
- Risk Register: Documented challenges and solutions

3.3 INSTRUMENTATION

3.3.1 HARDWARE USED

The following equipment was used:

i. Total station and accessories (Topcon ES-103)

ii. One Tripod

iii. Prism and Tracking rod

iv. One 7.5 meters short tape

v. One Plumb bob

vi. One Cutlass

vii. Bottle corks and nails

viii. Writing materials.

ix. Personal computer with the down listed specification:

Model: HP 15 Note book PC

System Manufacturer: Hewlett-Packard

Rating: 1.0 Windows Experience Index.

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

Installed Memory RAM: 8.00 GB

System Type: x64-based PC.

Product ID: F9F84EA#ABV

3.3.2 SOFTWARE USED

Some of the software used includes:

i. AutoCAD 2007

ii. Notepad

iii. Microsoft Word 2007

iv. Microsoft Excel 2007

v. ArcMap 10.5

3.4 EQUIPMENT PREPARATION AND INSTRUMENT TESTING

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

3.4.1 TEST FOR DGPS

The following steps were taken during the test for the GPS equipment used.

i. Every cable was appropriately connected.

ii. The GPS was switched on and booted for a few seconds.

iii. The level of battery used was checked to confirm if they were fully charged.

iv. The storage device was checked in case of enough space for data storage.

v. All necessary configurations were strictly done.

vi. After configurations, the receivers were allowed to track satellites.

vii. The receivers were allowed to collect data for 30 minutes and data were saved.

viii. After downloading and processing the data, the result of the receivers displayed the corrected local time and their approximate positions. This indicated that both reference and rover receivers were in good condition.

3.4.2 TEST FOR TOTAL STATION

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

3.4.2.1 PERMANENT ADJUSTMENT

1. Battery: Ensure full charge.
2. Optics: Clean lenses and prism.
3. Firmware: Update to latest version.

3.4.2.2 TEMPORARY ADJUSTMENT

- Setting up
- Centering
- Leveling

3.4.3 SETTING UP PROCEDURES

COLLIMATION TEST

- Purpose: Verify line of sight alignment.
- Procedure:
  - Set up the instrument at midpoint between two prisms (50m apart).
  - Measure horizontal angles to both prisms (Face Left/Face Right).
  - Acceptable error: ≤ 10" (per ISO 17123-3).

TILTING AXIS TEST

- Check perpendicularity of horizontal axis to vertical axis.
- Tolerance: ≤ 15" deviation.

EDM CALIBRATION

- Compare measured distances against a calibrated baseline.
- Correction: Apply ppm adjustment if error > 3mm.

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

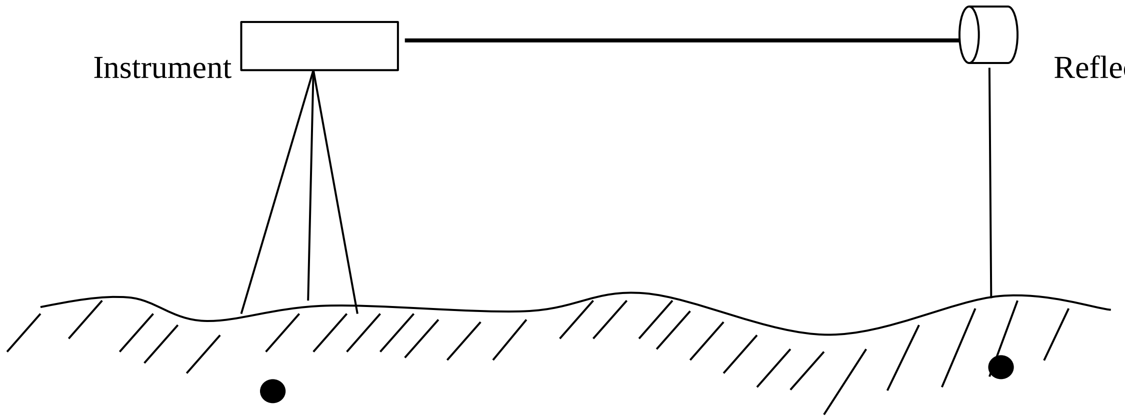


Figure 3.4.3: Instrument Test

Table 3.4.3: Collimation test of Total Station

STN	Sight	Face	HCR	Reduction	VCR	Reduction
A	B	L	156º 07’ 11.33”		88º 22’40”	
	B	R	336º 07’ 31.3”	180º 00’ 20”	271 º 37’ 1”	359 º 59’ 41”

Author Survey, 2025

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

=00°00’20’’ =00°00’20’’/2 =00°00’10’’

VERTICAL INDEX ERROR=360° - 359°59’41’’

=00°00’18’ =00°00’18’’/2 =00°00’9’’

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

3.5 CONTROL CHECK

Three control beacons (**KPT 120X**, **KWCS102** and **SC/KWEAS5072**) 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 **KWCS102**. After performing all the necessary temporary adjustment, the reflector was placed on the control beacon **KPT 120X** 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 **SC/KWEAS5072** 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.

Table3.8: Table showing the back computation of the control coordinates

From STN	Bearing	Dist(m)	ΔN	ΔE	Northing(m)	Easting(m)	ToSTN
					945235.040	682280.278	KPT 120X
KPT 120X	68°53'46"	1397.130	503.050	1303.424	945738.095	683583.702	KWCS102
KWCS102	64°07'57"	540.797	235.946	486.612	945974.041	684070.314	SC/KWEAS5072

Source: office of surveyor general kwara state

Table3.9: Table showing the distance observation result of the control check

FROM	OBSERVED DISTANCE (m)	COMPUTED DISTANCE (m)	TO
KPT 120X	1397.029	1397.130	KWCS102
KWCS102	540.694	540.797	SC/KWEAS5072

Table3.10: Table showing the observation result of the control check

STN	SIGHT	FACE	OBSERVEDHZANGLE	REDUCED HZANGLE	MEAN
	KPT 120X	L1	357° 08'47"		
KWCS102	KPT 120X	L2	288° 14'07"	68° 54'40"	
	SC/KWEAS5072	R2	108° 52'13"	68° 54'46"	
	SC/KWEAS5072	R1	177° 46'59"		68° 54' 43"

Difference in angle (observed -computed)=68°54'43"-68°54'40" =00° 00'03"

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°00'03") is less than allow able error. Therefore, the controls were angularly intact.

3.6 MONUMENTATION

In selecting station to represent the perimeter of the project area, establishment of the station were done so as to define the boundaries of the project area using survey beacon. For the project sake, station was established and they were marked with beacon and firmly driven into the ground hence, ensuring that stability of the station pegs in such w away that they cannot be temper with.

