PROJECT REPORT

ON

ROUTE SURVEY OF MANDALA TO AWE , MORO LOCAL GOVERNMENT AREA, ILORIN, KWARA STATE

BY:

FADUMILA KAYODE OLUWATUBOSUN

HND/23/SGI/FT/0082

BEING A RESEARCH PROJECT SUBMITTED TO THE

DEPARTMENT OF SURVEYING AND GEO-INFORMATICS

INSTITUTE OF ENVIRONMENTAL STUDIES

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

JUNE 2025

CERTIFICATE

I hereby certify that all 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 executed in accordance with survey rules, regulations and departmental instructions.

………………..……………………….

FADUMILA KAYODE OLUWATUBOSUN

DATE ………………………………

CERTIFICATION

This is to certify that **FADUMILA KAYODE OLUWATUBOSUN** with Matric No **HND/23/SGI/FT/0082** has satisfactorily carried out the survey duties contained in this project report under my instructions and direct supervision.

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

…. …………………………………… **DATE: …………………………**

SURV. R.O ASHONIBARE

(SUPERVISOR)

…. …………………………………… **DATE: …………………………**

MR. ISAU IBRAHIM ABIMBOLA

(H.O.D)

…. …………………………………… **DATE: …………………………**

SURV. R.S AWOLEYE

(PROJECT COORDINATOR)

………………………………………. **DATE: …………………………**

EXTERNAL SUPERVISOR

DEDICATION

I dedicate this project to God Almighty, for His grace, wisdom, and strength throughout this journey.

To my parents, for their endless support, love, and encouragement.

And to everyone who believed in me even when I doubted myself this is for you.

ACKNOWLEDGEMENTS

I am also sincerely grateful to my supervisor,**SURV. R.O ASHONIBARE**, for their guidance, constructive criticism, and support throughout the course of this project. Your mentorship made a lasting impact, and I am thankful for your patience and direction.

Also, my Special thanks goes to the head Of department **SURVEYING AND GEO-INFORMATICS** of Kwara State Polytechnic in Person of **MR.ISAU ABIMBOLA** and also to the director of Consultancy of Kwara State Polytechnic in person of **SURV. A.G AREMU, SURV. R.S AWOLEYE, SURV. ABDULSALAM AYUBA, SURV. KABIR, SURV. FELIX DIRAN AND SURV. KAZEEM** all my Lecturers who directly or indirectly guided me to Successfully Complete my Higher National Diploma Programme.

I would like to deeply appreciate my beloved mother, **MRS. FADUMILA OLUSHOLA BISOLA**, for her unwavering support, prayers, and sacrifices from the very beginning of my ND program through to the completion of my HND. Her dedication and love have been the backbone of my success, and I remain forever grateful.

A special thank you goes to my brother, **HURBAMIKKY**, whose constant encouragement, support, and belief in me played a vital role in keeping me focused and motivated throughout this academic pursuit.

Also, I want to extend my gratefulness to my group members for their endurance and mutual understanding. I thank all my course mates as well, for their understanding throughout the course.

To my siblings, I sincerely appreciate your care, patience, and the little ways you've all contributed to this achievement. Your love means more than words can express.

Lastly, I am thankful to every individual family, friends, and mentors who, in one way or another, have supported and encouraged me on this path. Your kindness and belief in me have not gone unnoticed.

Thank you all. **FADUMILA KAYODE OLUWATUBOSUN**

JUNE 2025

ABSTRACT

The project reports contains reconnaissance, field work, data processing exercise, and every other procedures undertaking in the course of this project which focused on Route Survey which involves acquisition of data for the purpose of the road construction design of the road spanning from Mandala to Awe Moro Local Government Area Ilorin Kwara State.The field work involved, reconnaissance, EDM third other traversing, distance measurement, station description, leveling for the horizontal alignment, longitudinal alignment and cross sectioning. The acquired data were processed using appropriate formulae. The plans (Horizontal and Vertical plans) were produced from the processed data at suitable scale both in digital and graphical format. Finally a project report was writing.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Engineering Surveying is one of the branches of surveying which form the general express for any survey work carried out in connection with construction engineering and building projects, it is a large scale map survey which form the basis for design of engineering works such as highways, railways, canals, tunnels, dams, pipelines and transmission lines.

In the World of engineering and environmental studies, surveying has been recognized as the inevitable operation been described as the bedrock of every meaningful development. The greater part of its responsibility is seen from the various types of surveying which are all geared toward promoting, convenience, accessibility and spatial declination of both natural and social environments. In addition, surveying means the activities of planning, designing, constructions, development and rehabilitation of roads, depending on the survey data required by the surveyor.

Route survey which is an aspect of engineering survey may be defined as the survey operation that is done for the establishment of the horizontal and vertical alignment of transportation facilities. It involved: planning, design and setting out of any route such as railways, highways, pipelines and canals etc. as obtained by a surveyor and it also involved the proper assessment of natural and man-made features.

In addition, this type of survey should be applied when there is need for alignment, expansion, or rehabilitation at any existing route (road) e.g. for traffic purposes. The reason is that route survey provides a plan/map that shows the alignment, details, profile and cross sectional leveling which depicts the nature of the terrain of a given strip of land which serves the purpose of location, design and construction of route networks.

Good road network is one of the basic amenities needed by human being as movement is one of the characteristics of living things. There are needs for people to move from one place to the other and transportation of goods and services. Therefore for any meaningful development in a country, good road is a must.

Route surveying is such a survey exercise that requires all field works and calculations made for the purpose of locating and constructing a cross country social utilities such as highways, railways, canals, transmission lines and pipeline. This involve the determination of the ground configuration and location of physical features (naturals and manmade) along the route, establishing the line on the ground and computing the volume of earthwork.

The main purpose of any route survey is to: Identify and select one and more tentative general routes for the roadway or utility And collect sufficient data about the proposed route to assist route desiger in making informed decision .

With these purposes, route survey usually entails reconnaissance, preliminary and final location survey phases that satisfy respectively, each of the purposes given above. Sometimes the prevailing circumstances may preclude the requirement to perform all three phases, for example if a new road or utility is to be constructed on a military installation, having a marked vertical and horizontal control networks and up to date topographic maps and utility maps, then the reconnaissance and preliminary survey phases may not necessarily be required .

Roads in Nigeria can be classified in Nigeria can be classified in to three major groups which are:

Federal roads (interstate roads)

State roads (intra state roads)

Local roads (rural roads)

Each class of roads differ in the sense that it control access to different degree, also the amount of traffic that can be safely supported and the speed at which traffic can safely travel. The federal government is responsible for the construction and maintenance of federal roads through its agencies like federal ministry of works; federal ministry of Niger delta affairs, or federal roads maintenance agency (FERMA) State Governments are responsible for the construction and maintenance of intra state roads e.g roads that falls within a state capital or roads that traverse between towns in a state. This is done through their different states ministry of works and transportation or any other agencies established by the state government for this purpose. While Local Government Councils are responsible for the construction and maintenance of rural and street roads. The road under the subject matter here falls within the third category mentioned above i.e. local government road.

1.2 SIGNIFICANT OF THE PROJECT

It was discovered that the route of Mandala to Awe Village, Moro Local Government Area, Ilorin, Kwara state, had been badly eroded and full of potholes which is responsible for accidents along the road. Rehabilitation of this road should be carried out and certain information about the road must be acquired which calls for route survey so as to get the data necessary for the road.

1.3 AIM(S) AND OBJECTIVES

1.3.1 AIM OF THE PROJECT

The main aim of this project is to carry-out Route Survey of Mandala to Awe Village in Moro Local Government Area, Kwara State. This is to provide geo-spatial information necessary for the rehabilitation of the road.

