PROJECT REPORT

ON

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

BY:

AHMED SAHEED TOYYIB

HND/23/SGI/FT/0084

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.

……………….………………………..

AHMED SAHEED TOYYIB

DATE ………………………………

CERTIFICATION

This is to certify that **AHMED SAHEED TOYYIB** with Matric No **HND/23/SGI/FT/0084** 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: …………………………**

SURV. ISAU IBRAHIM ABIMBOLA
(H.O.D)

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

SURV. R. AWOLEYE
(PROJECT COORDINATOR)

………………………………………. **DATE: …………………………**

EXTERNAL SUPERVISOR

<u>DEDICATION</u>

This project is dedicated to Almighty God and to my lovely parent **DR. AHMED SAHEED AND MRS AHMED KHADIJAT** for both their immense moral and financial support during my period of attachment.

ACKNOWLEDGEMENTS

I give glory, honour and adoration to Almighty Allah, who is the alpha and the omega, the author and the finisher of my faith; who had made me to endure the vigor of my study. So, I return all glory back to God.

My special thanks go to my Parent **DR. AHMED SAHEED** and **MRS AHMED KHADIJAH**, my mentor whom I can't for ever forget **MR. OMOLOSODADA OTUNOLA OLASENI** (General Manager Fik Global Nig Ltd), and **ENGR. RAFIU ABDULYAKEEN ADEBAYO** (Project Manager Fik Global Nig. Ltd) and my lovely people for provisions and the great confidence they deposed in me, their unrelenting efforts and pieces of advice in spurring me to be the best I can that led to the success of my academics, thank you very much sir/ma may you live long in good health and peace of mind, may the lord crown all your efforts and your children shall continuously receiving the favour of God anywhere they found themselves in Inshallah (Amen).

My profound gratitude goes to all those who help me in one way to other for their encouragement, advice and support both spiritually, materially and financially toward the success of this course. May almighty God reward you with long life, good health and prosperity and may you live to reap the fruits of your labour in Inshallah (Amen).

Also, my appreciation goes to my able supervisor **SURV. R.O. ASHONIBARE** for his wonderful advice and guidance, accurate criticism and attentiveness together with solution he proffered to the challenges I faced during the course which have contributed to the successful completion of this project and our Head of Department **SURV. ABIMBOLA I. ISAU**, **SURV. ABDULSALAM AYUBA**, **SURV. KABIR** and all ours distinguished Lecturers in the department; I pray that God will continue to bless them and there respected family, there wisdom, knowledge and understanding shall never seize and they shall succeed in everything they laid there hands on (Amen).

I also wish to acknowledge the effort of my great friend and course mate who has been so supportive in all ways since the beginning of this course, I really appreciate all you have done for me, may the lord reward you. I cannot but appreciate the efforts of my special friends in person of ,**HON. SPEAKER ABDUL MUIZ**

OLADITI, **ALAI ABDULLAH**, **YUNUSA RUQAYAH**, **ABDULGANEEY MUSTAPHA**, **ABDULHAMID AJAGBE**, **OFFICER MUFTAU OPEYEMI** and **PRES. NURUDEEN AROWOLO** for their moral and financial support, may you never labour in vain inshallah.

My warm greeting goes to all my group members for their endurance and co-operation and to all my course mates for their understanding throughout the course.

I cannot do without acknowledging my entire family members (brothers and sisters, uncle and aunt, cousin and niece), my friends and all well wishers for their concern and generosity throughout my stay in school, may God almighty reward you.

AHMED SAHEED TOYYIB

MAY 2025

ABSTRACT

This project topic route survey is an engineering survey carried out to acquire base line data required for the rehabilitation of route along Mandala to Awe Moro Local Government, Kwara Ilorin. Ground survey method was adopted in the data acquisition with the use of digital (Topcon (ES-103) total station) instruments. The exercise involved traversing and leveling. Traversing was carried out to adequately locate the path of the route while leveling was used to determine the height of points at 25m interval along the centre line and for cross-section at offset distance of 4m, (8m) intervals on both sides of the centre line. Also the total station was used to determine the heights of drainage edges. The data acquired were processed manually and by the use of computer system and some applications like AutoCAD Land Development and Microsoft Office Excel software. The end result was the production of the location plan of the route, longitudinal profile and the cross section plans of the route all at suitable scale both in digital and graphic formats. Finally a project report was written.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND TO THE STUDY

The term "Engineering survey" can be described as a large scale survey operation carried out in order to provide special information for consumers purposes. It involves measuring heights differences and angle on site either for the preparation of large scale plan or that engineering works that be located in their right position on the earth surface.

Surveying plays a vital role and a crucial role in the development of any engineering project such as road alignment, irrigation projects, hydroelectric schemes, tunnels, construction of dams, building construction, etc.

Surveyor plays an essential role in each stage in any engineering surveying. It is the surveyor who will provide information relevant for the design and construction part of the project. The stages are classified into three:

i. Investigation and planning stage: the work of the surveyor here is to follow other project committee to the site in other to ascertain the actual location, the marking out area of interest, and thereafter, to produce detailed large scale plan which serves as the base plan.

ii. Design Stage: the role of the surveyor here is to guide the architects and the engineers on the interpretation of the base plan produced.

iii. Construction Stage: at this junction, it is required for the surveyor to set out the design plans produced by engineers, where he /she will fix on the ground, the details shown on the plan.