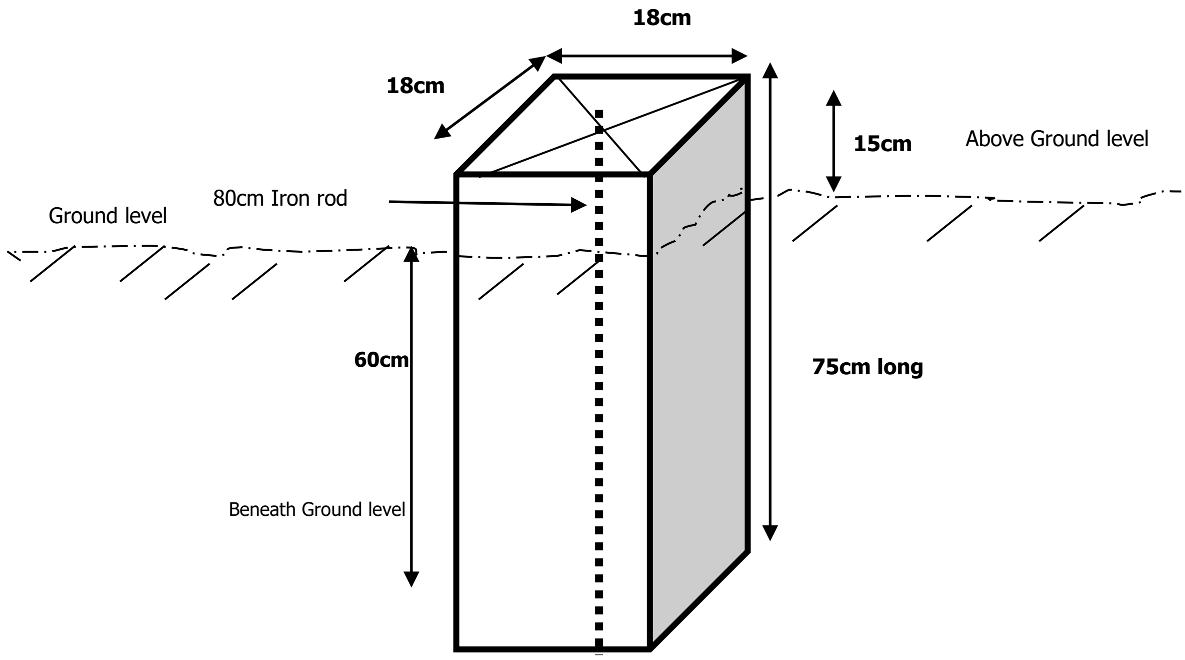


Figure 3.5 Typical Third order Survey Beacon

3.7 CENTERING AND LEVELING

- Position the total station vertically over a known control point known as the instrument station.
- Align the front face of the total station with two tribrach foot-screws.
- Adjust the horizontal bubble in the display to be at it centre of runs by tuning those same two first foot-screws.
- Adjust the vertical bubble using the third foot-screw.
- Once both the vertical bubble and the horizontal bubble at a time are found to be centre of their runs, the total station is rotate randomly at 360° for checking.

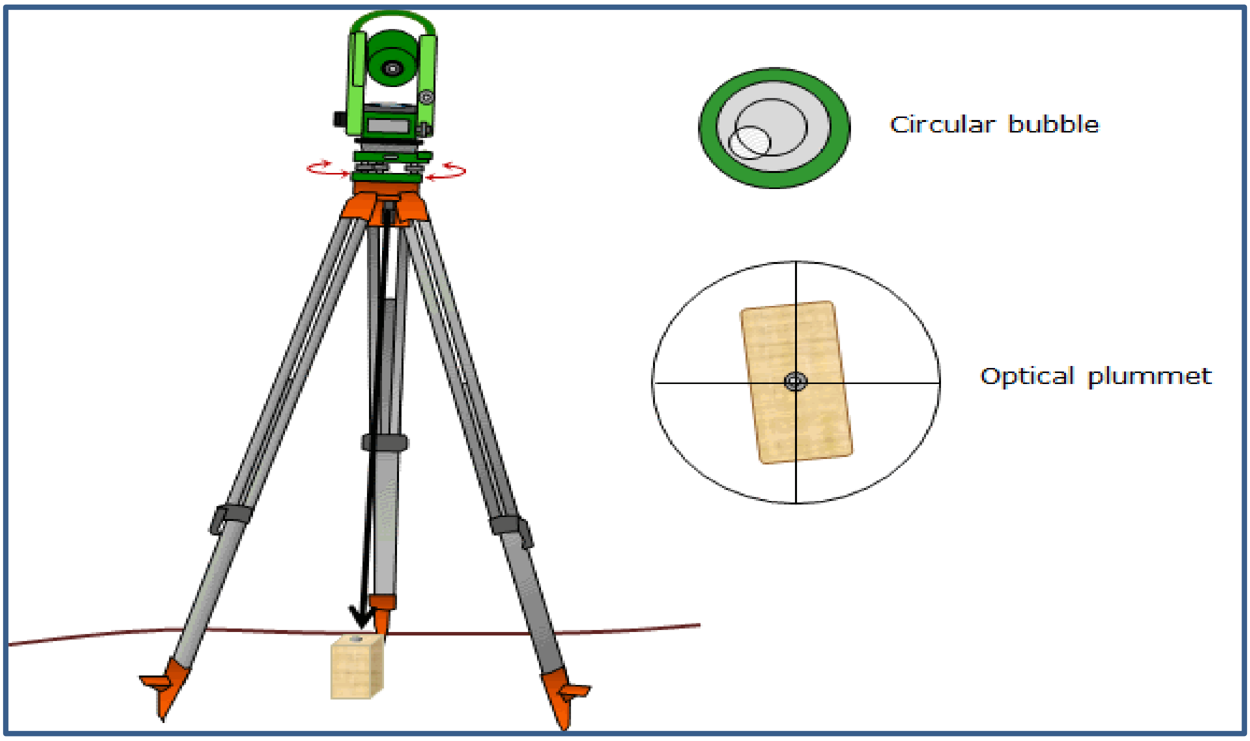


Figure 3.6: Leveling Operation of a Total Station

3.7 DATA ACQUISITION (FIELD MEASUREMENT)

The data acquisition stage involves the acquisition of geometric data which were acquired using traversing and detailing techniques.

3.7.1 TRAVERSING

This is a series of connected straight lines, the length and direction of which are determined from measurements. This includes the distance measurement and angular measurements which include horizontal angle and vertical angle between points, whose direction between selected points is determined after some calculations. The total station computed directly the angle and distance measured on the site to determine the coordinates of the point with the aid of the processor. The total station was used to determine the coordinates of the boundary of the project site. The instrument was set on control 'SC/KW D6565 AF' and adjustment (temporary) was done, the instrument was focused at the reflector on point ‘SC/KW D6566 AF’ to set orientation and point ‘SC/KWD6567 AF’ was observed as the forward station. All other boundary point was observed subsequently as the reflector was placed on them referencing to previously establish transverse point until all point was established.

3.7.2 DETAILING

Detailing entails fixing both natural and artificial feature that exists in the boundary. These include buildings, electric poles, footpaths, culverts, etc. In this project, details were fixed using the total station and its accessories using the ray shooting method. Here, the ray shooting method was employed to effectively fix the details within the project area. Features such as roads, buildings, etc. were fixed. To achieve this, the total station is set on the transferred point in the project boundary to bisect many edges of details and the reflector was placed at a known station for orientation before positioning it at each corner of the details. The coordinate of each corner is observed and recorded. The details taken include Boundary, Road, and Building.

Field data collection was performed by systematically observing and recording the coordinates of physical features and structures relevant to the as-built survey. Data was stored electronically in the instrument's internal memory for download and post-processing.