1.3.2 OBJECTIVES

To achieve the stated aim of the project, the following objectives were implemented sequentially:

1. Reconnaissance

• Conducted office planning and field reconnaissance to assess the project area.

2. Identification of Features

• Identified existing features and adjoining roads relevant to the roadway design.

3. Ground Control Stability

- Ensured the stability of ground control points used for orientation.

4. Centre Line Determination

- Determined the centerline and marked chainages along it at 25-meter intervals.

5. Cross-Sectioning

- Marked points for cross-sectioning at 4m (8m) intervals on both sides of the centerline.
- Marked the edges of the drainage system.

6.Electronic Distance Measurement (EDM)Traverse

- Performed a tertiary EDM traverse to establish the relocation and orientation of the roadway.

7. Leveling

- Determined the elevation of selected points along the roadway using leveling techniques.

8. Detailing

- Conducted detailed surveys using Topcon (ES-103) total station.

10. Plan Production

- Produced a graphical representation of the surveyed roadway, drawn to an appropriate scale.

11. Report Writing

- Documented the entire project in a detailed report in accordance with project guidelines.

This structured approach ensured precision and alignment with project goals.

1.4 PROJECT SPECIFICATIONS

The following are the specification to be ascertained in the project:

Traverse must commence on three coordinated (known) controls and closed on another set of three coordinated controls which must be confirmed undisturbed by necessary measurement (control checks).

Third order traverse must be run along the route on all turning points at one zero observation and the angular difference from both faces should not be more than thirty seconds (30"), the angular misclosure is determined by $30''\sqrt{n}$. Where 'n' is the total number of station observed.

Establishing traverse points by using pegs together with nails and bottle corks.

Leveling must be observed at every 25m intervals on the center line and at 8m intervals on both sides of the center line for the cross sectioning. Edges of drainage at both sides should be heightened.

Fixing of relevant features to enhance assessment and necessary composition for good interpretation of plan.

The accuracy of the project must fall within the order of the project.

1.5 SCOPE OF THE PROJECT

The entire project encompassed the following components:

1. RECONNAISSANCE

i. Conducted both office planning and field reconnaissance to gather preliminary insights about the project area.

2. DATA ACQUISITION

i. Selection of Stations: Identified suitable locations for survey stations.
ii. Traverse: Carried out angular observations and data recording using a Topcon (ES-103) total station.
iii. Linear Measurements: Measured distances using a Topcon (ES-103) total station .
iv. Spirit Leveling: Conducted leveling for the traverse centerline and adjacent sides, including longitudinal profiles and cross-sections.
v. Detail Fixing: Identified and fixed both temporary and permanent features using Total Station.

3. COMPUTATIONS

i. Determined:

ii. Horizontal Coordinates (x and y): Through traverse adjustments.
iii. Vertical Coordinates (z): Using level reduction techniques.

4. DATA ANALYSIS

i. Compared obtained results against required accuracy to ensure compliance with project standards.

5. DATA PRESENTATION

i. Produced the following plans:
ii. Horizontal Alignment Plan: Showing existing features and proposed route.
iii. Longitudinal Section Plan: Depicting elevation profiles along the route.
iv. Cross-Section Plan: Showing perpendicular profiles at specified intervals.

6. PROJECT REPORT WRITING

i. Prepared a comprehensive project report detailing all phases of the project, in accordance with the outline provided by the project supervisor.

This structured approach ensured the project's objectives were met with accuracy and clarity.

1.6 PERSONNEL INVOLVED

All the under-listed names are members of HNDII 2024/2025 group 2C that participated in the successful execution of this project.

NAMES	MATRIC NUMBER
FADUMILA KAYODE OLUWATUBOSUN (WRITTER)	**HND/23/SGI/FT/0082**
YEKIN RAUF OLUWAFEMI	HND/22/SGI/FT/0118
PIUS RACHEAL NAOMI	HND/23/SGI/FT/0087
OMOLABI MARVELOUS TAIWO	HND/23/SGI/FT/0089
MOHAMMED NAFISAT	HND/23/SGI/FT/0088
AKINPELU OLASHILE RIDWAN	HND/23/SGI/FT/0085
AHMED SAHEED TOYYIB	HND/23/SGI/FT/0084
ADEDEWE VIVIAN ODUNAYO	HND/23/SGI/FT/0115

1.7 PROJECT AREA

The project site is the route of Mandala to Awe Village Moro Local Government Area Ilorin Kwara State. It cover approximately 3.5km extent of land. With geographical coordinates of :

Long. 004°28’07”

Lat. 008°32’55”

Long. 004°28’07”

Lat. 008°32’55”

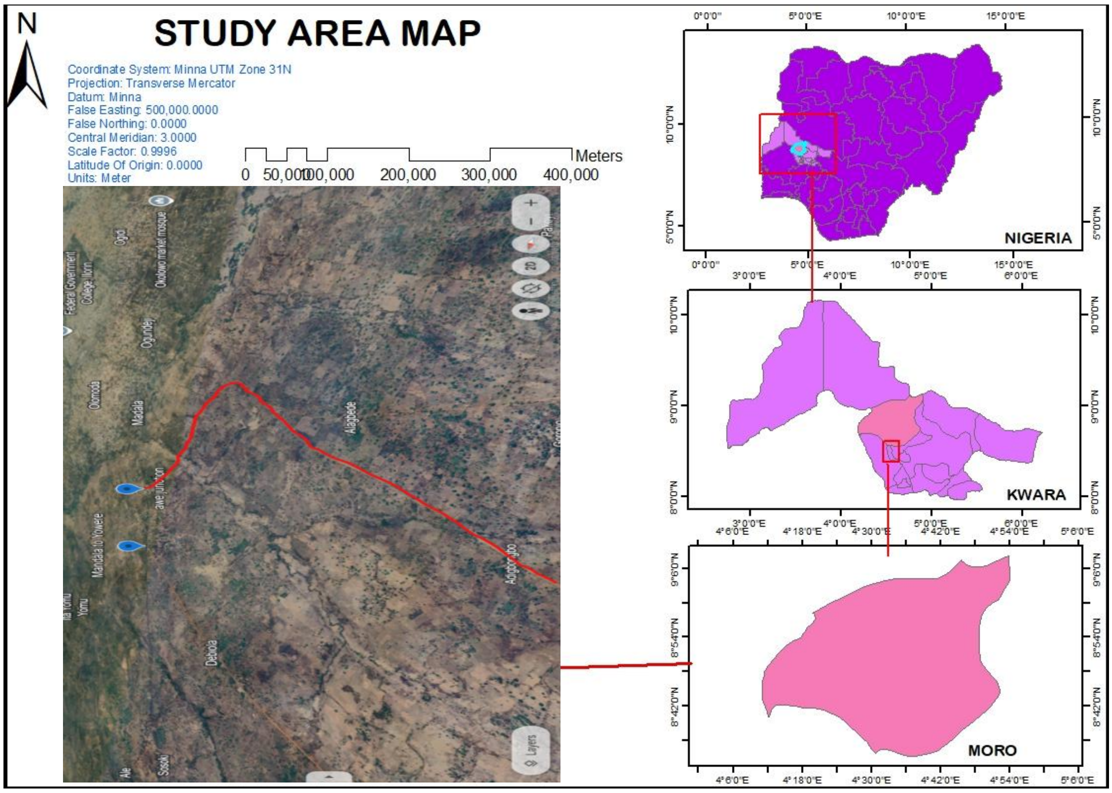


Fig 1.1: Study Area

Source:-GoogleEarth

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 INTRODUCTION

Route surveying plays a critical role in the planning, design, and construction of transportation infrastructures, including highways, railroads, canals, and pipelines. These surveying processes are essential in ensuring that a route aligns optimally with both natural and man-made features, complies with safety standards, and meets the specific needs of the project. The selection of a route is a highly technical and iterative process that requires careful consideration of topography, environmental impact, and resource availability.