This project is all about **ROUTE SURVEY**, which is one of the aspects of engineering survey.

Route survey required a proper planning before execution. This is so because the data obtained aids in the construction and engineering design of the road. The features (both natural and man-made) were also fixed and as well plotted.

Route survey provides information necessary for vertical and horizontal alignment for design and construction of the route.

Before need arises for route surveying, there will be a major happening that would lead to its invention.

There are some reasons that call for route surveying, and they are listed below:

i. To reduce traffic congestion in highly populated area.

ii. To enhance free movement within a city.

iii. For easy communication network between communities.

iv. To have good transportation network in the city.

v. To boast the economy of a particular community.

vi. To acquire data which will enable construction engineers carry out work on a specific site.

1.2 STATEMENT OF PROBLEMS

It was found that route along Mandala to Awe Village, Moro Local Government Area, Ilorin, Kwara State, needs further construction. It was also found too be narrow and needs to be expanded considering the volume of traffic plying the road. Rehabilitation of this road should be embark upon in the in order to increase its carrying capacity. Thereby increase the physical development and human activities along the road with other conveniences. Due to the nesssacity of the road rehabilitation, certain information about the road must be acquired which calls for route survey so as to get the baseline data necessary for the road design.

1.3 AIM(S) AND OBJECTIVES

1.3.1 AIM(S)

The aim of the project is to carry out the route from Mandala to Awe Village, Moro Local Government Area, Ilorin, Kwara State.

The project is also aimed at training the students on how to carry out a route survey and to examine whether the student will be able to carry out route survey which entails production of horizontal,vertical alignment and cross section plans of the route running through the project area.

1.3.2 OBJECTIVES OF THE STUDY

In other to achieve the aforementioned aim, the objective listed below were pursued.

i. Collection project guide and instructions from the school department.

ii. Searching for controls and as well the selection of traverse stations.

iii. Determination of the center-line and marking of chainages along the centre line at an interval of 25m

iv. Marking out some selected points for cross-sectioning at 8m interval on both side of the center-line.

v. Topcon (ES-103) total station for the determination of spot height along the center line for the longitudinal profile.

vi. Third order Spirit leveling on both sides of the center-line for cross sectioning.

vii. Field book reduction and as well as computation.

vii. Data presentation i.e. plan production showing the location of the road, profile and cross-section of the road way, digitally and manually.

x. Report Writing.

1.4 PROJECT SPECIFICATIONS

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

i. The traverse should start from the second order coordinated controls which are known and must close on the same or another set of controls which are ascertained to be undisturbed by necessary measurements (control checks).

ii. Linear measurement should be done with the use of Electronic Distance Measurement (EDM).

iii. Point should be created on the profile at 25m interval. Cross-section point at 8m and 4m to the right and left on the profile respectively. The height of the center line and cross section point should be determined by a flying EDM traversing procedure.

iv. Computation should include volume calculation by end-area method.

v. Three (3) plans i.e longitudinal/profiling plan, cross-section plan, and cut and fill analysis plan.

1.5 SIGNIFICANCE OF THE STUDY

Route survey is a branch of survey that spans through a long distance. It is essential for the acquisition of necessary data that would be required for the construction of road at the project area, it provide a 3D data that can be used for generating of profile, cross section and for volume computation of the cut and fill. However, proper care was taken so as to ensure the safety of vehicles that will ply the route. It also provide the following solutions:

i. Reduce the time of travel between the villages.

ii. Help in the transportation of local agricultural products to nearby markets

iii. Facilitate the poultry and fishery farms of the area by ensuring good transportation of farm product.

iv. Facilitate access to the raw materials

v. Speed up the development rate of the area.

1.6 SCOPE OF THE PROJECT

The scope of the project are the activities carried out which include the following.

i. Reconnaissance survey of the project area.

ii. Selection of traverse stations and field preperation/line clearing

iii. Setting-out of the chainages points along the center line of the road (25m interval)

iv. Setting out of some selected points on both sides of the center-line 4m apart and 8m offset from the center-line of the road.

v. Detailing.

vi. Determination of the geographical location of the road way by third order EDM traversing.

vii. Cross-sectioning by third order EDM traversing.

viii. Longitudinal profile by third order EDM traversing.

ix. Plan Production

x. Report Writing.

1.7 PERSONNEL

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

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

1.8 PROJECT AREA

The project site is the route of Mandala/Awe to Adigbongbo 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”

