PROJECT REPORT

ON

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

BY:

MOHAMMED NAFISAT

HND/23/SGI/FT/0088

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.

……………….……………………….

MOHAMMED NAFISAT

DATE ………………………………

<u>**CERTIFICATION**</u>

This is to certify that **MOHAMMED NAFISAT** with Matric No **HND/23/SGI/FT/0088** 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 herself 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. AWOLEYE
(PROJECT COORDINATOR)

………………………………………. **DATE: …………………………**

EXTERNAL SUPERVISOR

DEDICATION

This project is dedicated to God Almighty and to my Parents.

ACKNOWLEDGEMENTS

To God be the glory, I owe God a lot for the preservation of my life through out my program in school. Also, I thank him for success of program.

Special thanks to my supervisor **SURV. R.O ASONIBARE** explaining every aspect of the project and write ups. I also thank him for his encouragement, recommendation and full support towards successful project. To all the apartment lecturers, **MR. A.I ISAU, SURV. A.G AREMU, SURV. R.S AWOLEYE, SURV. A.O AKINYEDE, SURV. AYUBA ABDULSALAM, SURV. F.D DIRAN AND SURV. BABATUNDE KABIR,** for there fatherly advise and support sir my sincere appreciation goes to my loving and irreplaceable family, my Parent **Mr** and **Mrs MOHAMMED** and the entire family member of the **OLUWALOGBON'S FAMILY** for their concern and generosity through my stay in school, may Almighty Allah reward you all abundantly.

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

MOHAMMED NAFISAT
JUNE 2025

ABSTRACT

The project was aimed at determining direction of the route, the height along the center of the route as well as fixing of the details within the corridor of the route. Suitable control beacons were chosen after due considerations and the profile intervals were decided based on the terrain of the route and the specifications of the job. Topcon (ES-103) total station was used for data acquisition. The final coordinates obtained were used for the production of the existing Road and drainage plans as well as their profiles using AutoCAD Land Development.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Survey is made to physically establish a location in the field. It includes the location of both natural and artificial features in relation to the established roadway centerline in such a manner that these features can be accurately indicated on the plans. The survey also includes datum necessary to locate grades, culverts, bridges, and to compute excavation quantities. To ensure proper accounting for each of the various surveying tasks involved with route survey.

Banister and Raymond (1992) defined surveying as the art and science of making measurement of relative position above, on or beneath the earth surface and plotting of these measurement to some suitable scale in order to form a plan, map and chart. Surveying is considered to be the bed rock of environmental and meaningful development. It plays a very important role in every aspect of human development. Environmental studies are based on the laid down foundation by the surveyor.

Wilson (1976) Stated that engineering surveying is a large scale survey operation carried out in order to provide spacial information for construction purposes. Route survey falls under engineering survey, which provides "heights differences along a proposed route and perpendicular to the centerline within the strip of land that forms runway". This serves the purpose of showing the location of the road and it helps the engineers in the design and construction of the road. Route survey is also a survey for the design and construction of linear work such as; road, transmission lines, canals etc. it also applicable when alignment is needed in the expansion and rehabilitation of existing route especially roads for traffic purpose.

Mikhail (1985) defined route survey as that survey carried out in establishing the horizontal and vertical alignment of a particular area needed for social utilities like highways, railways, transmission lines, pipelines, canals etc.

This project involves a detailed study of a topographical map to determine the geographical location of the study area. This will help in selecting the appropriate route by identifying key existing features, such as buildings and transmission lines.

The surveying method to be used will depend on the nature of the project and the equipment required for its execution.

The aim or purpose of this project is to provide information about the configuration of the terrain, the detail and the topographical information about route. In other to achieve this various operation were carried out such as, staking of the center line of the route at regular intervals, chainage and other details. Longitudinal and levelling is to be carried out both along the centerline perpendicular line to establish the point respectively. Hence, this project laid an emphasis on route surveying, starting from investigation and planning stage to the final data presentation stage.

Generally speaking route survey project was carried out for the purpose of showing all the processes involved in route planning. Without route survey the necessary data for the construction exercise or rehabilitation purpose would be lacking.

Route survey operations are in various stages. At the concept and design stage, route survey Provides large scale map, as a base map and other measurement from which project are designed. At the construction stage, route survey provides the precise control from which it is possible to position the work and most importantly, to ensure that engineering projects are built in their correct relative and absolute position (known as setting out). In addition, data for the measurement of the work was also collected to enable volume of material to be estimated during construction, occasionally, as – built records of the project are surveyed as construction proceeds.

At the post construction stage, route survey is useful to: monitor for structural movement on major retaining structures such as dams, canals and bridges.

Moreover, my project was carried out first with reconnaissance (office and field reconnaissance), therefore during field work; selection of traverse point and marking of chainnage distance and test of instrument both total station and level instrument carried out in which the instruments were in good condition and were used to make measurement for traverse and level (profile and cross section levelling) were done in loops i.e, After field work, computation was done, both level and traverse computation to arrive at the final needed value. Therefore the plan produced by any engineering project such as “route survey” must be large scale plan for better and accurate interpretations. The allowable scales are as follow: 1:250, 1:500, 1:1,000, 1:1,250, 1:2,000, 1:2,500, 1:5.000 etc.