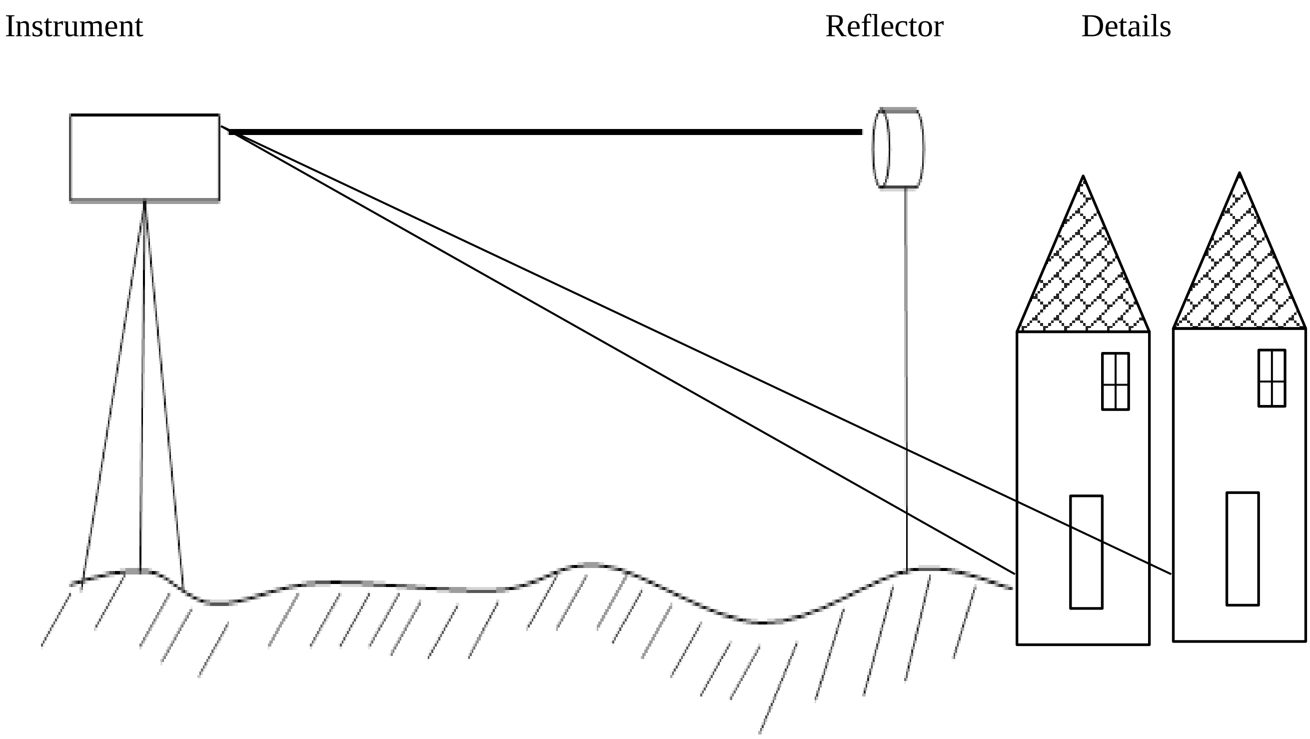


Figure 3.7.2: Illustration of Detailing by Ray shooting

3.8 DATA PROCESSING, MAPPING AND CARTOGRAPHY

This entails retrieving, downloading, sorting, and analysis of the acquired data (field data). The recorded data was downloaded and processed using suitable surveying software (e.g., AutoCAD, Civil 3D, or GIS applications). Processing steps included:

3.8.1 DATA DRAUGHTING AND PLAN PRODUCTION USING AUTOCAD

All detailed features were plotted according to their accurate positions and represented with appropriate symbols and labels. This was done by importing the downloaded data inform of excel file format (.csv) into Notepad in order of (_Text Easting,Northing Text Height Rotation Angle Height) and save as a script file format (.scr) which is then run on Autocad. Each points is displayed label with point I.D. Nodes were joined into lines, lines join to form Polygon, this was repeated until all feature were visualized and represented.

Procedure:-

Data Import

- Use AutoCAD's "SCRIPT" or "POINT" command to import points.
- For Civil 3D users, the "Import Points" function allows for direct import of point files with format specifications (e.g., PNEZD or PENZD).

Layer Structuring and Object Classification

- Use layers to differentiate features: e.g., Layer: FENCE, Layer: ROAD_EDGE, Layer: WALL.
- Convert point data into polylines or line strings using manual drafting or point connectivity logic.

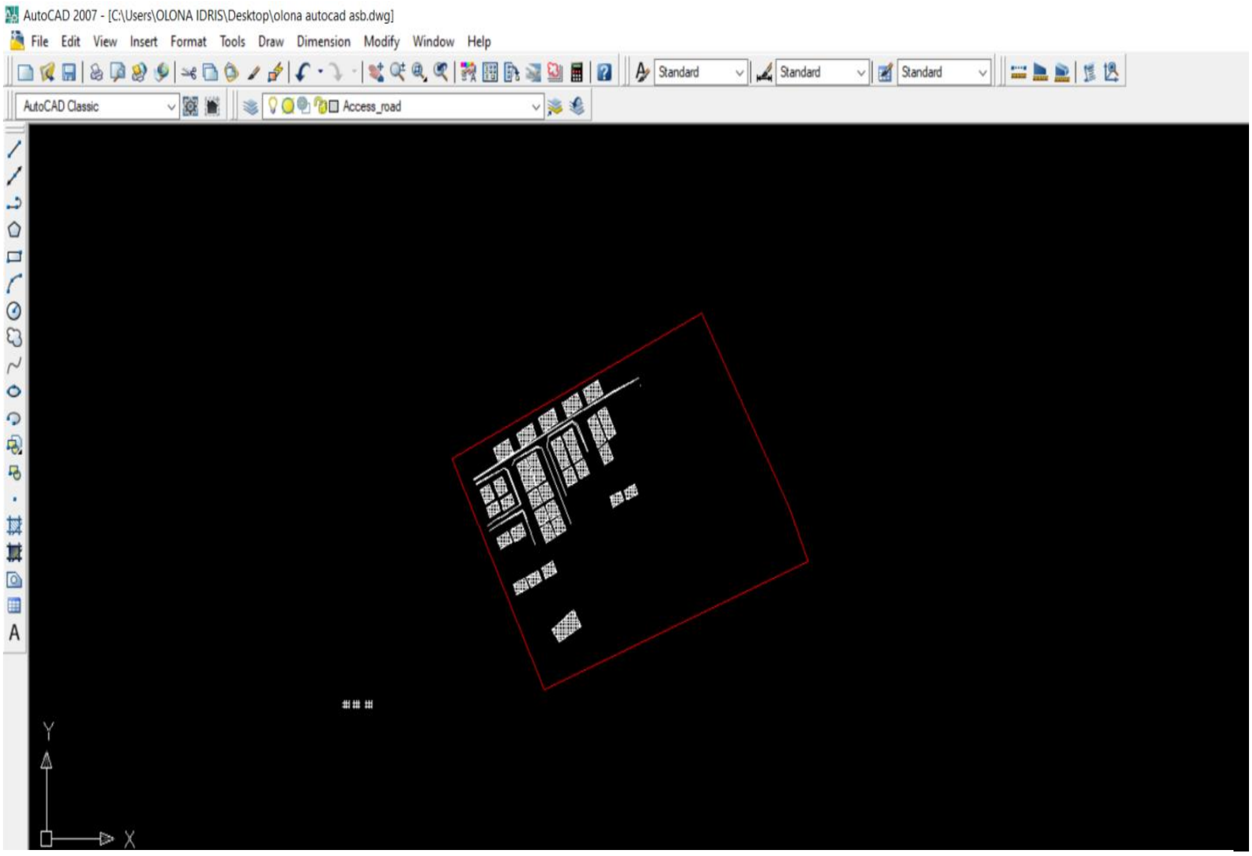


Figure 3.8.1: Data Draughting in Autocad

3.8.2 DATA VISUALIZATION ON ARCMAP

Features created on the Autocad were imported into Arcmap environment following these procedures:-