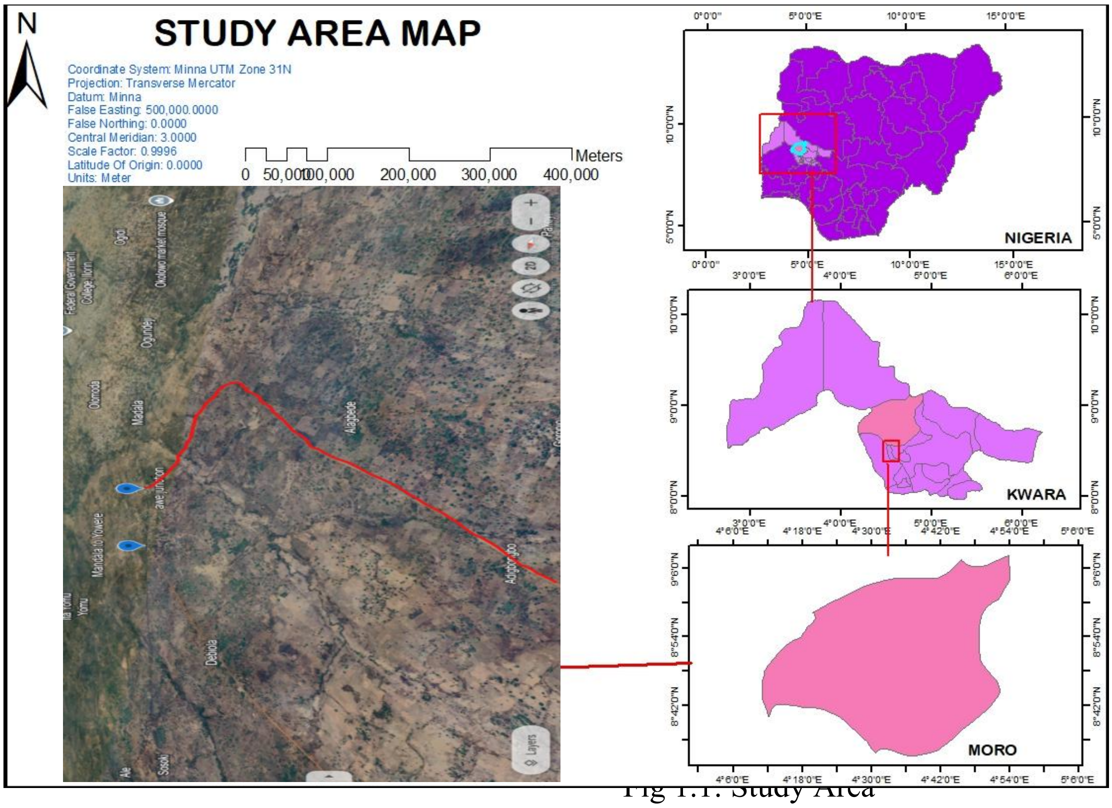


Fig 1.1: Study Area

Source:-GoogleEarth

CHARPTER TWO

2.0 LITERATURE REVIEW

Highway and railroad routes are chosen only after a complete and detailed study of all possible locations has been completed. Functional planning and route selection usually involve the use of aerial imagery, satellite imagery, and ground surveys, as well as the analysis of existing plans and maps.

According to Road Planning and Design Manual (2014), site specific risk assessment incorporating engineering judgement is required for all designs. This manual is emphasizing on the importance of risk assessment to incorporating engineering judgement. The importance of risk management in road planning can never be overemphasize, it is very important to consider the safety of the road user in planning.

Local planning handbook (2015) said routes that follows simple patterns with few turns are easier to understand for transit riders. A network of simple routes makes the whole system easier to use spontaneously with little planning. Routes that do not make a lot of deviations also provide a faster trip for riders and are less expensive to operate for the provider – meaning more service can be provided for the same resources. Communities can support this principle by encouraging development along denser, linear corridors and connecting gaps in the street grid to allow transit to have simple and direct routes in their communities.

Surveying is very important for planning and as well for acquisition of the required data for route alignment, with special attention on road network, for rehabilitation and construction of roads.

A comprehensive route survey consists of reconnaissance, preliminary survey (control establishment or location of benchmark etc.), location survey (traversing, leveling etc.) and construction. According to Chandra (2009), Reconnaissance is a rapid and rough survey in which a thorough examination of the area through which the proposed survey is to run. It is conducted to ascertain the best route, approximate cost and vital information about the project. According to Ghilani and Wolf (2012) Control surveys establish precise horizontal and vertical position of reference monuments. These serve as the basis for originating or checking subordinate surveys for project such as route or construction survey, topographic mapping etc. for effective implementation of this project and determining the exact position of point, Reference point (control) was established in order to determine the accurate co-ordinate of such points. Traversing is the act of marking lines on ground, establishing traverse stations and making necessary observations for the purpose of determining the relative positions of those points marked. It is also defined by Shurantul (2010), A traverse is a succession of straight lines along or through the area to be surveyed. The direction and lengths of these lines are determined by measurements taken in the field. A traverse is currently the most common of several possible method for establishing the series or network of monuments with known positions on the ground. Such monuments are referred to as horizontal control points and collectively, they comprise the horizontal control for the project.

Leveling is the most widely used method for obtaining the elevations of ground points relative to a reference datum and is usually carried out as a separate procedure from that used for fixing planimetric position. Leveling involves the measurement of vertical distance relative to a horizontal line of sight. Hence, it requires a graduated staff for the vertical measurement and an instrument that will provide a horizontal line of sight.

A Route Survey is defined as being the required service and product that adequately locates the planned path of a linear project or right of way which crosses a prescribed area of real estate, extending from at least one known point and turning or 9 terminating at another known point. Adequate location shall mean substantial compliance with the conditions and tolerances expressed in this standard. A route survey which defines new or proposed boundaries shall be conducted as a boundary survey and must adhere to the rules and regulations of the Texas Board of Professional Land Surveying (TBPLS).

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 pipelines. This involves the determination of the ground configuration and location of physical features (naturals and man-made) along the route, establishing the line on the ground and computing the volume of earthwork.