1.2. STATEMENT OF THE PROBLEM OF THE STUDY AREA

Route survey plays an important role in the social and economic activities of any community. This is why there is need for route survey of communities roads the modern trend of development in the field of science and technology has made inability of goods and services in an environment easy, this has tremendously encourage socio-economic development roads, therefore to promote good living growth of economy, sound interaction of unequal impact. The bad road is the societal problem via economic, health, sociol-political and religious process.

The route from Mandala to Awe Village Moro Local Government Area, Ilorin Kwara state has badly damaged thus not motorist choice. Therefore the project can provide relevant data.

1.3 AIM(S) AND OBJECTIVES

1.3.1 AIM(S) OF THE STUDY AREA

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

In actualization of the said aim of the project, the following objectives were followed sequentially:

i. Reconnaissance: Includes office planning and field reconnaissance.

ii. Checking of Controls: To be used for orientation.

iii. Centerline Determination: Marking of chainages along the centerline at an interval of 25m.

iv. Cross-Sectioning: Marking selected points for cross-sectioning at 8m and 4m intervals to the right and left on the profile.

v. Alignment Determination: To determine the alignment of the road.

vi. Detailing: By the use of DGPS.

vii. Plan Production: Graphical representation of the surveyed roadway drawn with an appropriate scale.

viii. Report Writing: Writing a detailed report on the entire project.

1.4. PROJECT SPECIFICATIONS

a. Angular measurement should be observed on both faces of the instrument on one zero.

b. Traverse should commence from a set of known points and terminated on set of known points.

c. Traversing operation should commence from a bench mark and close on same or another bench mark.

d. EDM traversing observed at every 25meters interval of longitudinal profile. The choice of distance interval is a function of many factors; nature of the terrain, purpose of the project, the type of instrument used, etc.

e. Linear measurement should be done with an electromagnetic distance measurement, steel tape and the ranging pole for the alignment of the line.

f. Fixing of relevant details for good interpretation of plan.

g. Reduction and computation of the acquired data.

h. Presentation of the processed data in a graphical format.

1.5 SCOPE OF THE PROJECT

i. The entire project covered the following:-

ii. Reconnaissance (both office planning and field reconnaissance).

iii. Selection of control stations and general field preparation.

iv. Data acquisition.

v. Data processing.

vi. Data analysis i.e. comparing result obtained with the required accuracy.

vii. Data presentation and Project report writing: - This involves writing of detail report in connection with entire project done in conformity with the outline given by the project supervisor.

1.6. PERSONNEL

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

NAMES	MATRIC NUMBER
MOHAMMED NAFISAT	**HND/23/SGI/FT/0088 (AUTHOR)**
FADUMILA KAYODE OLUWATUBOSUN	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
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”

