



PROJECT REPORT

ON

ROUTE SURVEY OF LAJOLO JUNCTION TO ELEKO ANFEYIN ROAD,

MORO LOCAL GOVERNMENT AREA

ILORIN, KWARA STATE

BY:

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HND/23/SGL/FT/0066

BEING A RESEARCH PROJECT SUBMITTED TO THE

DEPARTMENT OF SURVEYING AND GEO-INFORMATICS

INSTITUTE OF ENVIRONMENTAL STUDIES

IN PARTIAL FULFILMENT OF THE REQUIRMENT FOR THE AWARD OF

HIGHER NATIONAL DIPLOMA (HND) IN SURVEYING AND GEO-

INFORMATICS

MAY 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.

.....

BAMIGBOSE IDOWU MAYOWA

DATE

CERTIFICATION

This is to certify that **BAMIGBOSE IDOWU MAYOWA** with Matric No **HND/23/SGL/FT/0066** 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

.....

SURV. ABDULSALAM AYUBA

(SUPERVISOR)

DATE:

.....

SURV. ISAU IBRAHIM ABIMBOLA

(H.O.D)

DATE:

.....

SURV. R. AWOLEY

(PROJECT COORDINATOR)

DATE:

.....

EXTERNAL SUPERVISOR

DATE:

DEDICATION

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

To my parents, for their endless support, love, and encouragement And to everyone who believed in me even when I doubted myself this is for you.

ACKNOWLEDGEMENTS

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

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

A special thank you goes to my brothers and sister, **GRACE BAMIGBOSE, KOLADE BAMIGBOSE, TAIWO BAMIGBOSE ,KEHINDE BAMIGBOSE, ALABA BAMIGBOSE AND OGUNLADE MATHEEW** whose constant encouragement, support, and belief in me played a vital role in keeping me focused and motivated throughout this academic pursuit.

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

I also grateful to all my lectural that made my stay in school inevitable and without forgetting those that contribute in several way towards the successful completion of my academics career in thia institution and towards the complete of my project work most especially, **SURV.R.O ASONIBARE and SURV A.G AREMU, SURV.BELLO FELIX DIRAN, SURV.BANJI, SURV.WILLAMS KAZEEM, SURV.BABATUNDE KABIR, SURV.ABDUSALAM AYUBA**

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

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

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

Thank you all

BAMIGBOSE IDOWU MAYOWA

MAY2025

ABSTRACT

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

TABLE OF CONTENTS

Title page.....	i
Certificate.....	ii
Certification.....	iii
Dedication.....	iv
Acknowledgements.....	v
Abstract.....	vi
Table of contents.....	vii
list of tables.....	ix
list of figures.....	x
CHAPTER ONE.....	1
1.0 Introduction.....	1
1.1 Background to the study.....	1
1.2 Significance of the project.....	3
1.3 Aims and Objectives.....	3
1.3.1 Aim.....	3
1.3.2 Objectives.....	3
1.4 Project specifications.....	4
1.5 Scope of the Project.....	4
1.6 Personnel.....	5
1.7 Study Area.....	6
CHAPTER TWO.....	7
2.0 Literature review.....	7
CHAPTER THREE.....	13

3.0 Methodology.....	13
3.1 Reconnaissance.....	13
3.1.1 Office Reconnaissance.....	14
3.1.2 Field Reconnaissance.....	14
3.2 Monumentation.....	15
3.3.1 Equipment Used.....	16
3.3.1.1 Hardware Used.....	16
3.3.1.2 Software Used.....	16
3.4 Test of Instrument.....	17
3.4.1 Test of Sokkia Total Station	17
3.5 Data Acquisition	18
3.5.1 Control Check	19
3.5.2 Traversing (profiling).....	21
3.5.3 Detailing.....	22
3.6 Total Station Data Downloading.....	22
CHAPTER FOUR.....	23
4.0 Data Processing Procedure.....	23
4.2 Data Editing	23
4.3 Plan Production.....	23
4.5 Result Analysis	30
CHAPTER FIVE.....	31
5.0summary, Conclusion And Recommendation.....	31
5.1 Summary	31
5.2 Problems encountered	31

5.3 Recommendation.....	31
5.4 Conclusion	32
References.....	33
Appendix.....	34

LIST OF TABLES

Table 3.1: coordinates of existing ground controls used.....	14
Table 3.3.2.1: showing the collected co-ordinates of the controls.....	17
Table 3.3.2.2: The observed coordinate of the controls.....	17
Table 3.3.2.3:..showing the Comparison of observed and computed data	18

LIST OF FIGURES

Fig 1.1 Diagram showing location of the study area.....	7
Fig 3.1 Recce Diagram.....	15
Fig 3.2An Illustration diagram of peg.....	15

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND TO THE STUDY

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

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

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

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

the terrain of a given strip of land which serves the purpose of location, design and construction of route networks.