The main purpose of any route survey is to:

i. Select one or more tentative general route for the roadway or utility
ii. Gather enough information about the general route to make it possible for the route designers to select the final location of the route, and
iii. Mark this final location selected from the available options.

With these purpose, 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 line is to be constructed on a military installation, having a well-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.

Punmia et al (2005) explained route surveying as surveys along a comparatively narrow strip of territory for the location, design and construction of any route of transportation, such as highways and railroads, aqueducts, canals and flumes, pipeline for water, sewage, oil and gas, cableways, belt conveyors and power, telephone and telegraph transmission line is called 'ROUTE SURVEY'. At this stage, it must be noted that the examples mentioned above cannot design themselves until some methods are used to make them refined.

It is worthy to note the construction of roads in Nigeria dated back to decades ago or during colonial era; roads are commonly found narrow till now, few are found serviceably and their horizontal and vertical alignment are much influenced by their topography. The road construction was then constrained by non-availability of earth 10 moving equipment, limited funds, no skillful personnel and fewer numbers of vehicles on roads.

More so, certain procedures or method are used when carrying out a route survey explained by Basak (1994) that when the question of constructing a new road for public demand or some strategic reasons arises, the procedures to be taken are:

a. To find the necessity for the existence of the road
b. The marking of the tentative alignment
c. The reconnaissance survey
d. Preliminary location survey traverse
e. Final location survey and report

- ✓ He further explained that the tentative alignments are marked on the general map and contour map and contour map of the area through which the route is expected to pass.
- ✓ Meanwhile, in every construction work, the surveyor stands to perform certain roles and also must be familiar with some procedures of the work at hand as at the time of execution.

In view of the foregoing, Anderson and Raymond (1985) stressed that “In order to plan and perform, the surveyors needed to acquire the data of a route survey and the surveyor must be familiar with the following:

- ✓ The geometry of horizontal and vertical control and how they are used in the route alignment procedure.
- ✓ The methods of acquiring terrain data utilized in route design.
- ✓ The procedures followed in processing terrain data to obtain earth work volumes
- ✓ Establishment on the ground, a system of staves both in plane and elevation, from which measurement of earth work and structures can be taken conveniently by the construction force
- ✓ Giving lines and grades as needed either to replace stakes disturbed by construction or to reach additional points on the structure itself.
- ✓ Making measurements necessary to verify the location of completed part of the structure as-built survey.

In addition to the above, the surveyor concerned must also learn or be familiar with the reasoning and interpretation of maps, the symbols and signs, scales, directive, locations etc. certain parameters therefore are necessary to explain routes e.g. cross section, longitudinal sections, curves and setting out etc.

Duggal (2006) defined curves as arcs with some finite radius, provided between intersecting straights to gradually negotiate a change in direction. He classified as horizontal or vertical curves, the former being in the horizontal plane and the latter in the vertical plane.

According to a U.S based website homepage, circular curves are used to join intersecting straight lines (or tangents), they are usually assumed to be concave. It was explained that horizontal curves are classified into four (3) major types i.e. simple curve, compound curve and reverse curve.

Furthermore, it was explained that laying out circular curves must follow the following procedures.

i. Select tangents and general curves making sure you meet minimum radius criteria.
ii. Select specific radii spiral and calculate important points using formulae or table, those needed for design, plans and lab requirements.
iii. Station alignment as curves are encountered
iv. Determine super and runoff for curves and put in table.

More so, he further stressed that the elements of a circular curve are point of intersection, tangent, point of curve, point of tangent, radius, long chord, external ordinate, internal ordinate, curve length, and the apex angle. He also said that a curve may be designated either by its radius or degree of curve.

In his quest to explain the methods of setting out of circular curves, he said that the various linear methods of setting out a simple circular curve are;

1. Offsets from the long chord
2. Perpendicular offsets from the tangents
3. Radial offsets from the tangent
4. Successive bisection of arcs
5. Offsets from the chord produced.

He also said that the angular methods are:

- Rankine method of deflection angle, one Total station method
- Two Total station method
- Tachometric method.

In the laying out of simple curves, some obstacles are usually encountered, on this note; Duggal (2006) explained that the obstacles in laying out simple curves are:

- When the complete curve cannot be set out from point of curves i.e. obstruction to vision
- Obstacles to chaining
- When the point of intersection is inaccessible.

He explained that a compound curve is a combination of two or more simple circular curves with different radii.

According to The Transit, New Zealand State Highway Geometric Design Manual May, 2005. A horizontal road alignment is a usually series of straights (tangents) and circular curves. Transition curves are often used to join straight sections smoothly into circular curve sections.

A curve should normally be used whenever there is a change of direction in a road alignment and must be of sufficient length to avoid the appearance of a kink in the road alignment.

Small changes in alignment are not usually noticed by drivers and in some cases it might not be necessary to provide a curve between adjacent straight tangent sections of road, provided they do not produce a kinked road alignment.

Horizontal road alignments without significant straight sections are described as curvilinear. A curvilinear alignment normally has:

a. long, large radius circular curves, with or without spiral transitions, and
b. Occasionally, other types of curves which conform to polynomial mathematical relationships.