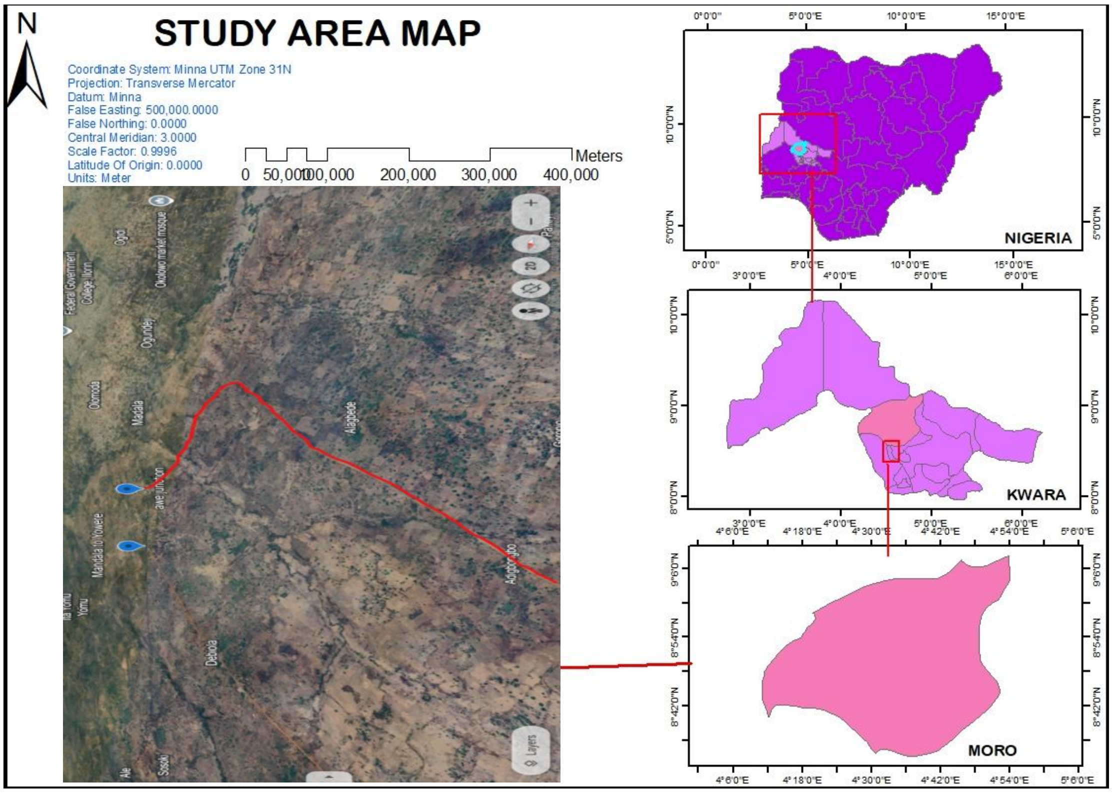


Fig 1.1: Study Area

Source:-GoogleEarth

CHAPTER TWO

2.0 LITERATURE REVIEW

The American Congress on Surveying and Mapping (ACSM) in 1997, defined the term surveying as the science and art of making all essential measurements to determine the relative position of points and /or physical and cultural details above, on, or beneath the surface of the earth, and to depict them in a usable form, or to establish the ‘position of points and /or details. Brinker (1977) stated that, surveying is used for quick determine the distance, direction and elevation of points by a single observation from an instrument station.

Norman (1961), defined engineering survey as an expression for any survey work carried out in connection with the construction of civil engineering and building projects. He also stated that engineers and surveyors involves in site, surveying are responsible for all aspect of dimensional control on such schemes. According to him, the main purposes of engineering surveying are:

i. To provide large scale topographical map/ plan and other measurement at the concept and design stage.

ii. To provide precise framework at the construction stage.

iii. To monitor structural movement on major retaining structure at the post construction stage.

Basak (1994) Roads are used by various forms of transportation, such as trucks, automobiles, buses, motorcycles, and bicycles. Roads allow trucks to move goods from points of production, such as fields and factories, directly to markets and shopping centres. Private individuals rely on roads for safe and efficient automobile, motorcycle, and bicycle travel. Fire departments, medical services, and other government agencies depend on an organized system of roads to provide emergency services to the public in times of need. The earliest roads evolved from animal paths and served as trails for early hunters. Paths eventually grew around primitive settlements, and as trade grew, longer routes were developed to transport food and other important materials. The use of wheeled vehicles encouraged construction of better roads. The roads built by the ancient Romans were carefully planned and solidly constructed. Modern methods of road construction were first developed in the 18th century. Innovations of the time included waterproof surfaces and better drainage systems. Modern engineers make use of a variety of materials and construction techniques to build roads that can handle the high volumes and stresses of modern automobile and truck traffic.

Route surveying can also be explained as the survey carried out in establishing the horizontal and vertical alignment of a particular area needed for social utilities or construction like railways, highways, transmission lines, pipeline and canals. The purposes of every engineering surveying are for social development. This route survey project was made possible by the application of leveling, traversing and detailing. Maurray (1980), explained route surveying as the constructional processes and procedure that is involved in the production of design of route such as, pipeline, railways, transmission lines, road. Further still, Mikhail (1976), also explained route surveying as the topographical and constructional surveys that are necessary for the location and construction of lines of communication and transportation, roads and canals. Route Survey can be explain as a survey of the earth's surface along a particular route in the compilation and updating of topographical, geological, soil, and other maps and the correlation of selected contours and objects with geodetic reference points or landmarks during linear surveys, and also in the study of the dynamics of natural and socioeconomic phenomena in a narrow strip of terrain.

Allen et al (1968), defined traversing as an orderly sequence of determination of the length and directions of lines between two points on the surface of the earth to determine the exact position of point referred to the ground and the previous survey made and connected to in order to determine coordinate of such points. There are two types of traverse, namely

- Closed traverse
- Open traverse

Levelling was defined by Schofied (1972), as "the process of obtaining the height of specific points on the earth's surface above a datum plane". In a similar vein, Banister and Raymond (1972) defined levelling, as "the operation required in the determination or more strictly the comparison of heights of specific points on the earth surface. Due to advancement in technology computer are now used extensively in engineering surveying for general application such as network analysis, automated data processing for plan production and computation of setting out data and qualities".

Wilson (1977) opined that when there is need for design of route to be carried out, different types of plans must be acquired to enable such design to be appropriately done such plans are cadastral and topographic plan. Since prior to the design, field survey work which enable the production of various plans such as preliminary survey from which the plan showing extent of the existing road and other topographic features is produced on scale of either 1/25000 or 1/250 depending on the site involved. Topographical map is a map on which features are shown by use of suitable symbols and relief characteristics (contours). These features are both natural and man-made. Also Cadastral map on which the location, shape and size of features are shown with a suitable scale Linear (horizontal and vertical distances), area and volume of surface structures are usually the geometrical elements obtained for ascertaining the undulation of surface of structures and size. In establishing any communication route, the importance of route survey cannot be over emphasized. Route survey consists of the following:

i. The location survey.
ii. Profile survey and cross sectioning

With regard to location survey, the lines projected after the preliminary surveys having carefully studied and compared with regard to the cost and operating expenses, selection of the scheme to be adopted are made. The remaining field work is directed to make a more detailed investigation of the ground along the preliminary survey line selected. The final location may be performed on the field, the surveyor using the gradient shown on the preliminary profile as a guide in seeking for improvements in the alignment. The detail work would be performed by traversing.