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

Route surveying is such a survey exercise that requires all field works and calculations made for the purpose of locating and constructing a cross country social utilities such as highways, railways, canals, transmission lines and pipeline. This involve the determination of the ground configuration and location of physical features (naturals and 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: Select one or more tentative general route for the road way or utility gather enough information about the general route to make it possible for the route designers.

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

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

Federal roads (interstate roads)

State roads (intra state roads)

Local roads (rural roads)

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

1.2 SIGNIFICANT OF THE PROJECT

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

1.3 AIM AND OBJECTIVES

1.3.1 AIM OF THE PROJECT

The main aim of this project is to carry-out Route Survey of Lajolo junction to Maya/Anfeyin Village, Moro Local Government Area Ilorin, Kwara State,

1.3.2 OBJECTIVES

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

- i. Reconnaissance which include office planning and field reconnaissance.
- ii. Identification of existing features and adjoining roads
- iii. Stability of the ground controls to be use for orientation.
- iv. Determination of center line and marking of chainage along the center line at an interval of 25m.
- v. Marking out some selected points for the cross-sectioning at intervals of 5m to the right and left on the profile and also the edges of drainage was marked.
- vi. Leveling to determine the height of some selected points along the road.
- vii. Detailing by the use of Total Station Sokkia and its Accessories
- viii. Plan production (graphical representation of the surveyed road way) drawn with appropriate scale.

1.4 PROJECT SPECIFICATIONS

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

- i. Traverse must commence on three coordinated (known) controls and closed on another set of three coordinated controls which must be confirmed undisturbed by necessary measurement (control checks).
- ii. Third order traverse must be run along the route on all turning points at one zero observation and the angular difference from both faces should not be more than thirty seconds (30"), the angular misclosure is determined by $30''\sqrt{n}$. Where 'n' is the total number of station observed.
- iii. Establishing traverse points by using pegs together with nails and bottle corks.
- iv. Leveling must be observed at every 25m intervals on the center line and at 5m intervals on both sides of the center line for the cross sectioning. Edges of drainage at both sides should be heightened.
- v. Fixing of relevant features to enhance assessment and necessary composition for good interpretation of plan.
- vi. The accuracy of the project must fall within the order of the project.

1.5 SCOPE OF THE PROJECT

The entire project covered the following:-

- Reconnaissance (both office planning and field reconnaissance).

- Data acquisition:
 - a. Selection of stations
 - b. Traverse angular observation and data recording.
 - c. Linear measurement (Fixing of details)
- Computations to determine:
 - a. Horizontal coordinates (i.e. x and y coordinates)
 - b. Vertical coordinates (i.e. z coordinates) by level reduction.
 - c. Setting out angles and distance for the curve.
- Data analysis i.e. comparing result obtained with the required accuracy.
- Data presentation :
 - a. Production of horizontal alignment
 - b. Production of longitudinal section plan
 - c. Production of cross section plan

1.6 PERSONNEL INVOLVED

All the under-listed names are members of group 6B that participated in the successful execution of this project.

NAMES	MATRIC NUMBER
BAMIGBOSE IDOWU MAYOWA	HND/23/SGI/FT/0066 (AUTHOR)
AROWOLO NURUDEEN AYINDE	HND/23/SGI/FT/0067
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ISAAC JOY SALOMI	HND/23/SGI/FT/0068
ADELOLU DANIEL ADEWALE	HND/23/SGI/FT/0070
OJERINDE ROMOKE HABEEBAT	HND/23/SGI/FT/0112
ABASS KAFAYAT OPEYEMI	HND/23/SGI/FT/0060
ABDULLAHI YUSUF SOFIYULLAHI	HND/23/SGI/FT/0117