Curvilinear alignment is most suited to dual carriageway roads but can also be successfully used on two-lane roads in flat and undulating terrain, providing overtaking provisions are not impaired. The horizontal curves of a curvilinear alignment are generally of large radius and:

1. do not normally restrict overtaking opportunities,
2. help reduce headlight glare, and give drivers a better perception of the speed of approach of opposing vehicles.

Billiaminu (2017), embarked on a route survey project between Mandala to Awe Village Moro Local Government, Ilorin. Area of Kwara State was carried out using modern method of surveying, planning and data search was carried out to obtain necessary information about available controls in that area and Google imagery that covered the length of the route was downloaded. This was followed by field reconnaissance. Control points were searched for on site, while other points were 13 selected, the inter-visibility and stability of such points were considered, reconnaissance diagram of the study area was drawn, chainage points were later marked at 25m interval, Control point monumented and traverse point marked with pegs. South Galaxy G1(GNSS receiver) GPS receivers were used to establish controls while Topcon (ES-103) total station was used to acquire X,Y,Z coordinate of profile points and cross sectional points and details. The acquired data were downloaded and processed using Hc loader for Differential Global Positioning System(DGPS) Data downloading, Hc Rinex for DGPS data conversion and Hi target geometric office for DGPS data processing, while Topcon ES-103 Total Station were used for Total Station data processing. Civil Cad 3D companion 2010 was used to plot the processed data while new horizontal and vertical alignments were designed using the same software, volume of cut and fill were computed. At the send of the project, working drawing were presented in both soft and hard copies and a comprehensive report was written.

Earnest (2014) used modern method of land surveying techniques for route definition of a road from Mandala to Awe village Moro Local Area, Ilorin, Kwara. In the execution of the work, he acquired data for both horizontal and vertical alignments with the aid of Total Station. He processed the data using Civil Cad 3D. The work produced longitudinal and cross sectional views of the proposed road. All errors obtained are within allowable limit.

On the 16th of May 2005, a gas project was awarded to a UK- based pipeline engineering group. This work entails a detailed route survey and installation of a specified dimension and quality of pipeline which covered a length of about 4.400km with about 800km across Niger Republic. The scope of this project include: market analysis, pipeline infrastructure requirement, establishment of gas supply sources, project cost estimates, economic and financial analysis, pipeline route survey, project risk analysis and assessment of environmental issues.

In 2016, the Federal Republic of Nigeria awarded a Modernized Lagos - Ibadan railway project to China Civil Engineering Construction Company (CCECC). Before the execution of the project, the direction of the route was extracted from Google earth, the coordinates also was extracted using ArcGIS software, query was done in order to know the number of the affected house to be demolished and in order to compensate affected individuals. Some practicing surveyors were also awarded a contract for the establishment of controls using Differential Global Positioning System (DGPS) along the proposed route of the project, the DGPS was used in static mode so 14 as to obtain the required accuracy. Level instrument was used for the transfer of height and total station instrument was also used for the setting out of the pilling of the abutment of the bridge. The total station instrument and differential GPS were used simultaneously for the setting out of the track in order to obtain the accuracy needed.

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;

- ✓ Office planning
- ✓ 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

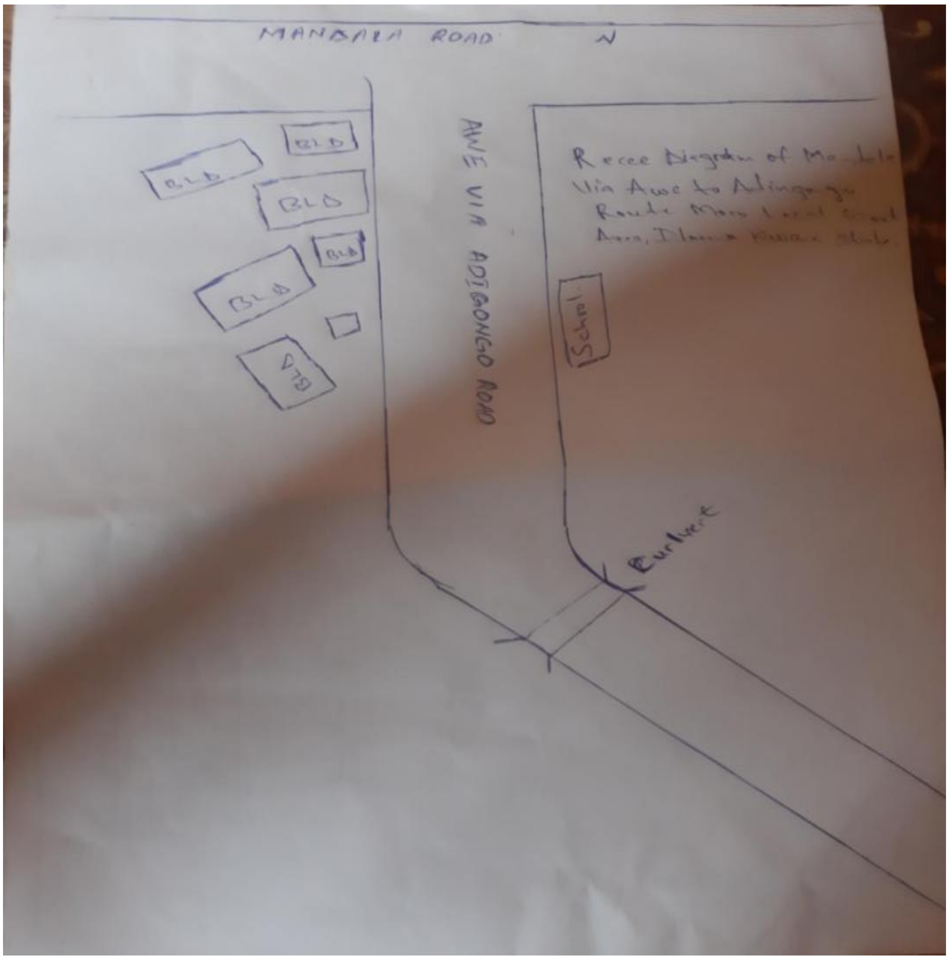
The field reconnaissance was done after the office planning it involved a visitation to the project site by all the group numbers to have a pre requisite knowledge of how it looks like and how the field operations would be carried out.