Clark (1971) explained profile levelling as a term used to describe the field work involved in surveying a longitudinal section of a route. The profile leveling may be of any regular interval such as 25m which would be a continuous process until the closing station is reached. Where cross section was done along and Perpendicular to the center line. Once any new road formation or construction is proposed, it is certain to involve cut and fill, a useful convention is that of the width of cross sections of the road has to be marked with pegs. This is done purposely to indicate the extent of the new route to be constructed.

Agor (1993) remarked that longitudinal and cross sectioning are the integral parts of route surveying. It consist of obtaining a record of the undulation of the ground surface along a particular line, straight or curve so that they may be represented to scale. In a route survey, representations of the actual course of the survey and of the plane horizontal features (including the terrain, if necessary) on both sides of it within the limits of direct visibility are plotted using methods of instrument surveying (plane-table, tachometric, and aerial photo topographic surveying) or exploratory surveying. At the time of the United State national road construction, road quality was poor and construction proceeded slowly. Improvements in materials came with the introduction of asphalt paving in 1870, but the biggest motivation for road improvement came with the popularity of the automobile at the start of the 20th century. A government survey of public roads done in 1904 showed that about 3 million km (about 2 million mi) of all roads in the United States were unpaved. Only 248,000 km (154,000 mi) of these roads were surfaced. Automobile use increased the wear and tear on these roads, and efforts increased nationwide to improve road conditions. Local governments administered most roads at the time. State governments soon formed highway agencies to take over and organize improvement efforts. In 1912 the federal government began funding one-third of the cost of roads on which mail was carried. The Federal Road Act of 1916 provided even more federal participation in state road improvements.Roads originated for economic reasons, related to the need to move food and other goods from one point to another. Early transportation focused on moving food from a hunt or a harvest to the places where people lived. Trails evolved from prehistoric animal paths, and early humans carried or dragged their loads along these paths. As humans learned to domesticate animals, they transferred their loads to pack animals, such as horses, mules, camels, llamas, elephants, and dogs.World War I (1914-1918) temporarily halted highway construction, but the rapidly expanding use of the automobile, along with increased truck traffic, brought on a growing demand for even better roads. In 1919 a tax was added to gasoline to help provide federal financing. By 1930 the principal population centres of the United States were connected by a system of all-weather, two-lane roads. However, much of the road construction was not adequate for the growing volume of traffic, especially truck traffic with its increasingly heavy loads and high speeds. Construction of the interstates began in the 1950s and continued through the 1990s. In 1991 the U.S. Congress named the interstate highway system the Dwight D. Eisenhower System of Interstate and Defense Highways. Private, commercial, and government vehicles use the interstate highways. This network of roads saves the United States billions of dollars each year in time and transportation costs. Therefore route survey of the route provides adequate information that yielded a better route design and construction. In the 1950s and 1960s, Canada also began major roadway construction to serve the rise in vehicle ownership that occurred after the end of World War II. Work began on construction of what became known as the MacDonald-Cartier Freeway, serving southern Ontario. The Trans-Canada Highway stretches across Canada, linking St. John’s, Newfoundland and Labrador, on the Atlantic coast with Victoria, British Columbia, on the Pacific coast, with ferries plying parts of the route. The highway was formally opened in 1962. It passes through every provincial capital and also through several other major cities in the southern part of Canada.

Civil engineers continue to research ways of designing and building the most efficient and cost-effective roads. New types of road surfacing make roads more durable and easier to construct. Computers play a large role in helping engineers experiment with different road designs and in anticipating how factors like population growth affect road and highway transportation. There are many different types of roads, from multilane freeways and expressways to two-way country roads. One important quality of a road is known as control of access. This term describes how vehicles are allowed to enter and exit a road. By controlling access to a road, the road can support more traffic at higher speeds. Roads can be classified into three broad categories: highways, urban or city streets, and rural roads. Each type of road controls access to different degrees. Each type also differs in location, the amount of traffic it can safely support, and the speed at which traffic can safely travel.

Road path established over land for the passage of vehicles, people, and animals. Roads provide dependable pathways for moving people and goods from one place to another. They range in quality from dirt paths to concrete-paved multilane highways. Highways with fully controlled access can handle the most traffic and are built to the highest construction standards. Interstate highways, freeways, and expressways are examples of fully controlled-access highways.

Vehicles that enter or exit these types of highways can do so only at certain points along the highway, generally by using special entrance and exit ramps. The ramps allow vehicles to access the road without disturbing the flow of traffic. Incoming vehicles must merge with flowing traffic, and vehicles leaving the highway use exit ramps that guide them off the highway without blocking the traffic behind.

Intersections with other roads are avoided by using either bridges known as overpasses to carry one roadway over another or short tunnel-like structures called underpasses to carry one roadway under another. Finished strips called shoulders on the edges of highways allow drivers of disabled vehicles to make repairs or await assistance without blocking traffic.