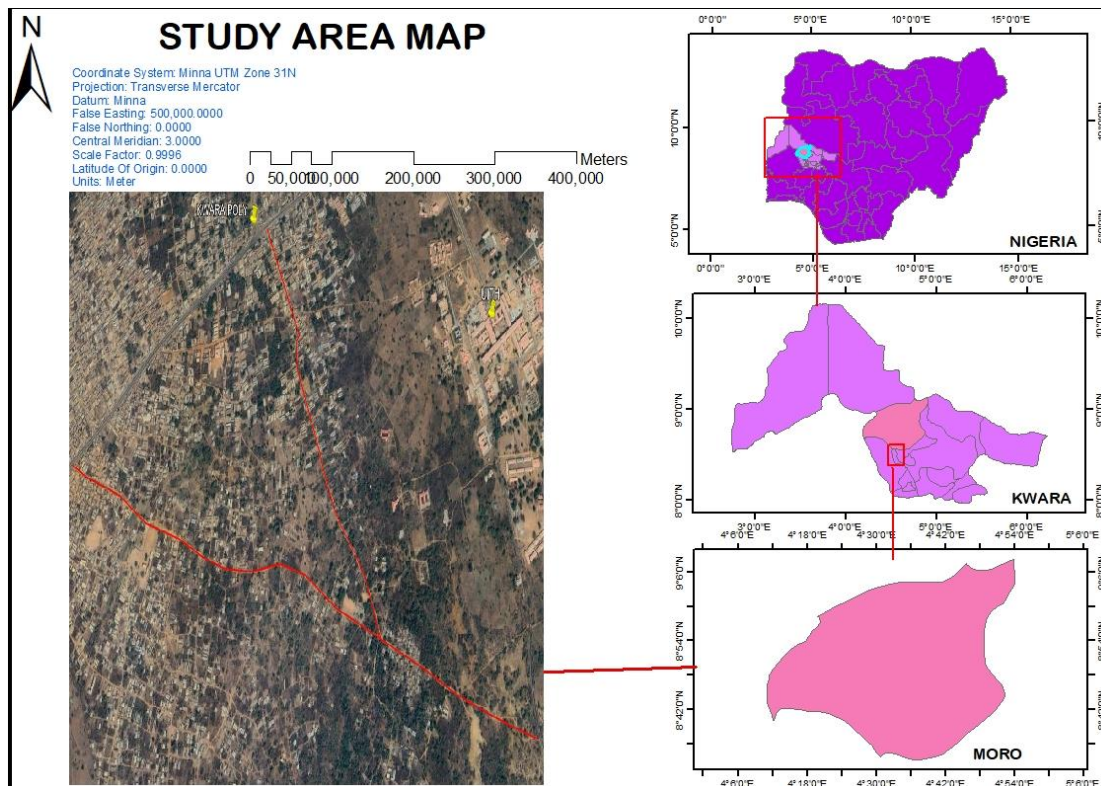
1.7 PROJECT AREA

The project site is the route of Lajolo junction to Maya/Anfeyin Village,Moro Local Government Area Ilorin, Kwara State. It cover approximately 4.5km extent of land. With geographical coordinates of :
Long. 004° 38' 06.61''

Lat. 008° 32' 35.44''

Long. 004° 38' 47.19''

Lat. 008° 31' 31.44''



CHAPTER TWO

2.0 LITERATURE REVIEW

Surveying has to do with the determination of the relative spatial location of points on or near the surface of the earth. It is the art of measuring horizontal and vertical distances between objects, measuring angles between lines, determining the direction of lines and establishing points by predetermined angular and linear measurements. Distances, angles, directions, locations, elevations, areas and volumes are thus determined from the data of survey. Survey data is portrayed graphically by the construction of maps, profiles, cross sections and diagrams (Oregon Department of Transportation, 2000).

Schofield (2001) defined surveying as the science of determining the position, in three dimension of natural and man made features on or beneath the surface of the earth. These features may then be represented in analog form as a contoured map, plan or chart, or in digital form as a three dimensional mathematical model stored in the computer.

There are different operations in surveying namely; Control survey, Boundary survey, Topographical survey, Hydrographic survey and Route survey.

Route survey is therefore defined as the survey done along a comparatively narrow strip of territory for the location, design and construction of any route of transportation. Oregon Department of Transportation (2000), while presenting a seminar also stated that it refers to those controls, topographical and construction surveys necessary for the location and construction of highways, railroads, canals, transmission lines and pipelines. Route survey is very useful in the determination and establishment of difference in elevation between two or more points. It includes the field and office work required to plan, design and lay out any

“long and narrow” transportation facilities. Also, it deals with earthwork which covers the movement of soil or rock from one location to the other for construction purposes. (Harry.L.Field and Michael T. 2006).

The need for surveying as a base for planning and the process of acquiring data of route alignment with special attention on road network, construction and rehabilitation cannot be overemphasized. In view of this, the principle of surveying in general and route surveying in particular is the comprehensive aim of the project.