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. 1 Field Recci diagram Mandala to Awe Route.



3.2 A TYPICAL PEG USED

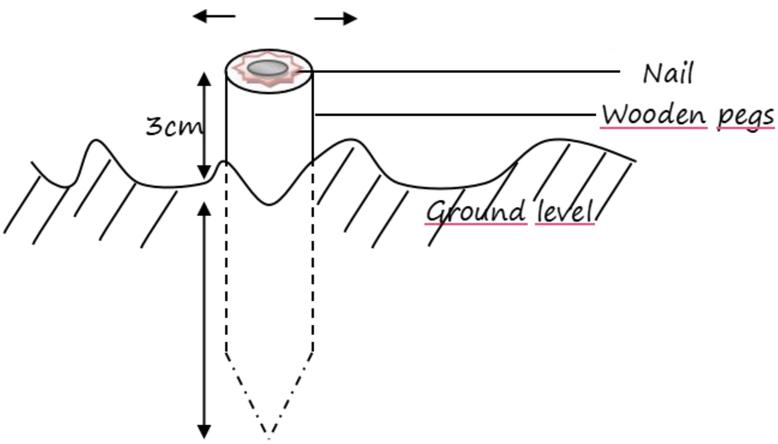


Fig 3.2 An Illustration diagram of peg

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

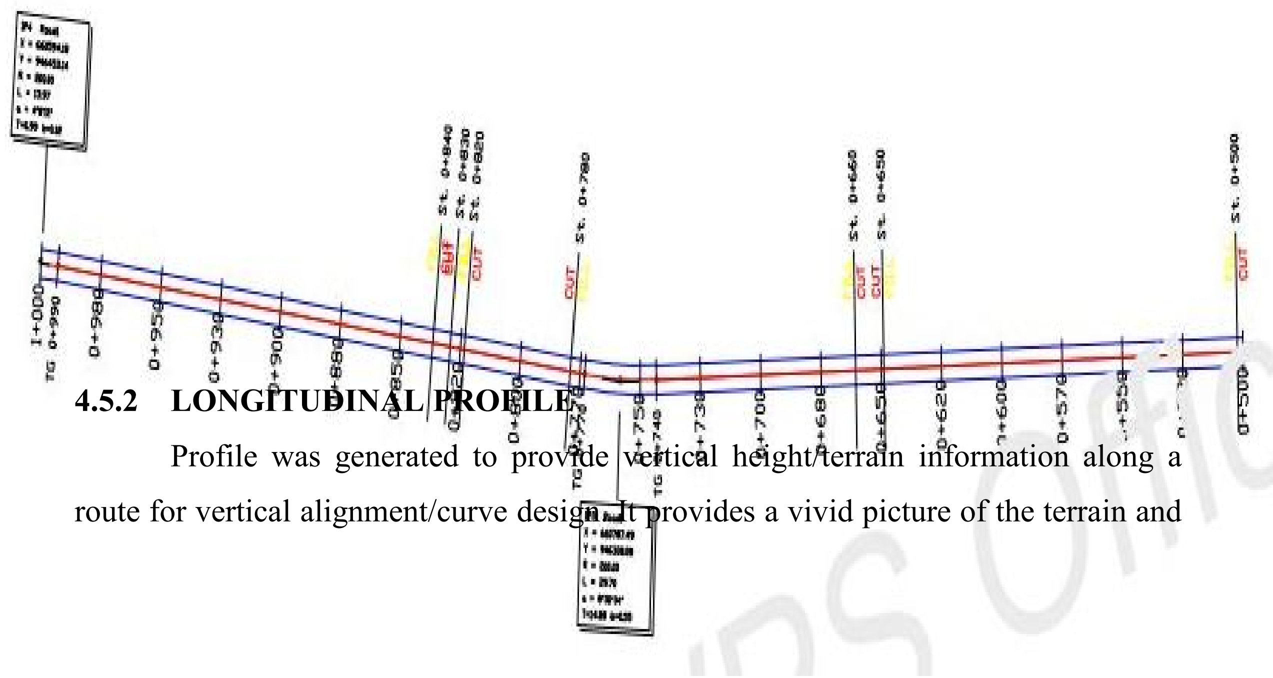
Refer to the appendix for the entire cut and fill data (Appendix).

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.