Some highways offer only partial control of access. These types of highways handle less traffic than do highways with fully controlled access. Highways with partially controlled access may intersect other roads at the same level (called at-grade), rather than using overpasses or underpasses. Vehicles can enter highways with partially controlled access at intersections rather than using ramps. However, the right-of-way is often given to one direction of travel, rather than requiring all traffic to stop at the intersection. Giving the right-of-way to one direction of traffic helps keep traffic moving at higher speeds, although typically not at speeds as high as those on a highway with fully controlled access. One benefit of highways with partially controlled access is that they are much cheaper to construct than highways with fully controlled access. Many U.S. and state highways are roads with partially controlled access.

Microsoft ® Encarta ® (2009) to support heavy vehicles moving at high speeds, a modern road is made up of several layers. Each layer helps the layers above it support the weight and pressure of moving traffic. Roads that carry more traffic at higher speeds, like highways, are built to stronger standards than roads that carry less traffic, such as rural collector roads. The number of layers in a road often depends on the intended use of the road, but generally roads have three distinct layers. From bottom to top, the layers are the roadbed, the base course, and the wearing course.

The roadbed is the very bottom layer of a road. Natural soil is the most common roadbed material. The roadbed is shaped to make a smooth, level surface that will support the layers built over it. Engineers use bulldozers and other construction equipment to distribute soil evenly along the roadbed. If a road is planned through an area where the natural landscape is uneven, soil can be removed or filled in as needed to obtain a level surface. The discovery and use of the wheel was undoubtedly a driving force in building and improving roads. Crude roads were in use in Mesopotamia in about 3000 BC. Italy was connected to Denmark by a roadway as early as 2000 BC.

During the period from 1900 to 300 BC, four trade routes, known as amber roads, ran across central and eastern Europe. Amber was an important ingredient in primitive and medieval medicine and was also used for statuary and jewellery. One of the first pre-planned roads was the Persian Royal Road, built by Darius I in 500BC in what is now Iran. The Royal Road was about 2,400 km (about 1,500 m) long and stretched throughout ancient Persia. The road was constructed for royal use, and it allowed Darius to keep informed, to convey orders, and to transport goods needed by the royal court. The road followed the shortest and most efficient route. It bypassed some of the largest towns in part, for the sake of following shortest route, but because large towns had the potential to rebel. An uprising in a town near the road could have threatened the security of the route or prevented troops from being dispatched.

Makanjuola (1988) stated that, because of employment opportunities provisions, there have been a continued migration of people from the rural area to urban area, the result of this is led to higher road traffic and congestion. This is a very big factor that constitute to route reconstructions, so as to provide solutions to this road traffic congestions. Haven't considered the points above, the processes that are involved in route survey are explained in the next chapter of this project

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 prior to the actual survey operation cannot be underestimated as it enables so as to give the best method to carry out the task.

The two phases of reconnaissance are;

iii. Office planning
iv. 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

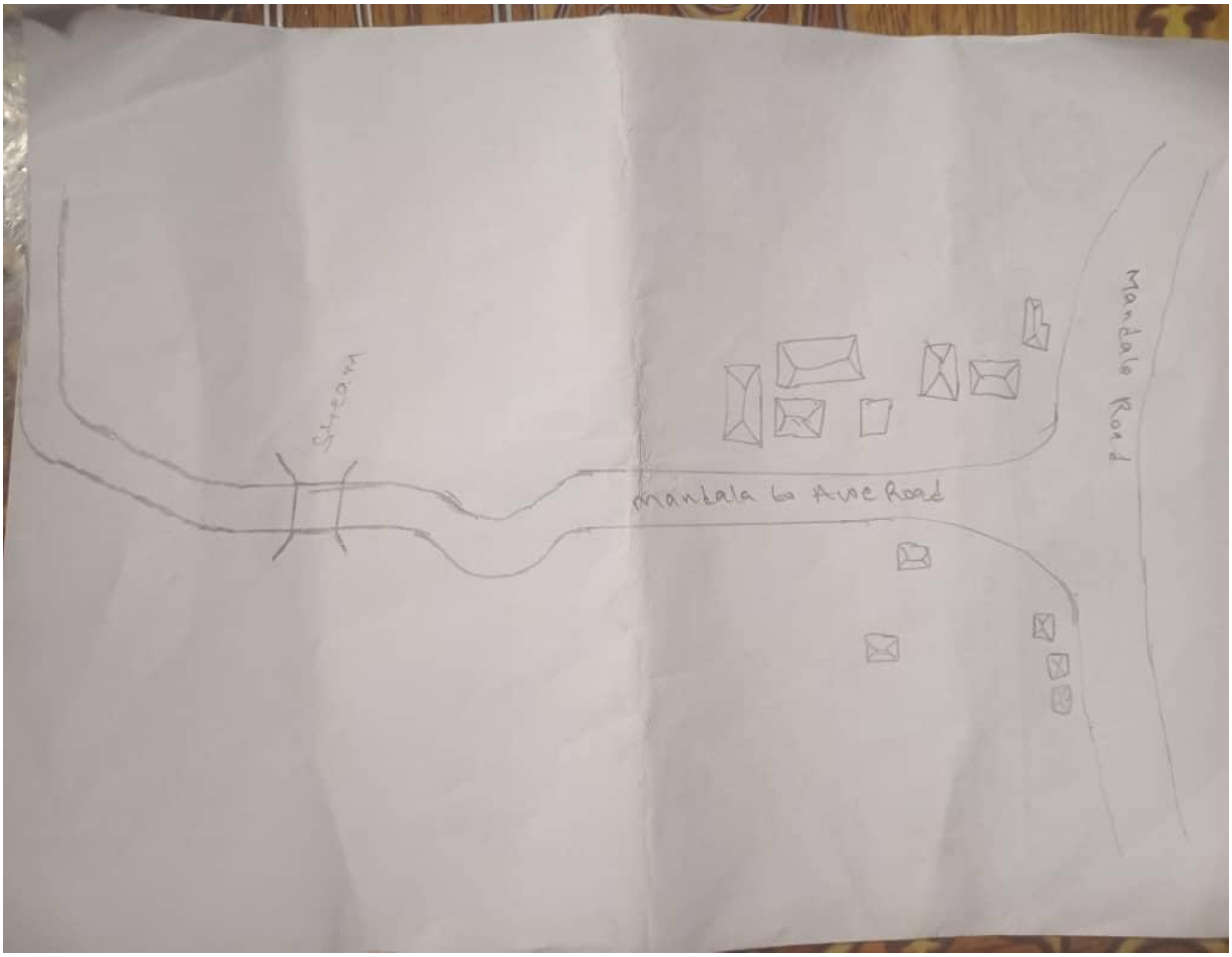
The field reconnaissance was done after the office planning it involved a visitation to the project site by all the group numbers to have a pre requisite knowledge of how it looks like and how the field operations would be carried out.