Transportation being a great function and purpose of route survey is regarded as the fulcrum upon which every other sector of the economy revolves. It is as well the movement of people, goods and services from one place to another, be it on land, water or by air. (Microsoft Encarta Encyclopedia, 2009).

In this wise, transportation has contributed immensely to the economic development of nations in which our dear country (Nigeria) is involved. Here are some benefits derived as a result of good transportation network.

- i. It aids movement of goods and services
- ii. It assists in the dissemination of ideas as well as technology
- iii. Opening up of new land and abandoned areas
- iv. It assists in national integration

Besides, route survey has contributed immensely as touching construction sectors of the engineering surveying.

Engineering surveying which breeds both route and construction survey involves the application of knowledge to the analysis, design and execution of surveying and mapping projects, and the design of land

mapping and information system. Mikhail. E (1977) opined that surveyors rely on an understanding of the science of surveying measurements and the surveying principles.

Moreover, it is vividly seen that surveying plays extremely important role in any construction project. Surveying can take many forms, it aids in establishing the location and alignment of highways, buildings, pipes and other man made or cultural projects. (James C. 1985).

A route survey as the name implies is a survey that deals with the route or course that imaginary road or utility line will follow while the end product of a route survey for a highway certainly differs from that of a utility line. The major reason for carrying out route surveying is to facilitate movement of people, yielding to socioeconomic benefits (i.e by determining the best general route between terminals).

Reginnal (1968) defined route survey as the topographical and construction survey necessary for the location and construction of lines of transportation or communication such as highways, canals, transmission lines and pipelines. He stated that the location and construction survey may consist of:

- i. Establishing the centre line by setting at intervals and running level to determine profile of the ground along the centre line.
- ii. Taking cross section.
- iii. Plotting such profile and fixing grades.
- iv. Calculation volume of earthwork.
- v. Measurement of drainage areas.
- vi. Laying out structures such as bridges and culvert.

It is a reality that surveyors are the major professionals needed when it comes to working on any engineering project, for example, Building project. They provide special information such as; site location, size of the parcel, the dimension and total area. The finished product (plan) forms the basis upon which further development depends.

The line projected by preliminary surveys, after it has been carefully studied and compared with regards to the cost and operating expenses would be made of the scheme to be adopted. Final location may be performed entirely on the field whereby the surveyors use the gradients shown in the profile as a guide seeking for improvement in the alignment. The detailed work would be performed by traversing (David, 1983).

The execution of route surveying entails some basic processes as far as data acquisition is concerned. These are outlined as follows:

- i. Traversing
- ii. Leveling
- iii. Detailing
- iv. Curve designation

Traverse is a sequence of connected straight lines whose direction and distances have been measured. Traverse is also the process of connecting series of lines with known bearings and distances. It is subdivided into first order for precise measurement and second order for the establishment of secondary controls while the third order is meant for survey of tertiary and topographical features.

Furthermore, route surveying consists of the following sequence of survey :

Reconnaissance of the terrain between the terminals

- i. Preliminary survey over one more location along the general route recommended in the reconnaissance report
 - ii. Location survey
 - iii. Construction survey.
-
- i. **Reconnaissance survey:** it is a rapid but thorough examination of an area or a stripe of territory between the terminal of the project to determine which of the several possible routes may be worthy of a detailed survey. Reconnaissance survey is the most important of the series of surveys mentioned above. A very thorough and exhaustive examination of the whole area should be made to ensure that no possible route has been overlooked.
 - ii. **Preliminary survey:** it is the detailed survey of a strip of territory through which the proposed line is expected to run. The preliminary survey is made of the best several lines of directions investigated previously on the reconnaissance survey. The purpose is to prepare an accurate topographic map of the belt of country along the selected route, and thus arrive at fairly close estimate of the cost of the line/direction surveyed.
 - iii. **Location survey:** The location survey is the ground location of the proposed. Line marked on the map. The main purpose of location survey is to make minor improvements on the line as may appear desirable on the ground, and to fix up the final grades. Profile levels are run over the centerline, benchmark is established, and profile which shows the existing ground level and the grade line is attained. Cross section notes are taken in order that the quantity of earth work for filling or cutting may be computed.

iv. **Construction surveys:** The purpose of construction survey is to re-establish points, lines and grades on the ground during construction. It also consists of staking out various details culverts and bridges and in carrying out such other surveying as may be needed for the purpose of construction. (Schofield 2001).

At the concept and design stage, large scale topographical surveys are produced and other measurements upon which projects are designed. Since this data forms basis to a great extent on the precision and thoroughness with which the survey is carried out.