- Launch ArcMap from your ArcGIS Desktop suite.
- Cancel the pop up dialog box displayed which contained an existing Map document.
- Right click on Layer, click on property and
- Set the primary unit to metre and coordinate system to Minna Zone 31N
- Click on file menu, select extension, click the available extensions and click OK.
- Click on file, select new project and in a small dialog displayed, click on add data.
- Select the connected working folder containing the AutoCAD drawing and import the drawing into the ArcGIS environment.
- Select the directory containing the AutoCAD drawing and import the drawing the ArcMap environment.
- Add the CAD Dataset
    - Go to File > Add Data > Add Data (or click the Add Data (+) button).
    - Browse to the folder containing the DWG or DXF file.
    - You'll see the CAD file represented as a composite dataset with these components:
        - Annotation
        - Polygon
        - Polyline
        - Point

- Multipatch

Note: These are automatically generated feature layers based on CAD geometry types.

- Select the layer(s) you want (e.g., "Polyline") and click Add.
- Right click on any of this layer then click on data.
- Click on export, a menu showing the file pop up
- Then click your connected working folder and export in your created file geodatabase

3.8.3 DATABASE CREATION

Creating a new file geo-database involves creating .mdb file on the disk. To create a new file geodatabase using ArcCatalog, the steps are as follows:

i. Right click the file folder in the ArcCatalog tree where you want to create the new file geo-database.
ii. Click on new.
iii. Click on file geo-database. ArcCatalog will create a new file geo-database in the location you selected.
iv. Rename the new file geo-database by right clicking on it and choose Rename.
v. Click finish.