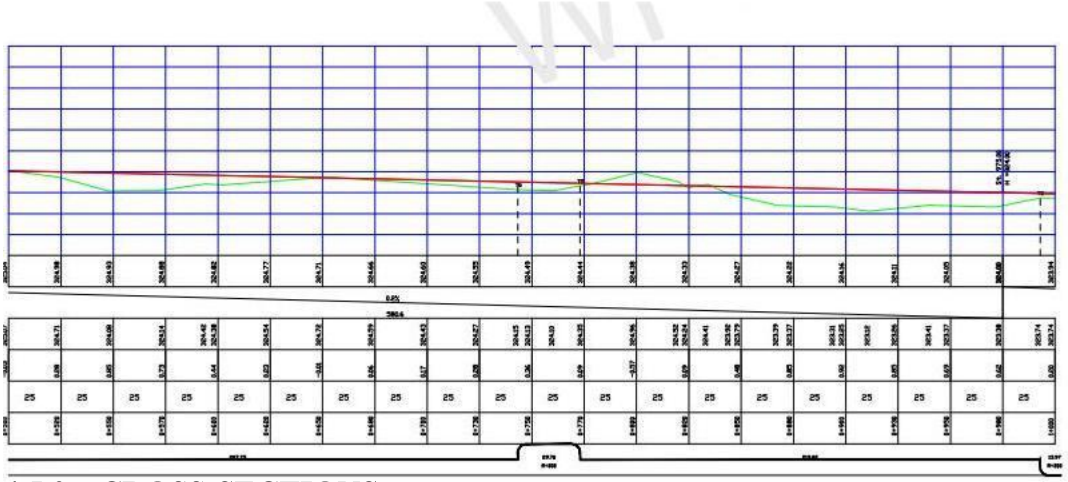
4.5.1 DETAIL PLAN

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.



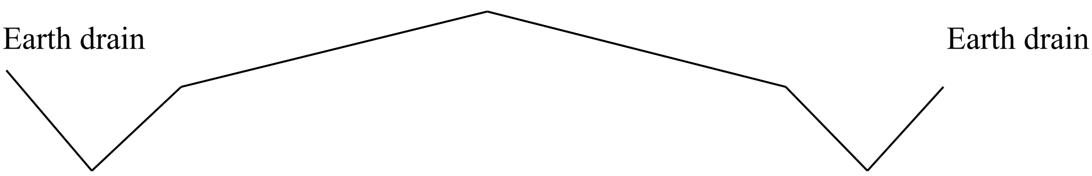
4.5.2 LONGITUDINAL PROFILE

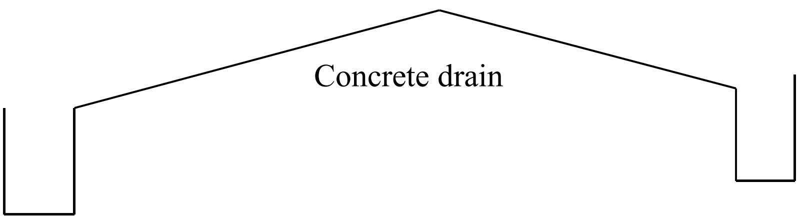
Profile was generated to provide vertical height/terrain information along a route for vertical alignment/curve design. It provides a vivid picture of the terrain and decisions of where to cut or fill was determined. It provides information such as the grade percent, tangent points, existing level and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



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, PROBLEMEN COUNTERED, RECOMMENDATION AND CONCLUSION

5.1 PROJECT COSTING

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. Reconnaissance
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	4,000.00
Driver	30,162.24
Fuel	20,162.35

1(c) FEEDING

Feeding for four person	₦8,000.00

TOTAL COST FOR RECONNAISSANCE ₦195,660.59

FIELD OPERATIONS

2(a) MONUMENTATION

Duration Estimated (Number of days) = 1

Personnel Daily	**Amount ₦**
1 Assistant Tech. of Officer	18,542.00
2 Labourers	4,076.00
3,00 Standard pegs	400.00
Basic Tools (Digger, Shovels, trowels, nail, hammer etc.)	15,000.00

2(b)TRANSPORTATION

Fuel	20,162.24
Driver	30,162.24

TOTAL COST OF MONUMENTATION ₦207,942.48

3(a) DATA ACQUISITION

Duration estimated number of days = 5 days

Personnel Daily	Amount₦
1 Surveyor	25,814.00
1 Assistant Surveyor	23,571.00
4 Labourers	5,078.00

Sub Total ₦267,237.00

3(b) EQUIPMENT LEASING

1 Total Station (With its accessories)	20,000.00
5 Ranging Poles	500.00 - 2,500.00
2 Cutlasses	1500.00 - 3,000.00

Sub Total ₦25,500.00

3(c) FEEDING

5Days	2,000.00 -10,000.00
Sub Total	**₦10,000,00**

3(d) TRANSPORTATION

Duration estimated number of days = 5 days

Fuel	20,162.24 - 100,811.2
Driver	5 Days

TOTAL COST OF DATA ACQUISITION ₦610,990.68

4. DATA PROCESSING AND PRODUCT GENERATION

Duration (Estimated number of days = 3 days)

Personnel Daily	Amount ₦
1 Surveyor	25,814.00 - 77,442.00
1 Computer Analyst	20,000 - 60,000.00
1 Computer hardware	5,000.00 - 15,000.00
Total	**₦152,442.00**