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.



A TYPICAL PEG USED

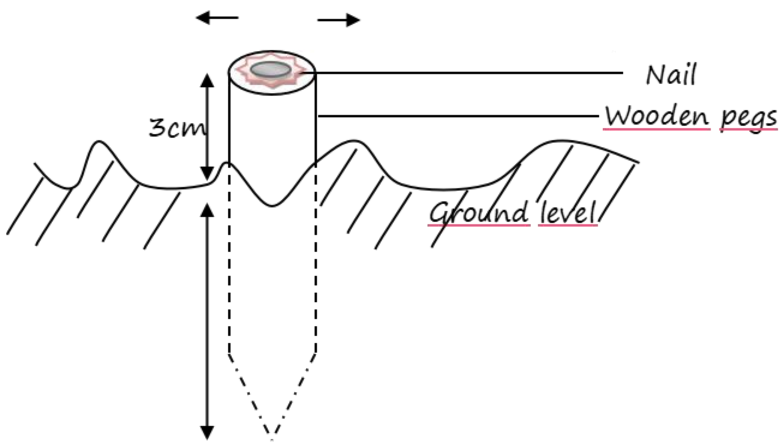


Fig 3.2 An Illustration diagram of peg

3.2 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.

3.2.1 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 2012
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 LONGITUDINAL / PROFILING

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 CROSS SECTION/ DETAILING

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 (MANDALA to AWE)
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

I. 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).

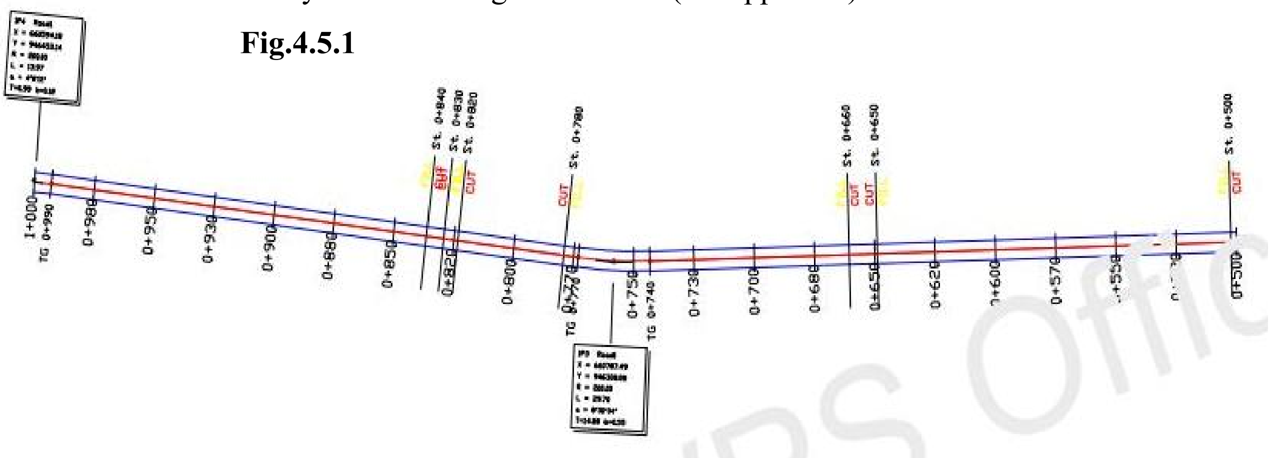
4.5 INFORMATION PRESENTATION/ PLAN PRODUCTION

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 (see appendix).