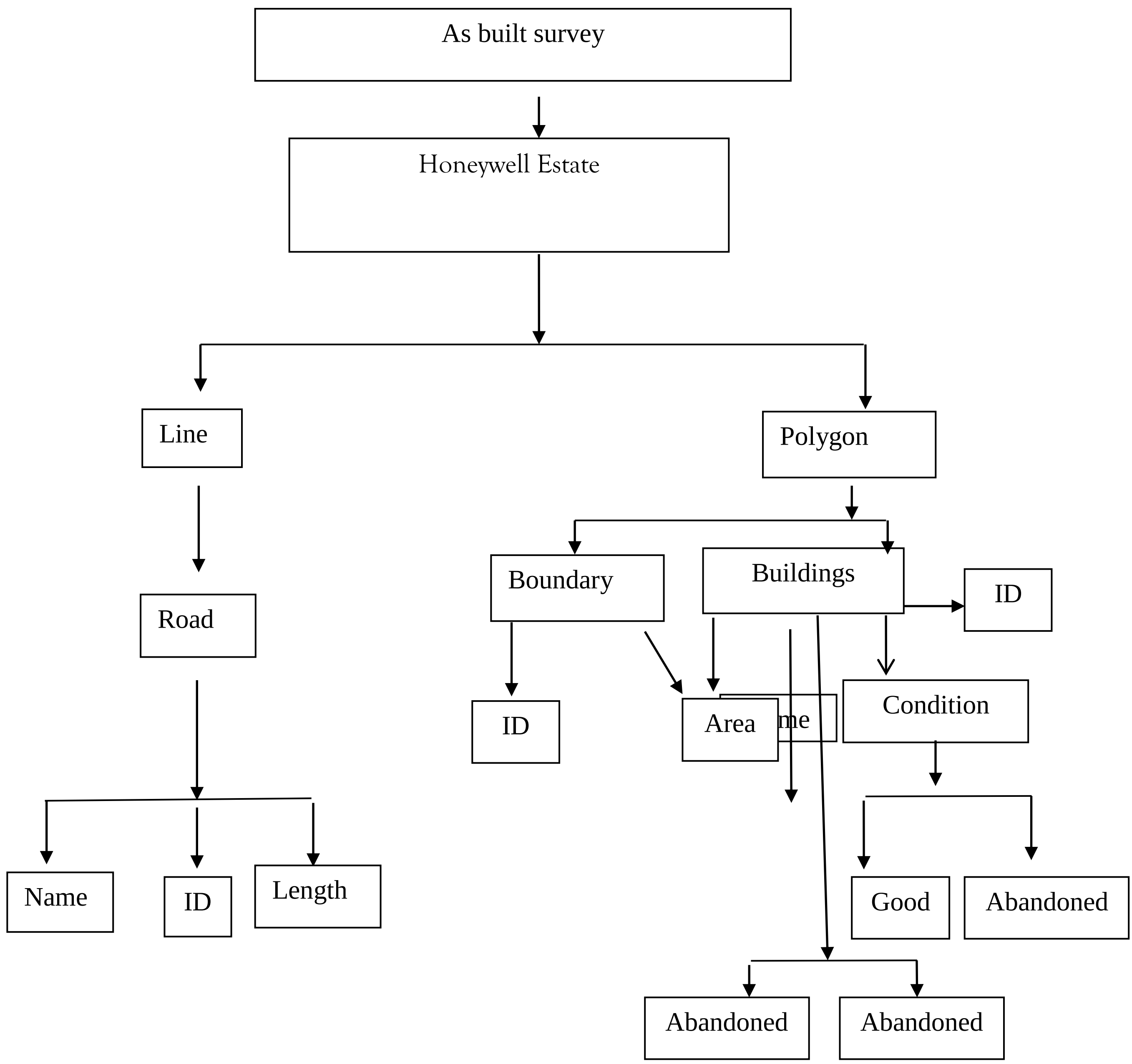


Figure 3.8.3: Entity Relation Diagram

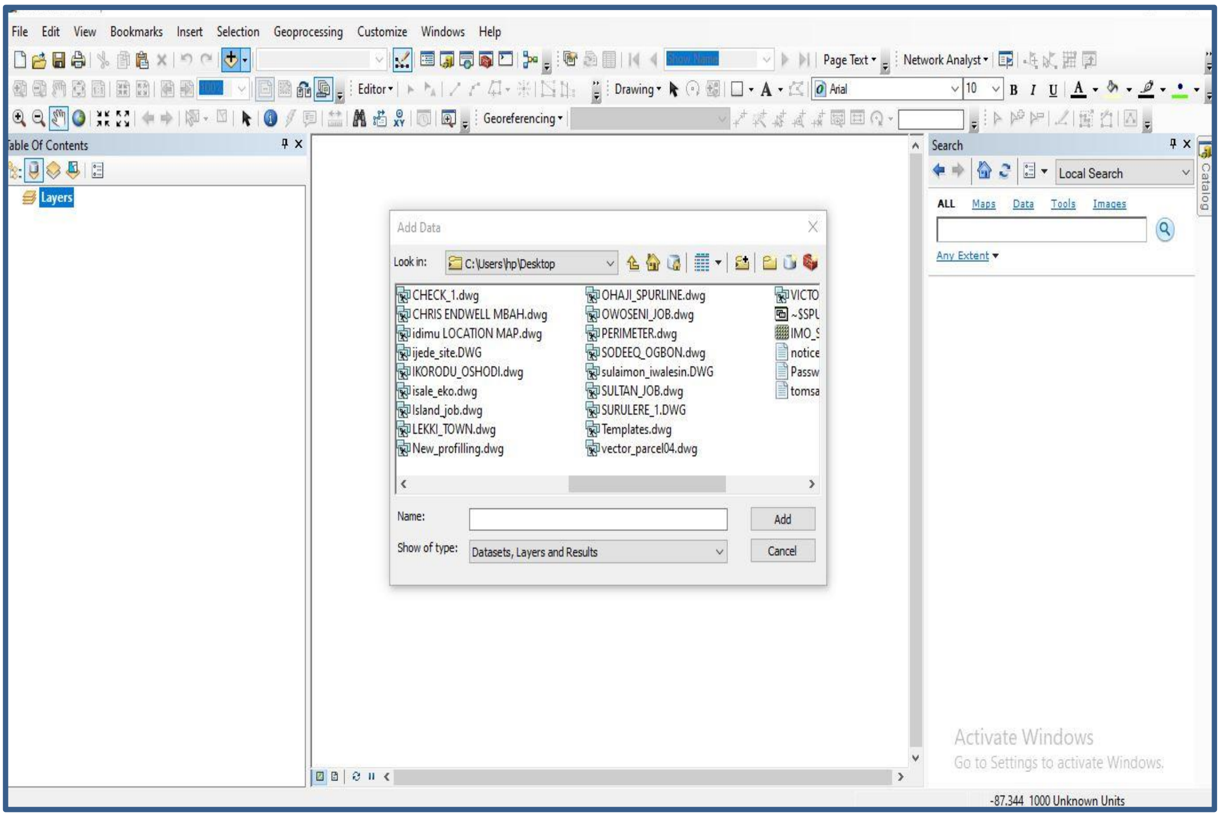


Figure 3.3.9: Attribute Table

3.8.3.1 LOGICAL DESIGN

This stage involves the translation of our conceptual design into a logical arrangement (Data structure). It is a representation of the data model in a format, designed to reflect the record of the data in the computer. The data structure organizes data in a single uniform manner in tables (relations). Each table was identified by a unique table name and was organized in rows (turples) and columns (attribute). The table was populated with fields. Each column has a unique name identifier. In this project, conceptual data was developed and later translated into a data structure in a single uniform manner in form of relation (tables). The conceptual model was translated into schemas as stated below:

Electric pole Table (EP_ID, EP_E, EP_NAME, EP_H).

Road Table (R_ID, R_E, R_N, R_NAME, R_L).

Buildings Table (B_ID, B_USE, B_TYPE, B_CONDITION, B_NAME).

Table 3.8.3.1: Line Entity and Its Attributes

S/NO	ATTRIBUTE NAME	DESCRIPTION OF ATTRIBUTE
1	R_ID	ROAD IDENTIFIER
2	R_N	ROAD NAME
4	R_NAME	ROAD NAME
5	R_LENGTH	ROAD LENGTH

Table 3.8.3.1: A Polygon Entity and Its Attributes

S/NO	ATTRIBUTE NAME	DESCRIPTION OF ATTRIBUTE
1	P_ID	POLYGON OBJECT IDENTIFIER
2	BLD_USE	BUILDING TYPE
4	BLD_CONDITION	CONDITION
6	BLD_NAME	BUILDING NAME
7	AREA	AREA OF THE GEOMETRY
8	PERIMETER	PERIMETER OF AREA OBJECT

CHAPTER FOUR

4.0 SPATIAL ANALYSIS AND INFORMATION PRESENTATION

4.1 TESTING OF DATABASE

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

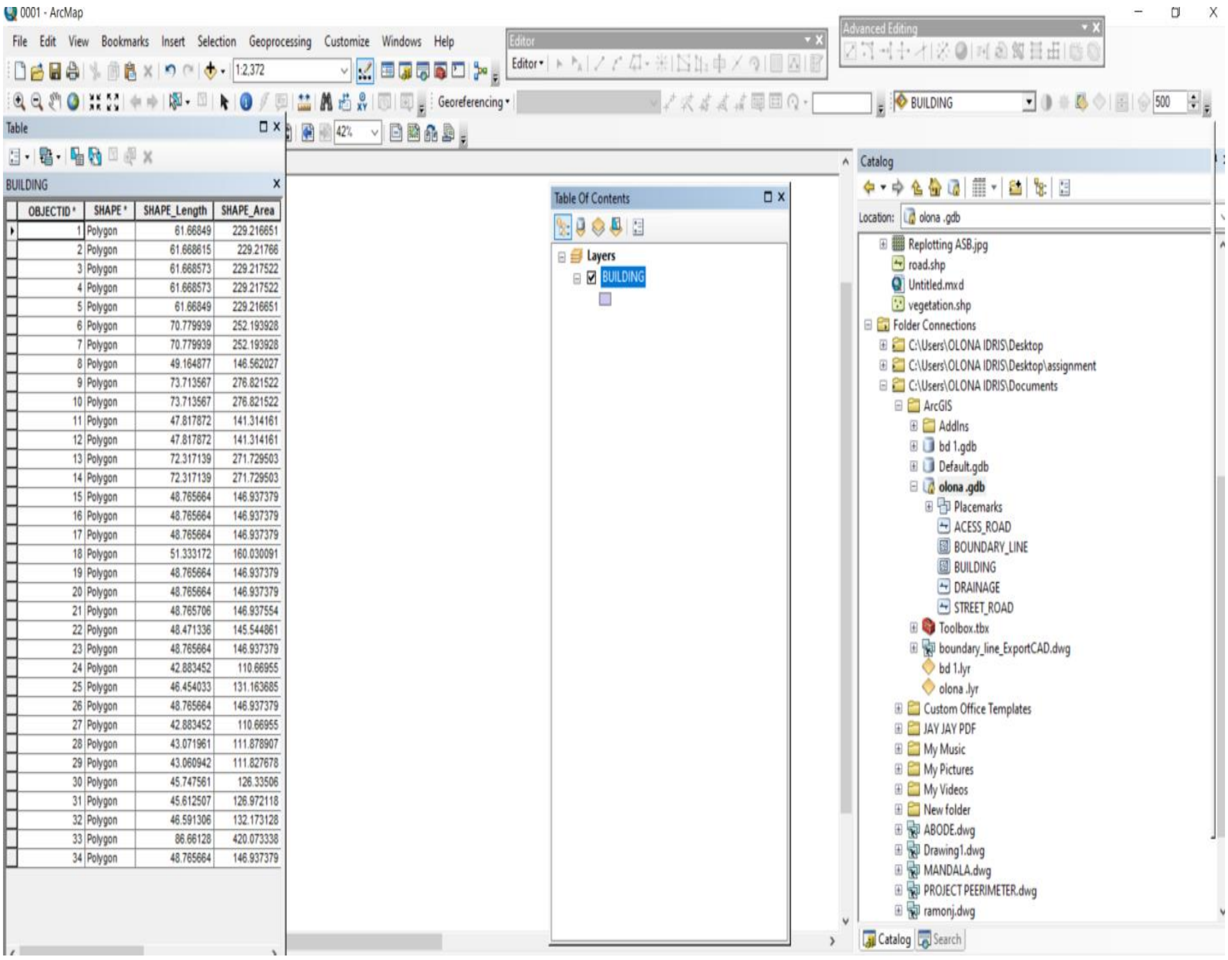


Figure 4.1: Testing of Geo-Database

4.2 BACK COMPUTATION

BEARING	DISTANCE	DN	DE	NORTHING	EASTING
				946283.850	683827.460
65° 01’ 55’’	303.145	123.146	-277.005	946407.843	684104.462
149° 46’ 46’’	192.751	-166.555	97.017	946841.288	684201.479
155° 17’ 55’’	50.039	-45.426	20.985	946195.862	684222.464
249° 25’ 28’’	312.969	-109.990	-293.005	946085.872	683929.459