According to the Road Planning and Design Manual (2014), comprehensive risk assessments and engineering judgments are integral to the planning of transport routes. This manual emphasizes the importance of assessing safety concerns, environmental impacts, and potential hazards before finalizing the route of a road or railway. Such preemptive steps not only mitigate risks but also ensure that the transportation system can be constructed, maintained, and operated efficiently.

2.2 SURVEYING TECHNIQUES IN ROUTE PLANNING.

Surveying is the backbone of route planning, providing the foundational data required to establish precise alignments for roads, railways, and utilities. The process is broken down into several stages, including reconnaissance, preliminary surveys, location surveys, and construction surveys.

Reconnaissance Survey: Chandra (2009) defines reconnaissance as a quick, preliminary survey used to examine the area for the best route, estimate project costs, and identify key factors that could affect the route. During this phase, surveyors assess the landscape, local infrastructure, and environmental conditions to determine whether the area is feasible for construction.

Preliminary Surveys: This phase involves more detailed fieldwork, where control points are established, benchmarks are located, and basic topographic data is gathered. Ghilani and Wolf (2012) explain that control surveys provide the horizontal and vertical positions of key points, forming the reference network for all subsequent surveying activities.

Location Surveys: As per Shurantul (2010), location surveys involve traversing the proposed route, marking out key stations, and conducting measurements to establish the relative positions of specific points along the route. This is a critical stage, where the rough alignment from reconnaissance is refined into a precise and usable path.

Construction Surveys: These surveys deal with the actual construction of the route, ensuring that it aligns with the design specifications. They involve marking out the final alignment on the ground, measuring earthworks, and confirming that the route is built to the required standards.

Surveying also plays a vital role in the acquisition of geospatial data, particularly in areas with complex terrain or where existing infrastructure must be incorporated into the new design. This process involves using advanced technologies such as GPS (Global Positioning System), Total Stations, and Laser Scanning to obtain accurate measurements for both horizontal and vertical alignments.

2.3 ROUTE SURVEYING AND ALIGNMENT DESIGN

A Route Survey refers to the process of collecting data to establish the path for linear projects like highways, railroads, and pipelines. This survey involves both fieldwork and computational analysis to determine the optimal alignment that takes into account both topographical features and the project's functional requirements.

Route Surveying Procedures are crucial for determining the boundaries and the specific location of a route. According to Punmia et al. (2005), route surveys must follow several distinct steps, which include identifying possible route options, gathering data, and finalizing the alignment. The survey process typically involves:

1. Tentative Route Selection: This is the first phase, where multiple potential routes are evaluated based on preliminary data such as topography, environmental impact, and community considerations.

2. Data Collection: During this stage, surveyors use a combination of ground reconnaissance and satellite imagery to gather precise information about the area. Tools like Total Stations and GPS equipment are used to collect accurate coordinates and elevations for all points along the proposed route.

3. Final Route Selection: Once enough data has been gathered, surveyors refine the tentative routes, select the optimal one, and mark the final route for construction.

The surveying process is inherently linked to design principles that ensure the route is functional, efficient, and sustainable. For example, a horizontal alignment involves the layout of straight lines or curves (circular or spiral), while a vertical alignment ensures that the route conforms to safe slopes and gradients for both vehicles and pedestrians.

2.4 THE ROLE OF TECHNOLOGY IN ROUTE SURVEYING.

Advancements in technology have significantly enhanced the accuracy, efficiency, and cost-effectiveness of route surveying. The use of modern tools such as Geographic Information Systems (GIS), LiDAR (Light Detection and Ranging), and Drones has revolutionized the field, enabling surveyors to conduct more precise surveys with less manual intervention.

GIS and Remote Sensing: GIS allows for the integration of multiple data sources, including aerial imagery, satellite data, and topographic maps, to create detailed maps and models of the terrain. This technology helps in identifying environmental constraints, geological conditions, and land ownership issues before physical surveying begins.

Total Stations and GPS: Total Stations combine the functions of an electronic theodolite and a distance measuring instrument, allowing for accurate angular and distance measurements. GPS technology provides real-time positioning data, enhancing the precision of both horizontal and vertical alignments.

Drones and LiDAR: Drones equipped with LiDAR sensors can rapidly capture high-resolution 3D data of the terrain. This technology is particularly useful in areas that are difficult to access or in cases where traditional methods would be time-consuming and costly.

These technological tools significantly reduce the time required for data collection, improve accuracy, and provide more detailed insights into the terrain and other key factors influencing route design.

2.5 CHALLENGES AND CONSIDERATIONS IN ROUTE SURVEYING.

Despite the advances in technology, route surveying remains a complex process fraught with challenges. Some of the most significant issues include:

Topographical and Geological Constraints: Uneven terrain, mountains, rivers, and urban environments often pose significant challenges in determining the best route. Complex topographies may require the use of specialized surveying methods like levelling, traversing, and curves to ensure that the alignment can accommodate the project's requirements.

Environmental and Regulatory Constraints: Environmental impact assessments are necessary to ensure that the proposed route does not cause undue harm to the local ecosystem. In addition, compliance with local zoning laws, land acquisition rules, and other regulatory frameworks can complicate the route selection process.

Accuracy and Precision: Even with advanced technology, ensuring the accuracy of measurements is paramount. As Duggal (2006) points out, horizontal and vertical curves must be laid out with high precision, and any errors could lead to costly delays or safety hazards.

2.6 CASE STUDIES AND PRACTICAL APPLICATIONS.

To illustrate the application of these surveying techniques, we look at several case studies that highlight both the practical use of route surveying methods and the challenges encountered in different environments.

For instance, a route survey project conducted by Billiaminu (2017) in Kwara State, Nigeria, utilized modern GPS and Total Station equipment to assess the road alignment from Mandala to Awe Villages Moro Local Government Area. The survey included field reconnaissance, data collection with Topcon (ES-103) total station, and processing of the data using AutoCAD Civil 3D software. The final report provided comprehensive horizontal and vertical alignment designs, with earthwork calculations for cut and fill volumes.

Similarly, the Modernized Lagos-Ibadan Railway project employed GPS and Total Stations for alignment setting, ensuring the accuracy and precision required for a complex urban infrastructure project. This project exemplifies how modern surveying techniques are crucial in large-scale infrastructure development.

2.7 CONCLUSION.

Route surveying is a fundamental aspect of infrastructure planning and construction, and it requires an in-depth understanding of both traditional and modern surveying techniques. As demonstrated, technologies such as GIS, GPS, and Total Stations have transformed the surveying process, enabling greater precision and efficiency. However, despite technological advancements, route surveying remains a challenging and multifaceted process that demands careful consideration of environmental, regulatory, and logistical factors. Future improvements in surveying technology, such as the integration of AI and automated surveying systems, are likely to further enhance the accuracy and efficiency of route surveys, making them more cost-effective and adaptable to evolving infrastructure needs.

CHAPTER THREE

3.0 METHODOLOGY

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

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

I. Reconnaissance survey
II. Chainage marking
III. Control establishment
IV. Data acquisition
V. Data downloading and processing
VI. Data analysis
VII. Road design
VIII. Information presentation

3.1 RECONNAISSANCE

This is a very important aspect of surveying that involves planning and preliminary inspection of the area before the commencement of the actual data acquisition of the project site, this is done for the purpose of planning on how to execute the project, fixing stations, locating controls etc. its importance to the actual survey operation that cannot be underestimated as it enable it to give the best method to carry out the task.