Profile leveling (longitudinal leveling) is an operation performed to determine the elevation points spaced apart at known distances along given line in order to obtain the accurate outline of the surface of the ground along the line. It is very useful for projects like construction and design of sewer, pipelines etc., and to determine the cut and fill. It is frequently essential to run a longitudinal section along various proposed centerlines and to compare their costs to select a suitable one (Duggal S.k, 2006).

Cross sectioning, according to Duggal (2006), is a leveling operation performed to determine the elevation of the points at right angles on either side of the centerline of the proposed road and radially on the curves. This is done to find out the vertical sections of the surface of the earth on the ground. The detailed information regarding the levels of the ground on either side of the longitudinal section helps in computing the quantity of the earth work. The cross sections are plotted in the same manner as longitudinal sections.

Flying leveling (checking leveling) should be done to connect the bench mark (BM) to the starting point of the work. The records pertaining to profile leveling are entered accordingly along with the cross sectional leveling while the leveling work is in progress. The cross sections are taken perpendicular to the center line

of the alignment at some regular intervals. The purpose of cross section is to know the undulation of the ground surface.

According to Anderson and Edward (1985), route survey refers to those controls and construction surveys necessary for the location and construction of line transportation and communication which may include highways, railways, canals, transmission lines, pipelines.

Finally, Route survey involves the determination of ground configuration and location of physical features both natural and artificial along the proposed route, establishing the line on the ground and computing volumes of earthwork involved where applicable (Schofield, 2001).

This kind of survey operation is very important on all road networks and in construction of new road which will increase the durability and carrying capacity of road networks.

CHAPTER TWO

2.0 LITERATURE REVIEW

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The need for surveying as a base for planning and the process of acquiring data of route alignment with special attention on road network, construction and rehabilitation cannot be overemphasized. In view of this, the principle of surveying in general and route surveying in particular is the comprehensive aim of the project.

Transportation being a great function and purpose of route survey is regarded as the fulcrum upon which every other sector of the economy revolves. It is as well

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In this wise, transportation has contributed immensely to the economic development of nations in which our dear country (Nigeria) is involved. Here are some benefits derived as a result of good transportation network.

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Besides, route survey has contributed immensely as touching construction sectors of the engineering surveying.

Engineering surveying which breeds both route and construction survey involves the application of knowledge to the analysis, design and execution of surveying and mapping projects, and the design of land mapping and information system. Mikhail. E (1977) opined that surveyors rely on an understanding of the science of surveying measurements and the surveying principles.

Moreover, it is vividly seen that surveying plays extremely important role in any construction project. Surveying can take many forms, it aids in establishing the location and alignment of highways, buildings, pipes and other man made or cultural projects. (James C. 1985).

A route survey as the name implies is a survey that deals with the route or course that imaginary road or utility line will follow while the end product of a route survey for a highway certainly differs from that of a utility line. The major reason for carrying out route surveying is to facilitate movement of people, yielding to socioeconomic benefits (i.e by determining the best general route between terminals).

Reginnal (1968) defined route survey as the topographical and construction survey necessary for the location and construction of lines of transportation or communication such as highways, canals, transmission lines and pipelines. He stated that the location and construction survey may consist of:

- i. Establishing the centre line by setting at intervals and running level to determine profile of the ground along the centre line.
- ii. Taking cross section.
- iii. Plotting such profile and fixing grades.
- iv. Calculation volume of earthwork.

- v. Measurement of drainage areas.

- vi. Laying out structures such as bridges and culvert.

It is a reality that surveyors are the major professionals needed when it comes to working on any engineering project, for example, Building project. They provide special information such as; site location, size of the parcel, the dimension and total area. The finished product (plan) forms the basis upon which further development depends.

The line projected by preliminary surveys, after it has been carefully studied and compared with regards to the cost and operating expenses would be made of the scheme to be adopted. Final location may be performed entirely on the field whereby the surveyors use the gradients shown in the profile as a guide seeking for improvement in the alignment. The detailed work would be performed by traversing (David, 1983).

The execution of route surveying entails some basic processes as far as data acquisition is concerned. These are outlined as follows:

- i. Traversing
- ii. Leveling
- iii. Detailing
- iv. Curve designation

Traverse is a sequence of connected straight lines whose direction and distances have been measured. Traverse is also the process of connecting series of lines with known bearings and distances. It is subdivided into first order for precise measurement and second order for the establishment of secondary controls while the third order is meant for survey of tertiary and topographical features.