332° 44’ 31’’	222.713	197.982	-102.002	946283.854	683827.457

Table 4.1: Table showing the back computation

4.3 AREA COMPUTATION

Double Latitude	Departure	Multiplier
123.99	-277.00	-34,345.23
123.99		
247.98		
-166.55		
81.43	97.02	7900.34
-166.55		
-85.12		
-45.43		
-130.55	20.98	-2738.94
-45.43		
-175.98		
-109.99		

-285.97	-293.00	83,789.21
-109.99		
-395.96		
+197.98		
-197.98	-102.00	20,193.96
+197.98		
0.00		

Table 4.2: Table showing Area Computation

Total Area = {(-34,345.23--2738.94) + (7,900.34+83,789.21+20,193.96)}/2

Total Area = {(-37,084.174) + (111,883.51)}

Total Area = 74,799.336/2

Total Area = 37,399.668 SQ MTS

4.4 LINEAR ACCURACY COMPUTATION

Linear Accuracy = 1

{[SQRT (change in Northing) ^{2} + (change in Easting) ^{2}

Total Distance

Linear Accuracy = 1

{SQRT [(0) ^{2} + (-554) ^{2}]

1081.954

Linear Accuracy = 1

{SQRT [306916]}

1081.954

Linear Accuracy = 1

554

1081.954

Linear Accuracy = 1

0.512036

Linear Accuracy = 1: 0.5

4.5 ANALYSIS OF RESULT

Data captured were full to ensure standardization of task. Coordinated point were used in order to produce information required and lastly to decision making and produce the output in digital form, while the attribute presented in tabular form. In most GIS operation package including arc view these include measurement techniques, query analysis and geometric operation in this project include questions such as:-

- Architectural planning
- Building overlay

The above listed queries are shown

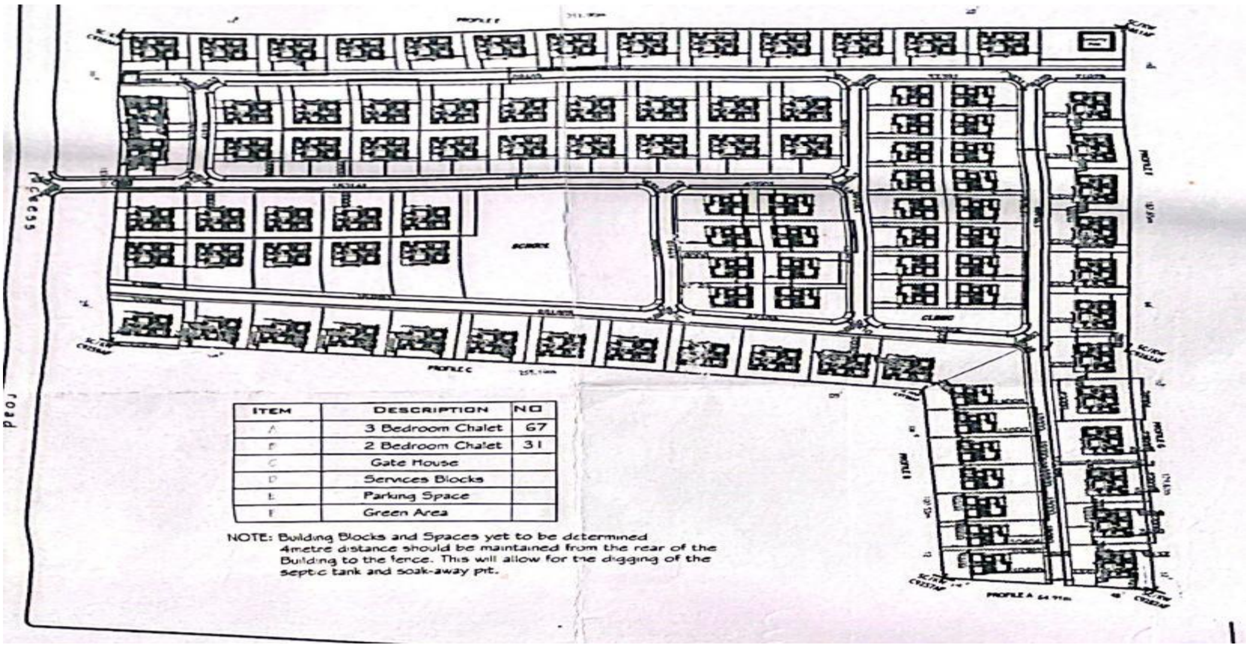


Fig4.1. showing the 2d plan architecture structure of the building

Note: - the 2d plan of the building in the study was gotten from the owner of the Honeywell estate and was captured with a digital camera. after which, the captured image was added into the ArcGis 10.2 environmental as a geo-referenced raster image and the conversion to digital form was done by digitizing then the overlay was done by putting on the two layers containing both files .