The two phases of reconnaissance are;

I. Office planning
II. Field reconnaissance

3.1.1 OFFICE RECONNAISANCE

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

I. Understanding the purpose of the survey from the project instructions.
II. Obtaining the specification for the accuracy required leading to the choice of a suitable scale.
III. Deciding the method to be employed for the measurement.
IV. The kind of instruments to be used in executing the project.

The coordinates of control stations around the project area were collected from the SOUTH GALAXY G1 (GNSS receiver).

Table 3.1 coordinates of the existing ground control used origin (U.T.M)

Control id	Easting (Nm)	Nothing (Nm)	Height (m)
BM1	661425.0232	945950.9002	324.7349
BM2	661402.8991	945939.4238	324.8356
BM3	661457.0369	945934.9219	324.0516

3.1.2 FIELD RECONNAISSANCE

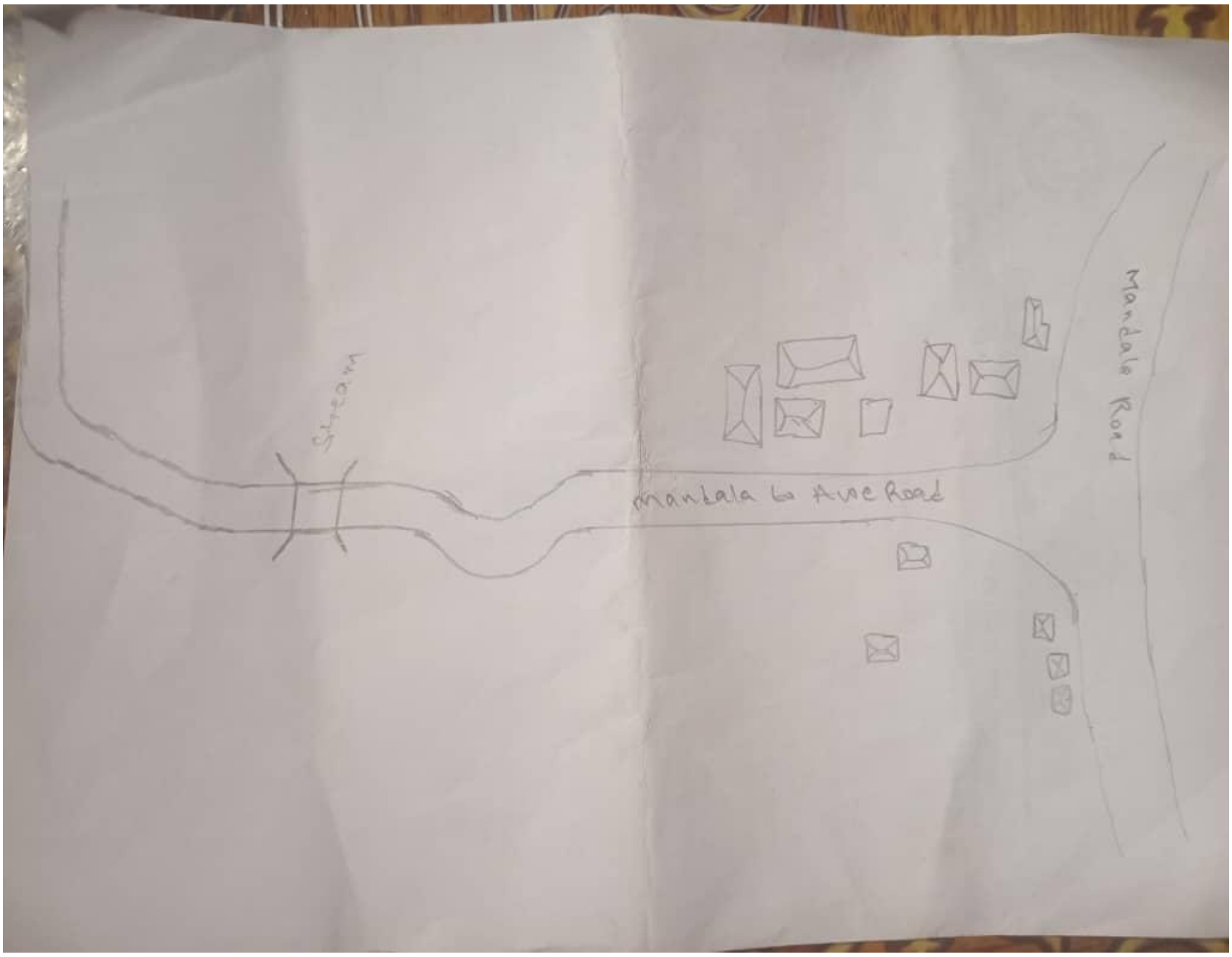
The field reconnaissance was done after the office planning it involved a visitation to the project site by all the group numbers to have a pre requisite knowledge of how it looks like and how the field operations would be carried out.

During the visit the control pillars planned to be used were located, traverse stations which were to form the traverse framework were selected and marked using pegs and nails, inter visibility between successive traverse station were ensured.

At the end of the visit, a sketch diagram known as “recce diagram” showing the physical appearance of the project site was drawn.

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

Fig. 3.1.1 Field Recci diagram Mandala Via Awe to Adigongo Route.



3.1.2 A TYPICAL PEG USED

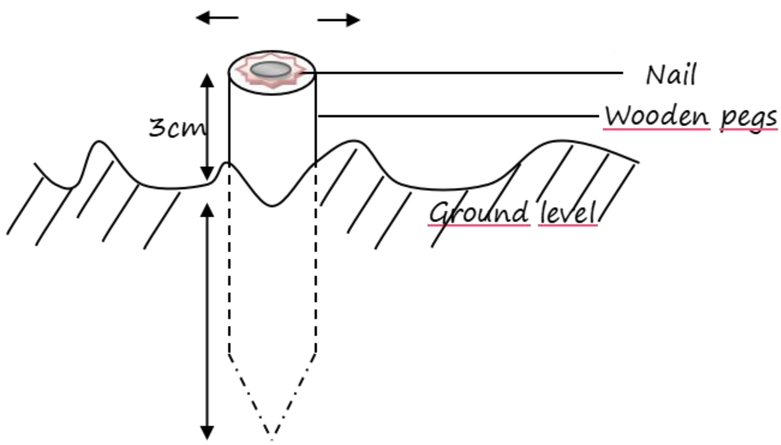


Fig 3.2 An Illustration diagram of peg

3.3 DATA ACQUISITION

This entails all activities involved in the collection of data for the successful execution of the project. This was carried out in chronological order using mode digital surveying equipment such that: they were coordinated using Topcon(ES-103) total station, the position of the center line was determined using Topcon(ES-103) total station and also both national and man-made features were observed and determined.

3.3.1 EQUIPMENT USED

I. Topcon (ES-103) total station
II. Tripod stand
III. S50mm steel tape
IV. 5m packet tape
V. Plumb pop
VI. Nails with crown corks
VII. Downloading cables
VIII. Writing materials

3.3.1.1 HARDWARE USED

The hardware used for this project includes.

I. Laptop computer for data processing

II. An Hp desk set for the printing of hard copy

3.3.1.2 SOFTWARE USED

I. Note pad
II. Microsoft excel 2010
III. Civil cad 2010
IV. Hp printer devices

3.3.2 CONTROL CHECK

The essence of carrying out the operation was to ascertain the reliability of all the controls used for the project whether they were in situ. The check was carried out by setting total station instrument on BM1 and all the necessary temporary station adjustment(i.e catering; leveling and focusing) was carried out, the reflector at back station on BM2 was then bisected, read and recorded, the instrument was turn to fore station BM3 and the reflector was also bisected read and recorded and on getting to every 500m interval where there are 2 benchmarks on the both side of the road same procedures where adopted in until the end of the road.