Furthermore, route surveying consists of the following sequence of survey :

- i. Reconnaissance of the terrain between the terminals
 - ii. Preliminary survey over one more location along the general route recommended in the reconnaissance report
 - iii. Location survey
 - iv. Construction survey.
-
- i. **Reconnaissance survey:** it is a rapid but thorough examination of an area or a stripe of territory between the terminal of the project to determine which of the several possible routes may be worthy of a detailed survey. Reconnaissance survey is the most important of the series of surveys mentioned above. A very thorough and exhaustive examination of the whole area should be made to ensure that no possible route has been overlooked.

ii. Preliminary survey: it is the detailed survey of a strip of territory through which the proposed line is expected to run. The preliminary survey is made of the best several lines of directions investigated previously on the reconnaissance survey. The purpose is to prepare an accurate topographic map of the belt of country along the selected route, and thus arrive at fairly close estimate of the cost of the line/direction surveyed.

iii. Location survey: The location survey is the ground location of the proposed.

Line marked on the map. The main purpose of location survey is to make minor improvements on the line as may appear desirable on the ground, and to fix up the final grades. Profile levels are run over the centerline, benchmark is established, and profile which shows the existing ground level and the grade line is attained. Cross section notes are taken in order that the quantity of earth work for filling or cutting may be computed.

iv. Construction surveys: The purpose of construction survey is to re-establish points, lines and grades on the ground during construction. It also consists of staking out various details culverts and bridges and in carrying out such other surveying as may be needed for the purpose of construction. (Schofield 2001).

At the concept and design stage, large scale topographical surveys are produced and other measurements upon which projects are designed. Since this data forms

basis to a great extent on the precision and thoroughness with which the survey is carried out.

Profile leveling (longitudinal leveling) is an operation performed to determine the elevation points spaced apart at known distances along given line in order to obtain the accurate outline of the surface of the ground along the line. It is very useful for projects like construction and design of sewer, pipelines etc., and to determine the cut and fill. It is frequently essential to run a longitudinal section along various proposed centerlines and to compare their costs to select a suitable one (Duggal S.k, 2006).

Cross sectioning, according to Duggal (2006), is a leveling operation performed to determine the elevation of the points at right angles on either side of the centerline of the proposed road and radially on the curves. This is done to find out the vertical sections of the surface of the earth on the ground. The detailed information regarding the levels of the ground on either side of the longitudinal section helps in computing the quantity of the earth work. The cross sections are plotted in the same manner as longitudinal sections.

Flying leveling (checking leveling) should be done to connect the bench mark (BM) to the starting point of the work. The records pertaining to profile leveling are entered accordingly along with the cross sectional leveling while the leveling work

is in progress. The cross sections are taken perpendicular to the center line of the alignment at some regular intervals. The purpose of cross section is to know the undulation of the ground surface.

According to Anderson and Edward (1985), route survey refers to those controls and construction surveys necessary for the location and construction of line transportation and communication which may include highways, railways, canals, transmission lines, pipelines.

Finally, Route survey involves the determination of ground configuration and location of physical features both natural and artificial along the proposed route, establishing the line on the ground and computing volumes of earthwork involved where applicable (Schofield, 2001).

This kind of survey operation is very important on all road networks and in construction of new road which will increase the durability and carrying capacity of road networks.

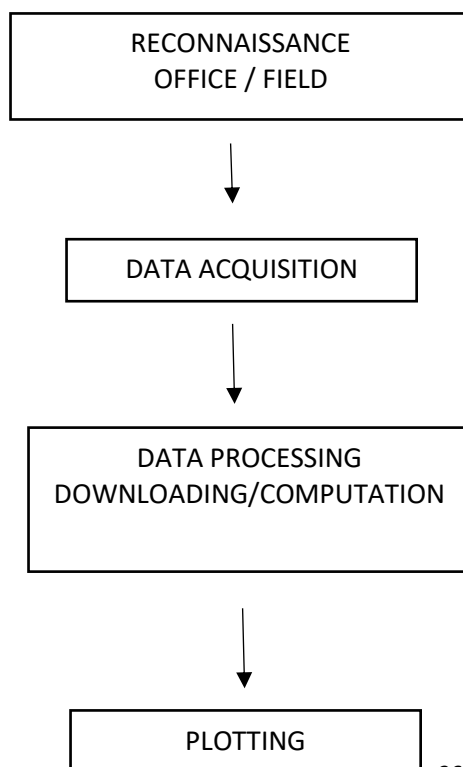
CHAPTER THREE

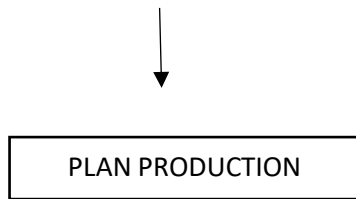
3.0 METHODOLOGY

This is a vital phase of the project that entails executing the objectives and scope of the project. A well-organized program was designed to speedily and professionally accomplish the aims and objectives of this project. The planning of this project started with meeting with the group members where all the necessary requirements were fully discussed.