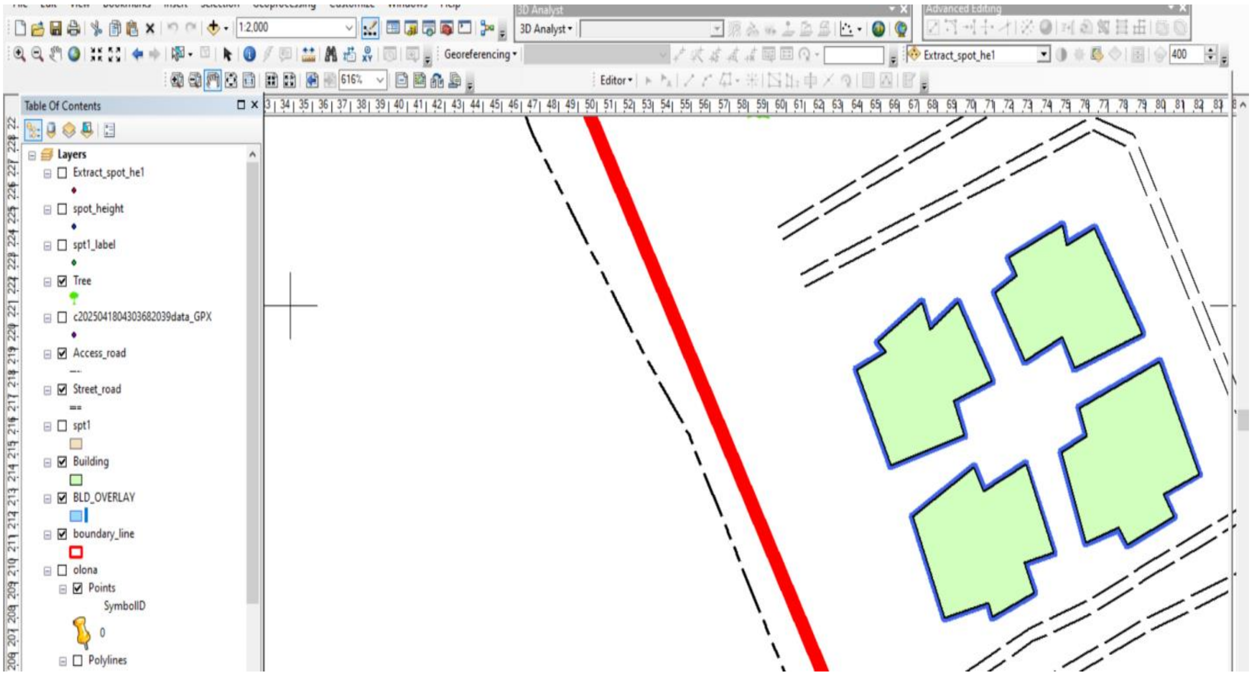
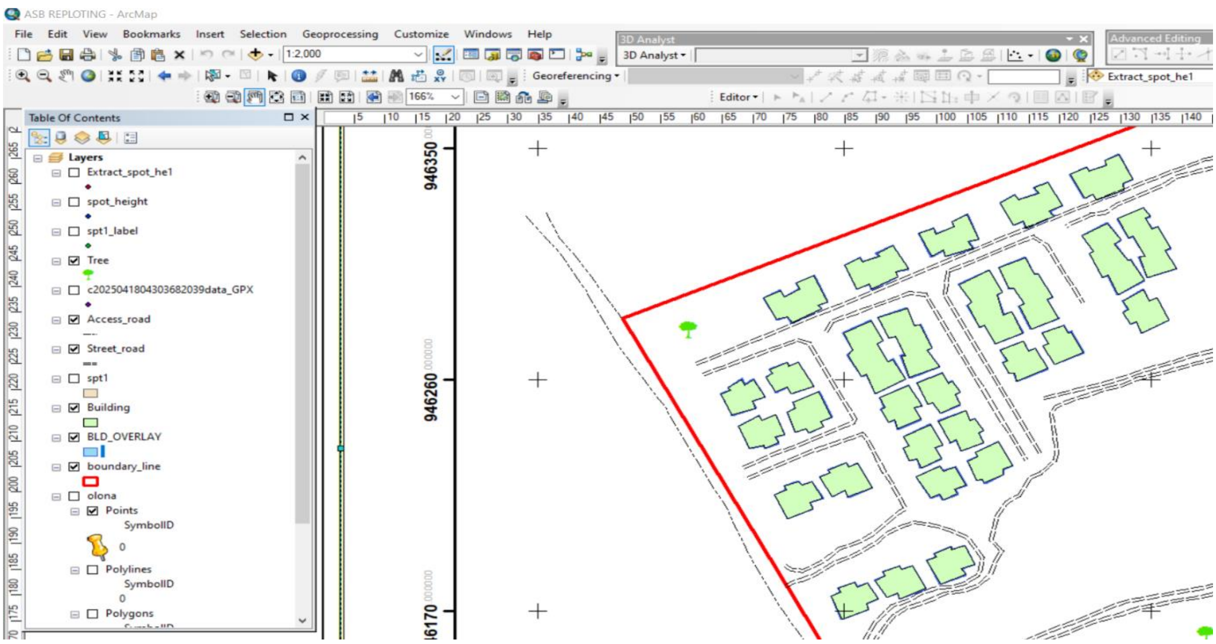


Fig4.2: showing overlaid of all building in block A

Discussion of result (building overlay block A)

The blue line represents observed edges of the building while the black line represent the digitized edges of the building. It was noticed that the existing building archive design is the same with what we observed in field.

Fig 4.3: showing overlaid of all building of all block



Discussion of result (building overlay of building in all block)

The blue line represents observed edges of the building while the black line represents the digitized edges of the building. It was noticed that the existing building archive design is the same with what we observed in field. But some road paramount with existing architecture lay out while some not paramount, and all of the building shows in architecture plan are not built in land.

CHAPTER FIVE

COSTING, SUMMARY, PROBLEM ENCOUNTERED, CONCLUSION, AND RECOMMENDATIONS

5.1 COSTING ANALYSIS

Costing Analysis for As-Built Survey of Honeywell Estate

S/No	Item	Cost (₦)
1	Instrumentation and Rent	15,000.00
2	Supervisor	30,800.00
3	Technologist	22,783.67
4	Technician (7 persons)	106,323.77
5	Basic Equipment	46,027.61
6	Transportation	46,027.61
	Subtotal	266,962.66

Table 5.1: Table showing the costing analysis for As-Built Survey of Honeywell Estate

Beaconing Materials

Item	Cost (₦)
5 Beacons @ ₦5,000	25,000.00

Table 5.1: Table showing the Beaconing Materials

Beaconing/Emplacement Phase

S/No	Item	Cost (₦)
1	Technician (7 persons)	106,323.77
2	Transportation	46,027.61
3	Basic Equipment	46,027.61
	Subtotal	193,378.99

Table 5.3: Table showing the Beaconing/Emplacement Phase

Data Acquisition Phase

S/No	Item	Cost (₦)
1	Technologist	22,783.67
2	Technician (7 persons)	106,323.77
3	Basic Equipment	46,027.61
4	Transportation	46,027.61
	Subtotal	221,162.66

Table 5.4: Table showing the Data Acquisition Phase

Data Processing & Manipulation

S/No	Item	Cost (₦)
1	Technologist	113,918.35
2	Technician (7 persons)	531,618.85
3	Personal Computer	230,138.05
4	Consumables	69,645.00
	Subtotal	945,320.25

Table 5.5: Table showing the Data Processing & Manipulation

Information Presentation & Analysis

S/No	Item	Cost (₦)
1	Supervisor	92,400.00
2	Technologist	68,351.01
3	Technician (7 persons)	318,971.31
4	Personal Computer	138,082.83
5	Consumables	41,787.00
	Subtotal	659,592.15

Table 5.6: Table showing the Information Presentation & Analysis

Comprehensive Report Writing

S/No	Item	Cost (₦)
1	Principal Surveyor	154,000.00
2	Technologist	113,918.35
3	Technician (7 persons)	531,618.85
4	Personal Computer	230,138.05
	Subtotal	1,099,320.25

Table 5.7: Table showing the comprehensive report writing

Total Cost = ₦3,410,737.00

5.2 SUMMARY

This project is an As-built survey of part of Honeywell Estate, Oke-Ose/Oke-Oyi, Ilorin South Local Government Area, Kwara State.

The As-built survey were carried out with aims and objectives to produce an As-Built plan which depict the shape, the sizes, heights, differences (elevations) and the boundary corners of the area.

The data were collected and digitalized in database system using AutoCAD, Notepad for spatial analysis.

5.3 PROBLEM ENCOUNTERED

The problem encountered in the cause of the project work is as follows;

i. Obstructions of vehicles which made it difficult for measuring the distance.

ii. The times the reading, the angles from the instrument are always difficult because of lack of light through the mirror.

5.4 CONCLUSION

The as-built survey of part of Honeywell Estate in Oke-Ose/Oke-Oyi, Ilorin South LGA, Kwara State, underscores the critical role of accurate geospatial documentation in managing urban growth and ensuring sustainable development. By systematically capturing the estate's current physical and infrastructural state, the survey revealed significant deviations from original development plans, including encroachments, unapproved land use changes, and suboptimal drainage systems. These findings highlight the urgent need for proactive urban governance, infrastructure upgrades, and community engagement to address risks such as flooding, utility inefficiencies, and legal disputes over land ownership.