The coordinates obtained were compared with the coordinates extracted from the use of SOUTH GALAXY G1(GNSS receiver) which the result shows that the discrepancy was very little and lower than the allowable standard for the specification of this project which shows that BM1, BM2 and BM3project were reliable enough for the third order survey project given.

Table 3.3.2.1 showing the collected co-ordinates of the controls

STATION	EASTING (Nm)	NORTHING (Nm)	DISTANCE (M)	BEARING
BM1	661425.0232	945950.9002	324.7349	
BM2	661402.8991	945939.4238	324.8356	$179^0$14’ 9”
BM3	661457.0369	945934.9219	324.0516	$24^0$27’ 53”

Source: Supervisor (May 2025)

Table 3.3.2.2 showing the observed co-ordinates of the controls

STATION	EASTING (Nm)	NORTHING (Nm)	DISTANCE (M)	BEARING
BM1	661425.0232	945950.9002	324.7349	
BM2	661402.8991	945939.4238	324.8356	179^{0}14’ 9”
BM3	661457.0369	945934.9219	324.0516	24^{0}27’ 53”

The included angle = bearing of bm2 to bm1 minus bearing of bm2 to bm3

Table 3.3.2.3.showing the Comparison of observed and computed data

	Bearing	Back dist (m)
Computed value	179^{0} 14’ 09”	220.590
Observed value	24^{0} 27’ 53”	14.6427
Error	00^{0}01’ 06”	0.006

For the control points, the allowable heights misclosure were lesser than obtained misclosure for each control point. There, the set of controls (bm1, bm2and bm3) were in situ vertically and could be used as benchmark for height determination of profile and cross sectional points.

3.3.3 SELECTION OF STATION

The station selected were ensured to be inter visible to each other, accessible and firmly pegged to the ground with wooden pegs and bottle corks carrying mills at the centre point to denotes its exact point on the earth surface.

3.4 FIELD OBSERVATION

3.4.1 HORIZONTAL ALIGNMENT

This way carried out on loops with the aid of Topcon (ES-103) total station which has the capability to capture all the three dimensional (3d) terrain characteristics (easting, northing and height) concurrently. To control swing, the observation we carried out by commencing it on a set of controls and ending on another control from loops.

The instrument was set up on Bm2 and the reflector was placed on Bm1and the orientation was performed, the reflector was placed at change 0+000, which was the starting point of the route survey. The chainage 0+000 served as nail.

The target (reflector) was properly leveled and the coordinate of all the changes in the direction were observed and recorded in the internal memory of the instruments; other points which were visible from this instrument station were bisected and coordinated. This was done repeatedly until the entire section of the route was covered.

3.4.2 LONGITUDINAL / PROFILING

This was carried out with the aid of Topcon (ES-103) total station as well. The instrument was set on Bm2 and the reflector was placed on Bm1and the orientation was at every 25m interval. Whenever the target from the instrument station is too far and cannot be sighted from the instrument which might affect the accuracy of data, another stations were coordinated station where same procedures were repeated until all the data were captured.

CHAPTER FOUR

4.0 DATA PROCESSING AND RESULT ANALYSIS

4.1 DATA PROCESSING PROCEDURE

This is the process that follows downloading of data into the computer system. It is the manipulation of data into a more used form. Data processing includes numerical calculation, classification of data and the transmission of data from one place to another.

This stage involves downloading of the acquired data on field from the digital equipment (total station) to the personal computer for further processing.

The data obtained using Topcon(ES-103) total station were downloaded in sequential arrangement. After successful download and process using notepad for sorting them into desired arrangements.

The file was opened and point data were displayed. This was then copied to Microsoft excel environment for further processing.

On Microsoft excel, data were prepared for scripting purpose in AutoCad. A small program was written to prepare point and text scripts files.

The coordinates obtained were x,y,z format which were used for plotting the routes longitudinal profile and cross sections.

4.2 TOTAL STATION DATA PROCESSING

The downloaded data from the total station was further edited using Microsoft excel, the final copy was saved as text file containing x,y,z coordinates of all points observe in the field.

4.3 DATA EDITING

Data editing is done using the Microsoft excel. The following steps are followed to edit our data in the project:

i. The Microsoft excel was lunched.
ii. Click on file, the click on “all file” and select the group data.

iii. On open “test import wizard”, select “delimitated” and click on next.

iv. Select comma, tap and space then click on next. All the co-ordinates will be arranged then click on finish.

Cut and copy and put them in its appropriate positions if there is any misclosure.

4.4 DESIGN AND VOLUME CALCULATIONS

The design of the route was done after the creation of the longitudinal profile. The longitudinal profile was created using AutoCAD Civil 2012. The steps in the creation of the longitudinal profile are as follows:

1. The Centerlines of the entire data is first extracted and arranged in Microsoft Excel and saved with the extension txt.
2. The AutoCAD Civil 2012 Software is launched.
3. A new project is created and named
4. The Units icon is clicked to set the units of the drawing as follows:

4 Length

i) Type- Decimal

ii) Precision- three (3) places (i.e., 0.000)

5 Insertion Scale

IX. Units to scale inserted content- Meters

6 Angle

i) Type- Deg/Min/Sec

ii) Precision- 0d00’00”

iii) The Clockwise Box below is clicked

5. The Direction icon below is clicked and a direction control dialogue box is opened. The North is selected.
6. The icon Points is clicked, the point settings are selected. The Coordinates icon is clicked to select the method of data arrangement (i.e., Easting-Northing). The type of Marker is also selected.
7. Under the point icon, the import/export point icon is selected.
8. The import point’s icon is selected. A dialogue box opens, the format in which the data is arranged is selected (E.g., ENZ (space delimited)). Also, the source file where the data is saved and ok is clicked to continue.

9. The points are imported and are joined with the polyline drawing icon on the AutoCAD Civil 2012 Environment. The OSNAP (object snap) below the AutoCAD Civil 3D 2012 Environment is switched on so as to highlight the endpoints for ease of joining the points.
10. On the Alignment icon, the icon define from polyline is selected.
11. The line is clicked and where the alignment is to start is also clicked; a dialogue box opens and the alignment is named.
12. On the Alignment icon, the station label settings is clicked; the station label increment, station tick increment and the station label offset are edited appropriately. The perpendicular labels and plus sign location are also clicked. Then the station labels are also created.
13. The Terrain is created by clicking on the Terrain icon, Terrain Model Explorer is selected. A dialogue box opens; a new surface is created and named. The point files are added, the format in which it is arranged is selected as well as the file where it is located. The surface is built by right clicking on it and select build. When the surface is built, the dialogue box is closed.

4.4.1 PROFILE GENERATION

On the Profile icon, sampling is selected and import is clicked. The Tangent Labels, Vertical Curve Labels and the Vertical Grid Lines values are edited appropriately. The created surface is made current by clicking on surfaces and set current surface. The profile is sampled by clicking on existing ground, sample from surface and accepting the beginning and ending stations. Then the profile is created by clicking on create profile, full profile is selected; a dialogue box opens where the grid height is adjusted and ok is clicked.

When the profile is created, the route is designed by first creating the Tangents along the route and the Vertical Curves are created by selecting the incoming and outgoing tangents and inserting the K- Value (see appendix).