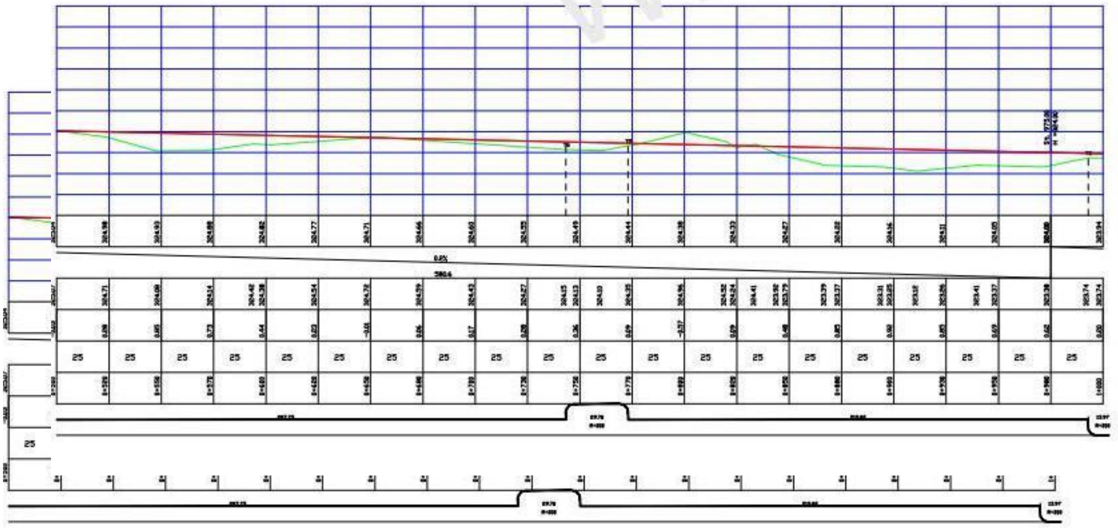
Fig.4.5.1



4.5.2 LONGITUDINAL PROFILE

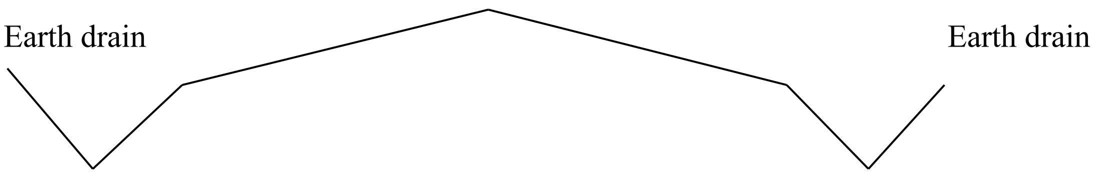
Profile was generated to provide vertical height/terrain information along a route for vertical alignment/curve design. It provides a vivid picture of the terrain and decisions of where to cut or fill was determined. It provides information such as the grade percent, tangent points, existing level and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

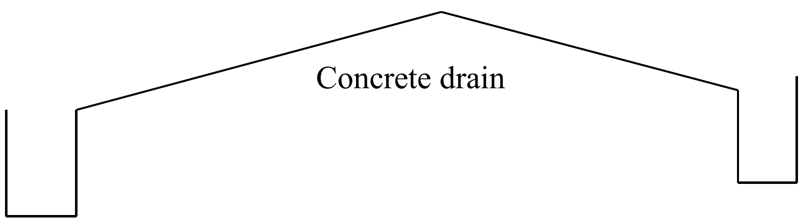
Fig.4.5.2



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 curvet, concrete drainage was used 150m before and 150m after each curvet, the curvet 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	15,000.00

Driver	30,162.24
Fuel	20,432.91

1(c) FEEDING

Feeding for four person	₦10,000.00
TOTAL COST FOR RECONNAISSANCE	**₦208,931.1**

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
3,000 Standard pegs	400.00
Basic Tools (Digger, Shovels, trowels, nail, hammer etc.)	15,000.00

2(b)TRANSPORTATION

Fuel	20,432.91
Driver	30,162.24
TOTAL COST OF MONUMENTATION	**₦1,288,213.1**

3(a) DATA ACQUISITION

Duration estimated number of days = 5 days

Personnel Daily	Amount₦
1 Surveyor	25,934.00
1 Assistant Surveyor	22,501.00
4 Labourers	4,078.00
Sub Total	**₦323,735.00**

3(b) EQUIPMENT LEASING

1 Total Station (With its accessories)	40,000.00

5 Ranging Poles	1,000.00 - 5,000.00
2 Cutlasses	2,000.00 - 4,000.00
Sub Total	**₦49,000.00**

3(c) FEEDING

5Days	5,000.00 -25,000.00
Sub Total	**₦25,000,00**

3(d) TRANSPORTATION

Duration estimated number of days = 5 days

Fuel	20,432.91- 102,164.5
Driver	5 Days
TOTAL COST OF DATA ACQUISITION	**₦510,822.75**