The integration of modern tools—such as GPS, drones, and GIS—demonstrated the value of technology in overcoming terrain challenges and improving data accuracy. However, the project also exposed systemic gaps, including outdated cadastral records and limited enforcement of zoning regulations, which hinder effective land administration. Moving forward, collaboration between the Kwara State Urban Development Authority, Ilorin South LGA, and residents is essential to implement the survey's recommendations, including adopting digital platforms for real-time updates, redesigning drainage networks, and sensitizing stakeholders on compliance.

Ultimately, this as-built survey serves as a foundational tool for transforming Honeywell Estate into a resilient, well-planned community. By prioritizing periodic surveys, leveraging cost-effective technologies, and fostering participatory governance, the estate can align its growth with broader regional development goals, ensuring equitable resource distribution, environmental sustainability, and enhanced quality of life for its residents. The lessons learned here offer a replicable model for other rapidly urbanizing areas in Nigeria facing similar challenges of unplanned expansion and infrastructural decay.

5.5 RECOMMENDATIONS

1. **Adopt Digital Documentation Platforms**: Transition to **GIS-based systems** (e.g., ArcGIS or QGIS) and **BIM tools** to create a centralized, updatable digital twin of Honeywell Estate. This will streamline data sharing among the Kwara State Urban Development Authority, Ilorin South LGA, and utility providers, ensuring real-time updates and reducing discrepancies between plans and on-ground conditions.
2. **Enforce Zoning and Land Use Regulations**: Strengthen monitoring mechanisms to curb unauthorized encroachments and commercial activities in residential zones. Implement geofencing via drone surveys to flag deviations from approved layouts and issue compliance notices to violators.
3. **Upgrade Drainage Infrastructure**: Redesign and reconstruct drainage systems in flood-prone areas identified by the survey, using hydraulic modeling tools to ensure optimal gradient and capacity. Prioritize areas near Oke-Oyi's uneven terrain to mitigate erosion and waterlogging risks.
4. **Utility Modernization and Safety Audits**: Conduct a comprehensive audit of water and electrical networks to map undocumented connections. Replace aging pipelines and

conduits with standardized materials, and install smart meters to monitor usage and detect leaks or faults.

5. **Community Engagement and Sensitization**: Organize workshops and participatory mapping sessions with residents to educate them on land use laws and the benefits of compliance. Establish a grievance redressal mechanism to address ownership disputes and foster trust in redevelopment efforts.

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COORDINATE LIST

NORTHING	EASTING	ELEVATION	POINT I.D
917077.357	726052.265	466.361	A1
917056.108	726040.409	465.352	A2
917072.805	726060.179	466.071	A3
917051.593	726048.197	465.159	A4
915053.0600	726038.880	465.080	B1
917042.186	726032.737	464.667	B2
917048.469	726046.528	465.308	B3
917037.732	726040.501	464.865	B4
917038.766	726031.025	464.532	C1
917028.020	726024.815	463.986	C2
917034.505	726038.812	464.651	C3
917023.621	726032.673	464.293	C4
917025.865	726020.798	463.798	D1
917017.815	726016.481	463.581	D2
917018.546	726030.204	464.084	D3
917012.381	726026.919	463.880	D4
917018.197	726010.815	463.403	DRAINAGE

917041.543	726024.149	464.746	DRAINAGE
917074.177	726042.012	466.174	DRAINAGE
917080.541	726052.044	466.457	DRAINAGE
917069.807	726070.461	466.161	DRAINAGE
917095.850	726017.412	466.896	A1
917095.810	726010.527	466.609	A2
917082.355	726034.474	466.728	A3
917074.478	726029.992	466.393	A4
917095.812	726001.694	466.308	B1
917095.812	725994.695	466.004	B2
917070.365	726027.738	466.253	B3
917062.474	726023.368	466.830	B4
917095.928	725974.880	465.193	C1
917096.021	725967.849	464.904	C2
917045.048	726013.696	465.070	C3
917037.177	726009.264	464.603	C4

917096.929	725931.892	463.179	D1
917097.235	725924.856	462.858	D2
917007.799	725991.856	463.093	D3
917000.000	725987.045	462.697	D4
917103.817	726008.505	467.031	Drainage
917092.494	726030.854	466.935	Drainage
917076.298	726036.311	466.424	Drainage
917055.363	706024.862	465.404	Drainage
917021.068	726005.573	463.499	Drainage

Building CD

917004.843	725996.779	462.820	a
916997.068	725992.188	462.340	b
916998.502	726007.570	462.805	c
916991.889	726004.993	463.021	d
917077.357	726052.265	466.361	A1
917056.108	726040.409	465.352	A2
917072.805	726060.179	466.071	A3
917051.593	726048.197	465.159	A4
915053.0600	726038.880	465.080	B1

917042.186	726032.737	464.667	B2
917048.469	726046.528	465.308	B3
917037.732	726040.501	464.865	B4
917038.766	726031.025	464.532	C1
917028.020	726024.815	463.986	C2
917034.505	726038.812	464.651	C3
917023.621	726032.673	464.293	C4
917025.865	726020.798	463.798	D1
917017.815	726016.481	463.581	D2
917018.546	726030.204	464.084	D3
917012.381	726026.919	463.880	D4
917018.197	726010.815	463.403	DRAINAGE
917041.543	726024.149	464.746	DRAINAGE
917074.177	726042.012	466.174	DRAINAGE
917080.541	726052.044	466.457	DRAINAGE
917069.807	726070.461	466.161	DRAINAGE
917057.181	726089.631	466.699	A1
917035.756	726078.137	465.664	A2
917053.016	726097.826	466.539	A3

917031.261	726086.501	465.391	A4
917032.494	726076.368	465.536	B1
917022.047	726069.781	464.957	B2
917028.248	726084.646	465.277	B3
917017.119	726078.969	464.914	B4
917048.331	726110.610	466.458	Drainage
917051.116	726101.126	466.440	A1
917029.677	726089.536	465.571	A2
917046.948	726109.387	460.530	A3
917025.277	7260097.689	460.610	A4
917026.233	726087.772	465.397	B1
917015.438	726081.930	464.904	B2
917021.812	726095.734	465.371	B3
917010.693	726091.024	464.922	B4
917002.471	726092.888	464.701	Drainage

917021.141	726103.313	465.400	Drainage
917038.138	726111.877	466.081	Drainage
917013.401	726106.348	465.232	Drainage
917024.013	726112.045	465.604	Drainage
917039.909	726127.173	465.516	Drainage
917071.486	726062.584	466.377	A1
917050.126	726050.925	465.566	A2
917067.128	726071.063	466.994	A3
917045.752	726059.413	466.017	A4
917046.918	726049.362	465.353	B1
917036.305	726043.590	464.843	B2
917042.606	726057.660	465.853	B3
917031.798	726051.854	465.559	B4
917032.858	726041.654	464.688	C1
917022.034	726035.727	464.373	C2
917028.253	726050.015	464.347	C3
917017.221	726044.702	464.812	C4

917017.246	726033.107	464.040	1
917010.602	726030.314	463.746	2
917012.387	726046.502	464.562	3
917004.360	726042.253	464.266	4

917060.568	726074.673	466.620	Drainage
917030.236	726059.223	465.423	Drainage
917001.534	726043.767	464.102	Drainage
916998.512	726049.158	464.112	Drainage

916034.047	726068.345	465.453	Drainage
917053.140	726078.458	466.307	Drainage
917059.031	726091.415	466.686	Drainage
917054.211	726099.820	466.555	Drainage