4.4.2 CALCULATION OF THE VOLUME OF EARTHWORK

One of the applications of survey products (profile and cross section) is in determining the estimate of the volume or quantity of earthworks, it is necessary to know the volume of materials which would be required to cut and to fill in road construction. For the scope of this project, the volume and fill were determined from the cross section using AutoCAD land development software. This is done also for subsequent cross-sections and the volume is cumulatively summed up to obtain the final cut and fill (see appendix)

4.4.3 CUT AND FILL ANALYSIS

This is an important aspect in route survey data analysis. The volume of earthwork needed can be calculated to a high degree of accuracy. It helps in the area of project costing to determine earthwork and materials quantity. The cut and fill table is shown in the appendices. The total cut was estimated to be 16803.12m3 while the total fill is estimated to be 10563.82m3. Having subtract the total fill from the total cut, therefore, the volume of material needed to be cut is 6239.30m3

Refer to the appendix for the entire cut and fill data (Appendix).

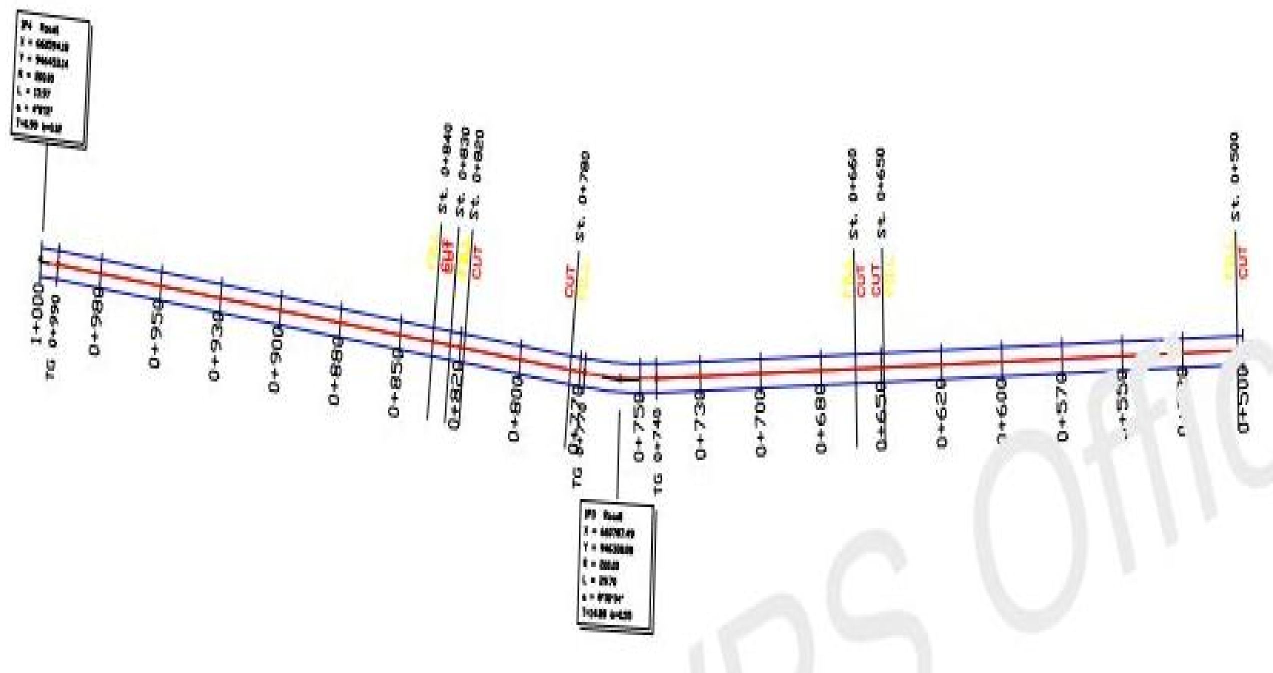
4.5 INFORMATION PRESENTATION/ PLAN PRODUCTION

The adjusted coordinates (X, Y, Z) were plotted in AutoCAD Civil 2012 Environment to generate the centerline of the road, longitudinal profile and cross-section. The details were also plotted.

4.5.1 DETAIL PLAN

The essence of obtaining a detail plan is to provide a platform for horizontal curve and alignment design for the road expansion/rehabilitation. Geometric information is also shown on the detail plan making a vivid representation of the land mass for easy understanding of the route.

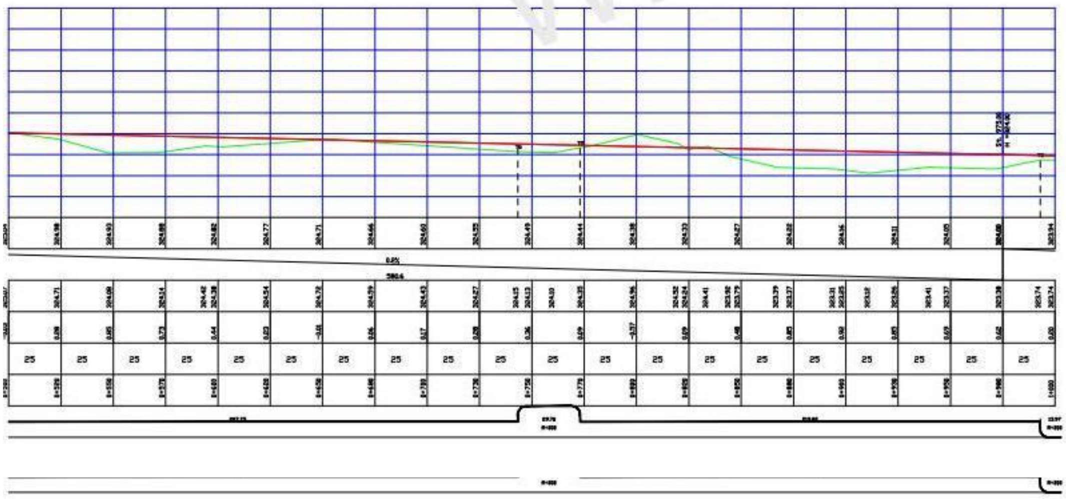
Fig.4.5.1



4.5.2 LONGITUDINAL PROFILE

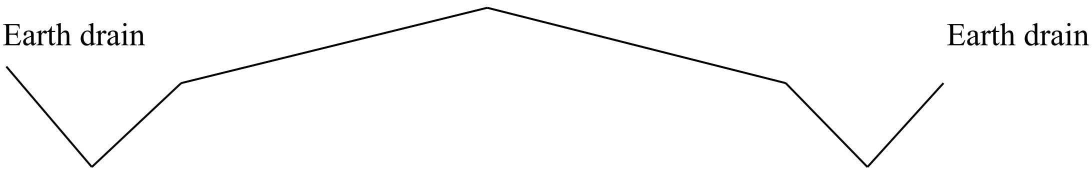
Profile was generated to provide vertical height/terrain information along a route for vertical alignment/curve design. It provides a vivid picture of the terrain and decisions of where to cut or fill was determined. It provides information such as the grade percent, tangent points, existing level and formation level.

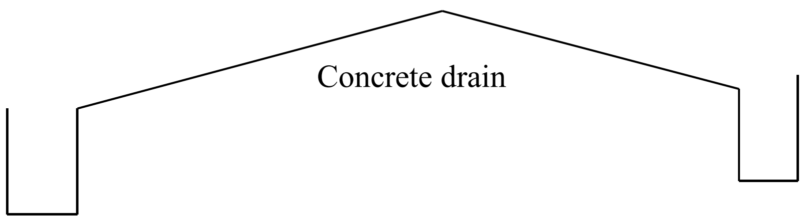
Fig.4.5.2



4.5.3 CROSS-SECTIONS

Cross-section depicts the terrain information across the road chainage. Information such as the height of existing and proposed center line and embankments were shown. The cross-section parameters were used to generate the area and hence, volumes of earthwork in cut and fill analysis (see appendix).





Earth drainage was used throughout except where we have culvert, concrete drainage was used 150m before and 150m after each culvert, the culvert used was 800mm by 800mm because the volume of the water that will be flowing there is much. The concrete drainage used was 0.10cm thick and 0.60cm by 0.60cm for easy flowing of waters.