This is an important aspect of surveying also involves preliminary inspection of the area before the commencement of the actual data acquisition on the project site, for the purpose of planning on how to execute the project as well as fixing stations, etc. Its value prior to the real survey work cannot be over emphasized and it enables the surveyor in obtaining the true picture of the whole area in his mind to work economically in terms of time, energy, labor and of course cost.

Figure 3.0: Flowchart Showing the Planning Procedure





A series of planning, pre-observation and analysis as shown in the flow chart were carried out during the project implementation.

3.1 RECONNAISSANCE

This involved having a general view of the project site in order to have an overall picture of the area and also for locating controls for orientation for execution of the project. It is also said to be rapid approximate survey conducted to examine the area in which the project site occupied.

Reconnaissance survey features in two forms; namely:

- I. Field Reconnaissance
- II. Office Reconnaissance

3.1.1 FIELD RECONNAISSANCE

A reacquaint visit was made to the project site in order to get familiar with the site condition, to access the volume of work to be carried out and to be carried out and to have a general overview of the topography of the route. A recci diagram which indicated the course of the road and points of interest on the road was drawn as shown below and there were no nearby control to be used for control extension.

FEDER 6B

RECCI DIAGRAM OF ROUTE SURVEY FROM LAJOZO ROAD TO ANFEITHAL ROAD

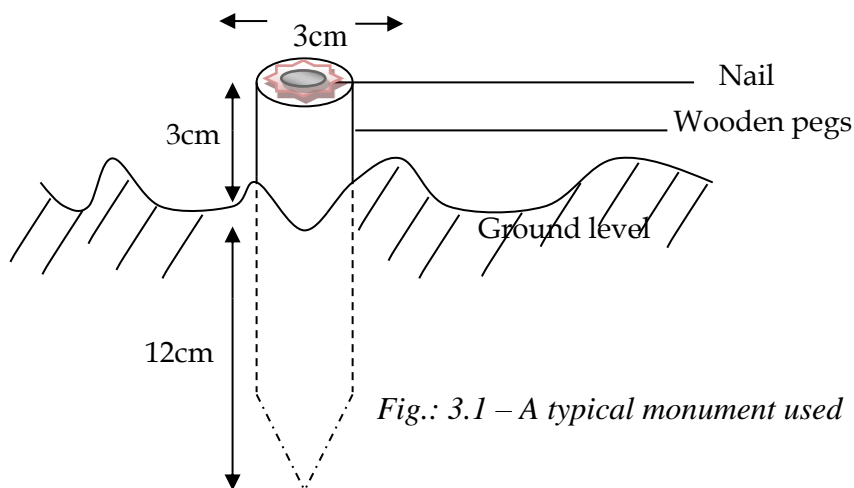


3.1.2 OFFICE RECONNAISSANCE

Based on the observations made during field reconnaissance many decisions and conclusion were made. Since no nearby control point for control extension, we decided to set up the instrument on an arbitrary point, due to unfriendly nature of the environment in terms of human and environmental factors; Sokkia Total Station EDM traversing was concluded to be adopted.

3.1.3 MONUMENTATION

This is the act of identifying the selected points and marking them with wooden pegs or nail/bottle corks during the execution of the project. This could be temporary or permanent, depending on the nature of the job specifically for the project. The wooden pegs traverse points and bottle corks for points were 3cm in diameter and about 15cm long with nail on top for easy identification of the points. These were driven into the ground leaving about 3cm above the ground as shown in the figure below.



3.2 Equipment Used

These consist of instruments used in the execution of this project. It equally included both hardware and software used. However, they were categorized into two and given as follows:

3.3 Hardware requirements

The hardware components used for this project includes:

- i. A set of Total Station Sokkia its accessories
- ii. Tripod Stand
- iii. 50m Steel tape
- iv. 3m Pocket tape
- v. Cutlass
- vi. Hammer
- vii. Nails with bottle corks
- viii. Writing Materials
- ix. Hp EliteBook laptop computer for data processing
- x. (A4 Printer) for printing reports.
- xi. An HP Color LaserJet 5550dtn Printer (A3 printer) for printing hard copy plans.