5. PLOTTING/TECHNICAL REPORTS

Duration (Estimated number of days = 2 days)

Personnel Daily	Amount ₦
1 Surveyor	25,814.00 - 51,628.00
1 CAD Operator	10,000.00 - 20,000.00
1 Clerical Officer	6,000 - 12,000.00
Total	**83,628.00**

6 ROUTE DESIGN

Duration estimated number of days = 2days

Personnel Daily	**Amount ₦**
1 Surveyor	25,814.00 - 51,628.00
1(one)Cad Operator	3,000.00 - 6,000.00
1 (one)Computer Hardware	10,000.00 - 20,000.00
Software used	10,000.00 - 20,000.00
Sub Total	**₦97,625.00**

7. PLAN PRINTING

Duration estimated number of days = 2day

Quantity Rate	Amount ₦
10 copies computer printing	1,000.00 - 10,000.00
7 copies of report	5,000.00 - 35,000.00
Binding	2,500 - 17,500.00
Sub Total	**₦62,500.00**

COST OF PROJECT EXECUTION	**₦1,710,525.75**
CONSULTANT FEES 20% OF TOTALCOST OF PROJECT	**₦342,105.15**
CONTINGENCE 5% OF TOTAL COST OF PROJECT	**₦85,526.2875**
VAT = 5% OF TOTAL COST OF PROJECT	**₦85,526.2875**
TOTAL COST OF PROJECT	**₦2,205,683.475**

5.2 SUMMARY

The reconnaissance, which was the main planning, was carefully carried out because of its importance to good execution of any survey project or work. Having carried out the reconnaissance, six (6) second order control stations were located and used as connection along the given route. The total number of nineteen (19) stations excluding the controls where the angles and distances were determine by a closed traverse method. All these measurements and the observations were carried out in third order traverse method.

The prominent features closer to each station along the project site were fixed as specified. All necessary reductions and computations, which include forward and backward computation and leveling computation, were done respectively in accordance with survey rules, regulation, departmental and project instructions.

Finally, plans showing longitudinal/profiling and cross sections/detailing design were drawn to scale for visualization.

5.2 PROBLEMS ENCOUNTERED

During the execution of this project the problems encountered was that there are a lot of vehicles,motor cycles plying the road as short cut delayed the project work and as well due to the rainy season. After several attempt, I waited till the weather was favourable before I could do the observation.

5.3 CONCLUSION

Despite the encountered problems during the execution of this project with the respect to the instructions, the result obtained were of accepted accuracy, these were achieve due to the precautions taken on the field during the execution. Also, at the end of the project, I was able to acquire a commendable practical techniques and skills owing to the fact that this project has exposed me to many aspect of surveying tasks and as well, the aim and the objectives of the project were achieved.

5.4 RECOMMENDATIONS

I hereby recommended that this kind of project should continued because it covers a lot of aspect in surveying and it will even put the school in position to actualize its missions which is to produce qualified and resourceful professionals.

In addition, the school management should make digital instruments available for students to execute their project conveniently. The use of computer should be intensified for the computation, plotting and typing of the project so as to enhance the quality of the project and as well to supply electric power during project.

REFERENCES

BANNISTER AND RAYMOND (1977) Surveying: 4th Ed, Pitman Publishing Ltd, London. Pg. 205

BASAK, N.N (2000): Surveying and leveling, Tata Mchraw Hill publishing company Delhi, p.173, Pp.439-444.

BRINKER, R. C. AND MINICK, P. R. (1987): Elementary Surveying, 6th Edition IEP- A Donnseley New York. Pg. 3

CLARK D. (1972): Pane and Geodetic surveying for Engineers, 6th edition, vol.1, London: Constable and Co. Limited, pg.144

IDEMUDIA, I.M. (2007):"Right of Way and Acquisition Survey of a part of Oyo Iseyin Road" An unpublished project submitted to Department of Survey and Geoinformatics, Federal School of Surveying ,Oyo. p.10

VICENT TAO C. AND EL-SHEIMY (2000): in university of Calgary, highway mobile mapping international, October 2000, p. 206

WILSON R.J.P (1978) Land Surveying 3rd Edition, Mac Donald and Evans, London

OLLIVER J. G (1978) Principle of Surveying. volume1: plane surveying. 4th edition(Van Nostrand Reinhold Company).

BRINKER R. C. AND WOLF P.R. (1980) Elementary Surveying 6th edition. Dun-Donnelly publisher.

UREN J. AND PRICE W. F. (1994) surveying for engineers, 3rd edition Macmillan press Ltd London P 54-55.

ROBERT (2000) remote sensing for engineering surveying. GLTC publication pp 34-35

THOMAS AND NORMAN (1961) engineering surveying 1st edition, Edward Arnold publisher P.145

REGINNAL (1968) route surveying, Williams Heinemann ltd, London pg 150

MC MAURY (1980) introduction to surveying, 6th edition, kinkeding printing company republic of Singapore pp4 and 463

BANNISTER AND RAYMOND (1992) Surveying, pitman publishing co-ltd, Great Britain.

SCHOFIEL W. (1972) Engineering surveying volume1, Newness-Butter worth London Boston.

WILSON R.J.P (1977) Land Surveying 2nd Edition, Mac Donald and Evans, London

GROLIER (1998) Book of knowledge deluxe home edition. www.google .com/encyclopedia.

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