Having carried out the flying method to checks on the linear accuracy of the closing control, it was discovered that the linear accuracy conforms with third order accuracy which show that the closing controls could still be used for this project.

CHAPTER FIVE

5.0 COSTING, SUMMARY, PROBLEM ENCOUNTERED, RECOMMENDATION AND CONCLUSION

To achieve this, the various project parameters were considered and their cost calculated to arrive at the total cost of the project. The costs are determined according to the project phases which are as follows;

i. Reconnais sance
ii. Field operation
iii. Data Processing
iv. Information presentation

Each of these aspects was cost based on the following components

i. Personnel
ii. Equipment
iii. Transportation
iv. Accommodation
v. Beaconing

COST AND ESTIMATION

1(a) RECONNAISSANCE

Duration (Estimated number of days = 2)

Personnel Daily Rate ₦	Amount ₦
1 Senior Surveyor	25,814.00
1 Technical Officer	20,542.00
4 Skill Laborers	5,078.00

1(b) TRANSPORTATION

Field Vehicle	
Mechanic	8,000.00
Driver	27,166.24
Fuel	12,638.12

1(c) FEEDING

Feeding for four person	₦12,000.00

TOTAL COST FOR RECONNAISSANCE ₦200,144.36

FIELD OPERATIONS

2(a) MONUMENTATION

Duration Estimated (Number of days) = 1

Personnel Daily	**Amount ₦**
1 Assistant Tech. of Officer	15,742.00
2 Labourers	2,061.00
3,00 Standard pegs	530.00
Basic Tools (Digger, Shovels, trowels, nail, hammer etc.)	19,000.00

2(b)TRANSPORTATION

Fuel	12,638.12
Driver	27,166.24

TOTAL COST OF MONUMENTATION ₦182,608.36

3(a) DATA ACQUISITION

Duration estimated number of days = 5 days

Personnel Daily	Amount₦
1 Surveyor	23,814.00
1 Assistant Surveyor	22,571.00
4 Labourers	2,078.00

Sub Total ₦749,760.00

3(b) EQUIPMENT LEASING

1 Total Station (With its accessories)	25,000.00
5 Ranging Poles	1,000.00 - 5,000.00
2 Cutlasses	1,700.00 - 3,400.00

Sub Total ₦33,400.00

3(c) FEEDING

5Days	3,000.00 -15,000.00
Sub Total	**₦15,000,00**

3(d) TRANSPORTATION

Duration estimated number of days = 5 days

Fuel	12,638.12- 63,190.60
Driver	5 Days

TOTAL COST OF DATA ACQUISITION **₦199,021.80**

4. DATA PROCESSING AND PRODUCT GENERATION

Duration (Estimated number of days = 3 days)

Personnel Daily	Amount ₦
1 Surveyor	23,814.00- 71,442.00
1 Computer Analyst	23,000 - 69,000.00
1 Computer hardware	9,000.00 - 27,000.00

Total **₦167,442.00**

5. PLOTTING/TECHNICAL REPORTS

Duration (Estimated number of days = 2 days)

Personnel Daily	Amount ₦
1 Surveyor	23,814.00- 47,628.00
1 CAD Operator	13,000.00 - 26,000.00
1 Clerical Officer	9,000 - 18,000.00

Total **115,442.00**

6 ROUTE DESIGN

Duration estimated number of days = 2days

Personnel Daily	**Amount ₦**
1 Surveyor	23,814.00- 47,628.00
1(one)Cad Operator	13,000.00 - 26,000.00
1 (one)Computer Hardware	10,000.00 - 20,000.00
Software used	10,000.00 - 20,000.00

Sub Total **₦113,628.00**

7. PLAN PRINTING

Duration estimated number of days = 2day

Quantity Rate	Amount ₦
10 copies computer printing	7,000.00 - 7,000.00
7 copies of report	7,000.00 - 49,000.00
Binding	3,500 - 49,000.00
Sub Total	**₦105,000.00**

COST OF PROJECT EXECUTION	**₦1,881,446.52**
CONSULTANT FEES 20% OF TOTALCOST OF PROJECT	**₦376,289.304**
CONTINGENCE 5% OF TOTAL COST OF PROJECT	**₦94,072.326**
VAT = 5% OF TOTAL COST OF PROJECT	**₦94,072.326**
TOTAL COST OF PROJECT	**₦2,445,880.476**

5.2 SUMMARY

This project was focused on a detailed route survey which involved key surveying operations such as reconnaissance, establishment of control stations, data acquisition through traversing, leveling, and feature detailing along a proposed route.

A total of six (6) second-order control stations were established and used for orientation along the route. Nineteen (19) traverse stations were observed excluding control points, using third-order traverse procedures to determine distances and angles.

Prominent features near each station were also located and plotted

accordingly.

All computations including forward and backward bearings, coordinate calculations, and leveling reductions were carried out using standard surveying procedures and departmental guidelines.

Finally, comprehensive plans showing longitudinal profiles, cross sections, and horizontal alignment were generated to scale for further engineering applications.

5.3 PROBLEMS ENCOUNTERED

During the execution of the project, several challenges were encountered:

i. Heavy vehicular and pedestrian traffic along the project site delayed observations and posed safety

ii. concerns.

iii. Unfavorable weather conditions, particularly rainfall, disrupted some field sessions.

iv. Instrumental difficulties, including the use of poorly graduated leveling staff and temporary loss of intervisibility between stations.

v. Removal of set pegs by passersby required re-establishment of some stations.

vi. Despite these issues, the project was completed successfully through patience, teamwork, and appropriate

vii. adjustments.

5.4 RECOMMENDATIONS

Based on the experience and observations during the course of this project, the following recommendations are made:

i. Digital equipment such as GNSS, total stations, and automatic levels should be made available and regularly maintained for student use.

ii. Field projects like this should not be limited to final-year students but introduced earlier to build technical confidence and skill.

iii. The application of computer software for computation and plotting should be emphasized to improve accuracy and efficiency.

iv. The school management should ensure that power supply and computing facilities are readily available for data processing and report preparation.

v. There should be proper legislation to strengthen the role of surveyors in route design and planning in national development.

5.5 CONCLUSION

In conclusion, the primary aim and objectives of this route survey project were fully achieved. The project offered a practical learning experience in various surveying techniques including control extension,

traversing, leveling, and mapping.

The processed data and generated plans are of acceptable accuracy and can be used for setting out, design, and future construction works along the proposed route.

This exercise has enhanced the student?s competence in field observation, data analysis, and map presentation, while also reinforcing theoretical knowledge through practical exposure.

REFERENCES

Bannister, A., & Raymond, S. (1977). Surveying (4th ed.). Pitman Publishing Ltd, London.

Basak, N. N. (2000). Surveying and Leveling. Tata McGraw Hill Publishing Company, Delhi.

Brinker, R. C., & Minick, P. R. (1987). Elementary Surveying (6th ed.). IEP - A Donnelley, New York.

Clark, D. (1972). Plane and Geodetic Surveying for Engineers (6th ed., Vol. 1). Constable and Co. Limited, London.

Idemudia, I. M. (2007). Right of Way and Acquisition Survey of a part of Oyo Iseyin Road (Unpublished project). Department of Survey and Geoinformatics, Federal School of Surveying, Oyo.

Wilson, R. J. P. (1985). Land Surveying (3rd ed.). MacDonald and Evans, London.

Uren, J., & Price, W. F. (1994). Surveying for Engineers (3rd ed.). Macmillan Press Ltd, London.