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	25,000 - 75,000.00
1 Computer hardware	12,000.00 - 36,000.00
Total	**₦565,326.00**

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	20,000.00 - 40,000.00
1 Clerical Officer	10,000 - 20,000.00
Total	**223,256.00**

6 ROUTE DESIGN

Duration estimated number of days = 2days

Personnel Daily	**Amount ₦**
1 Surveyor	25,814.00 - 51,628.00

1(one)Cad Operator	20,000.00 - 40,000.00
1 (one)Computer Hardware	12,000.00 - 24,000.00
Software used	10,000.00 - 20,000.00
Sub Total	**₦271,256.00**

7. PLAN PRINTING

Duration estimated number of days = 2day

Quantity Rate	Amount ₦
10 copies computer printing	1,200.00 - 12,000.00
10 copies of report	6,000.00 - 60,000.00
Binding	3,000.00 - 30,000.00
Sub Total	**₦102,000.00**

COST OF PROJECT EXECUTION	**₦3,567,539.95**
CONSULTANT FEES 20% OF TOTALCOST OF PROJECT	**₦713,507.90**
CONTINGENCE 5% OF TOTAL COST OF PROJECT	**₦178,376.9975**
VAT = 5% OF TOTAL COST OF PROJECT	**₦178,376.9975**
TOTAL COST OF PROJECT	**₦4,637,801.845**

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, three (3) third order control stations are located and used as connection along the given route. The total number off our (6) benchmarks and thirty-three (19) stations excluding the controls where the X, Y, Z values were determined, 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.

Finally, plans showing cross section, horizontal and vertical alignment were drawn to scale for visualization and in accordance with survey rules and regulations and departmental instructions.

5.3 PROBLEMS ENCOUNTERED

i. There were a lot of problems faced during the execution of this project, problem invisibility of the stations due to traffic congestion (to and fro of motor, motorcycle and people) and also no nearby control to tie with which want to stopped us from carrying out the operation along the route.
ii. Change in climate.

5.4 RECOMMENDATIONS

Having successfully carried out the project assignment, I hereby recommend the following

i. Engineering survey and design of transport infrastructure should not be left alone to civil engineers, The surveyor council of Nigeria, Nigeria institution of surveyors, Association of private practicing surveyors of Nigeria amongst others should take urgent steps through appropriate legislation of Laws which would give prominent role to surveyors in the transportation.
ii. The data and result obtained from this project can / should be use for further construction analysis.
iii. The result can further be used for more research work along / within the road limit.
iv. The school should set a department for consultancy service such that useful project like route survey carried out by the students would not only serve as a means of broadening the students knowledge but could also be used in actual practice to execute job for clients. In this, the clients would go a long way in relieving the students of whole and part of the financial constraints involved in the exercise.

5.5 CONCLUSION

It was concluded that the aims of the project was achieved and the result can therefore be used for planning and setting-out purpose during construction stage.

More so this project has been successfully executed as adequate data were acquired, processed and presented in plans.

The use of the modern equipment had drastically reduced the number of days and personnel used and thereby reducing the cost of carrying out such project.

Finally, this project result could be used in rehabilitation and construction of the route by any government authority concerned.

REFERENCE

Allanet al. (1968): *practical field surveying and computation*, 1st Ed, William Heinemann ltd, London, P150.

Agor R (1993): *Engineering surveying*, 4th Ed, Khan publishing limited, Delhi India, P.340.

Bannister and Raymond (1977) : *surveying*, 4th Ed, Pitman publishing Limited, London, P205

Bannister and Raymond (1992) *: surveying,* 6th Ed, pitman publishing Co-ltd, Great Britain,P14

Basak N.N (1994) *surveying and leveling*,10th Ed, Tata MC Graw Hill publishing company ltd, New Delhi, P.177

Bright S.G (1977) *surveying for engineering,* 5th Ed, Fitshoney and Whiteside Limited, Toronto, P.275 .

Brinker R.C (1977) *Elementary Surveying*, 6th edition, Thomas Y Company. London, P74

Clark A.D (1971) : *Geodetic for Engineers,* 26th Ed, E.D.S Ccoshanchore, P.312

Microsoft Encarta 2009. 1993-2008 Microsoft Corporation. All right reserved .

Mikhail E. (1976) *Route Surveying*,10th Ed, North Holland publication, co New York, P.156

Mikhail E.M. (1985) *introduction to surveying*, 12th Ed, North publication, co New York, P.160.

Maakanjuola S.A. (1988) *Factors affecting optimal use of highway system,* Vol 5, no 1 & 2, pg 92

Maurray S. (1980) *introduction to surveying* , 6th Ed, kinkeding printing company , Republic of Singapole, PP4,463.

Norman T.W. (1961) *Route surveying*,1st Ed, Edward Arnold publishers, P.145.

Schofield .W. (1972) *Engineering surveying* ,4th Ed, newness butter, London, PP.45-46.

Wilson R.T.P. (1976) *Land surveying* , 2th Ed, Pitman Press, London, P287.

Wilson R.T.P. (1977) *Land surveying* , 3rd Ed, Macolanall and Evans, London, P.287.

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