APPENDIX

POINT ID	EASTING	NORTHING	HEIGHT
tbm1	661425.0232	945950.9002	324.7349
tbm2	661402.8991	945939.4238	324.8356
0+00	661442.200	945926.970	324.735
0+25	661420.000	945938.470	324.836
0+50	661398.690	945951.520	324.052
0+75	661378.780	945966.520	324.381
0+100	661359.372	945982.380	324.975
0+125	661339.530	945997.580	324.401
0+150	661319.190	946012.120	324.517
Bld1	661298.380	946025.970	324.721
Bld2	661220.130	946039.130	324.038
ep1	661255.720	946052.050	325.034
0+175	661234.310	946064.960	325.367
0+200	661212.910	946077.870	325.296
0+225	661191.370	946097.560	325.744
0+250	661169.380	946102.460	325.889
0+275	661147.310	946114.200	325.735
0+300	661125.240	946125.950	325.836
0+325	661100.170	946137.690	325.052
epl2	661038.110	946149.440	325.381
0+350	661059.090	946161.280	325.975
0+375	661037.130	946173.240	325.401
0+400	661015.220	946165.270	325.517
0+425	660993.310	946197.310	324.721

0+450	660971.400	946209.350	324.038
tbm3	661457.0369	945934.9291	324.0516
tbm4	659614.397	946950.4665	325.3805
epl3	660949.490	946221.300	324.034
sch1	660927.600	946233.430	324.367
sch2	660275.670	946245.470	324.296
0+475	660883.760	946257.510	324.744
0+500	660661.840	946282.230	324.735
0+525	660618.840	946295.060	324.836
0+550	660787.490	946308.077	324.052
0+575	660776.140	946321.080	324.381
0+600	660754.860	946334.190	324.975
0+625	660733.920	946347.850	324.401
tbm5	659610.4873	946908.8838	325.975
tbm6	657863.5358	947370.1275	325.407
0+650	660713.372	946362.080	323.517
0+675	660693.220	946376.870	323.721
rd1	660673.400	946392.120	323.038
rd2	660653.620	946407.400	323.034
0+700	660633.830	946422.680	323.367
0+725	660614.050	946437.960	323.296
0+750	660594.180	946453.140	323.744
0+757	660574.100	946468.030	323.889
0+800	660553.810	946482.610	323.735
0+825	660533.310	946496.950	323.836
0+850	660512.610	946510.970	323.052
0+875	660491.720	946524.690	323.381

0+900	660470.620	946538.110	323.975
0+925	660449.340	946551.230	323.401
0+950	660427.880	946564.040	323.517
0+975	660406.230	946576.550	323.721
1+000	660384.410	946588.750	323.038
1+025	660362.410	946600.630	323.034
cul1	660340.250	946612.190	324.167
cul2	660317.930	946623.450	324.296
cul3	660295.550	946634.590	324.344
cul4	660273.170	946645.740	324.459
tbm7	660267.0369	946661.9219	323.554
tmb8	660257.0389	946663.9219	324.612
1+050	660250.790	946656.880	323.735
1+075	660228.410	946668.030	323.836
1+100	660206.030	946679.170	323.052
1+125	660183.660	946690.320	323.381
1+150	660161.280	946701.460	323.475
1+175	660138.880	946712.580	325.401
1+200	660115.600	946721.650	323.517
1+225	660092.050	946730.040	323.721
1+250	660068.500	946738.430	323.738
1+275	660044.950	946746.820	323.804
1+300	660021.400	946755.210	323.817
1+325	659997.850	946763.600	323.826
1+350	659974.300	946771.990	323.844
1+375	659950.750	946780.380	323.871
1+400	659927.370	946789.230	324.035

1+425	659904.320	946798.910	324.036
1+450	659881.640	946809.410	324.052
1+475	659859.250	946820.550	324.081
1+500	659836.900	946831.740	324.175
1+525	659814.540	946842.930	324.201
1+550	659792.180	946854.100	324.417
1+575	659769.700	946865.040	324.721
1+600	659747.090	946875.700	325.038
1+625	659724.340	946886.070	325.046
1+650	659701.470	946895.160	325.267
1+675	659678.470	946905.970	325.316
tbm8	661457.0369	945934.921	324.0516
tbm9	661461.1865	945967.091	324.9271
1+700	659655.350	946915.480	325.744
1+725	659632.120	946924.710	325.889
1+750	659632.120	946924.710	325.889
1+775	659585.310	946942.290	326.003
1+800	659561.740	946950.630	326.052
1+825	659538.080	946958.690	326.081
1+850	659514.310	946966.440	326.123
1+875	659490.450	946973.900	326.154
1+900	659466.500	946981.060	326.047
1+925	659442.460	946987.920	326.026
1+950	659418.360	946994.570	326.018
1+975	659394.260	947001.220	325.998
2+000	659370.150	947007.880	325.982
2+025	659346.050	947012.500	325.886

tbm10	659337.091	947014.378	325.873
tbm11	65935.981	947018.285	325.859
2+050	659321.950	947021.140	325.844
2+075	659297.850	947027.780	325.829
2+100	659273.690	947034.200	325.798
2+125	659249.450	947040.310	325.736
2+150	659225.130	947046.130	324.052
2+175	659200.750	947051.640	325.381
2+200	659176.290	947056.840	325.975
2+225	659151.780	947061.740	325.401
2+250	659127.200	947066.330	325.317
2+275	659102.570	947070.610	325.276
2+300	659077.900	947074.620	325.288
2+325	659053.210	947078.580	325.263
2+350	659028.530	947082.540	325.206
2+375	659003.840	947086.500	325.174
2+400	659003.840	947090.460	325.144
2+425	658979.160	947090.460	325.089
2+450	658954.480	947094.420	324.935
2+475	658929.790	947098.380	324.896
2+500	658905.110	947102.340	324.852
2+525	658880.420	947106.300	324.791
2+550	658855.740	947101.260	324.775
tbm12	658849.440	947114.252	324.729
tbm13	658838.195	947118.239	324.712
2+575	658831.050	947114.220	324.701
2+600	658806.370	947118.180	324.617

2+625	658781.580	947121.360	324.591
2+650	658756.620	947122.800	324.582
2+675	658731.670	947124.400	324.534
2+700	658706.790	947126.760	324.467
2+725	658881.990	947129.890	324.296
2+750	658657.290	947133.780	324.644
2+775	658632.630	947137.870	524.889
2+800	658607.970	947141.960	324.935
2+825	658583.300	947146.060	325.036
2+850	658558.640	947150.150	325.052
2+875	658533.980	947154.250	325.281
2+900	658509.320	947158.340	325.375
2+925	658484.650	947162.430	325.401
2+950	658459.990	947166.530	325.517
tbm14	658447.981	947168.590	325.542
tbm15	658439.695	947169.611	325.663
2+975	658435.330	947170.620	325.721
3+000	658410.670	947174.720	325.838
3+025	658386.020	947178.910	325.934
3+050	658361.500	947183.790	326.067
3+075	658337.150	947189.440	326.196
3+100	658312.980	947210.840	326.244
3+125	658289.030	947202.990	326.389
3+150	658265.310	947210.880	326.435
3+175	658241.840	947219.500	326.536
3+200	658218.440	947228.300	326.652
3+225	658194.890	947236.670	326.681

3+250	658171.160	947244.550	326.775
3+275	658147.300	947252.020	326.801
3+300	658123.430	947259.440	326.817
3+325	658099.560	947266.860	326.921
3+350	658075.680	947274.290	327.002
3+375	658051.810	947281.710	327.014
3+400	658027.940	947289.130	327.067
3+425	658004.060	947296.550	327.146
3+450	657980.080	947303.600	327.174
3+475	657955.970	948731.200	327.189
3+500	657931.850	947316.790	327.235
tbm12	657918.640	947304.190	327.251