3.4 Software Used

The software components used for this project includes:

- i. AutoCAD Civil 3D 2021 for plotting of acquired data
- ii. Microsoft office 2016 (Word and Excel) for grouping and formatting downloaded data
- iii. Notepad for grouping and formatting downloaded data

3.5 Test of Instrument

This is an important exercise in any survey operation, it has to be carried out before embarking on any survey project, and this was done in order to confirm the good working condition or otherwise of the equipment used.

3.5.1 Test of Sokkia Total Station

The total station used for this project was tested for both horizontal collimation and vertical index error.

The following procedures were carried out in testing Sokkia Total Station:

Two points A and B were selected on a relatively level ground and were used as instrument and target station respectively.

- (i) The instrument was set over the first point 'A', centered, leveled and focussed, while the target was set over the second point 'B'.
- (ii) The instrument was powered ON and its menu option was navigated through. From the configuration mode screen "Collimation" was selected and the instrument prompted for sighting on face one (F1).
- (iii) At this juncture, the target was bisected on face left of the instrument and enter button was pressed. The instrument again, prompted for sighting on second face (F2).
- (iv) The instrument was transited and the target bisected on face right of the instrument and enter button was pressed again. The results of the test were displayed and shown in the table 3.2 below.

Table 3.6: Test of Sokkia Total Station

Collimation	Horizontal reading	Vertical Reading
New	+00 ⁰ 00' 08"	+00 ⁰ 00' 07"
Old	+00 ⁰ 00' 10"	+00 ⁰ 00' 12"

Source: Field Observation (January, 2025)

Expected angular accuracy is:

$30'' \cdot n \sqrt{}$ where n is the number of station occupied

n=1

$$30'' \div \sqrt{1} = 30''$$

Obtained accuracy is: = +00° 00' 20''

Horizontal Collimation Error = **0° 00' 08''**

Vertical Index Error = **0° 00' 07''**

Allowable Angular accuracy = $30''/\sqrt{n}$, Where n is the number of station occupied

Therefore, n=1

Allowable Angular accuracy = $30''/\sqrt{1} = 30''$

Each of obtained Horizontal Collimation and Vertical Index errors was lesser than the allowable Angular accuracy of 30''. Therefore, the instrument was suitable for data acquisition

3.5 Data Acquisition

This has to do with the different field operations carried out and the technology adopted to acquire necessary data (observed facts) about the project site which. Schedules of operations are as follows:

- (i) Third order traversing using total station.
- (ii) Detailing using total station the center line at 25m interval and cross section at 5m and 10m on either sides of the center line were determined.

Furthermore, both man-made and natural features were fixed. All the data acquired were fully automated

3.6.1 Control Check

3.6.1.1 Initial Control Check

The control check was carried out to ascertain that the controls used for orientation still maintained their position for correct orientation of the project work. The instrument was set up on Point A and all necessary temporary adjustments were carried out. The reflector at back station on Point B was bisected, read and recorded. The instrument was turn to fore station Point C and reflector was bisected and also read and recorded.

The difference between computed and observed was deduced and it was within the allowable misclosure because the result obtained is less than expected misclosure as shown below;

Table 3.7: Coordinates of the Starting Control Pillars

STATIONS	EASTING(m)	NORTHING(m)	HEIGHT(m)
Point 01	679748.116	944715.534	350.785
Point 02	679981.321	944665.616	349.954
Point 03	680215.990	944716.757	348.872

Table 3.8: Back Computation from the Existing Coordinates of the Starting Control Pillars

From Stn	Bearing ° ' "	Dist(m)	$\Delta E(m)$	$\Delta N(m)$	Easting (m)	Northings (m)	Height (m)	To Stn
					679748.116	944715.534	3350.785	Point 01
Point 02	282 25 39	1238.49m	-233.205	49.918	679981.321	944665.616	3349.954	Point 02
Point 03	287 42 21	2240.18m	234.669	51.141	680215.990	944716.757	3348.872	Point 03

3.6.2 Traversing (Profiling)

The instrument was set up on point B while a target was held vertically on Point A as the back station. Temporary adjustments (Centering, Levelling and Focusing) were carried out on the instrument and the instrument was then powered on. A job was created on the memory of the instrument and ‘coordinate’ option was selected from the menu list. Coordinate of the instrument station was keyed in to the instrument and the height of the instrument and that of reflector were measured and keyed in as well. The coordinate of the back station was also keyed in. having supplied the coordinate of the instrument station, the back station was bisected and the bearing and distance between the instrument station and the back sight were displayed on the display unit of the total station.

The option 'yes' was clicked to accept the orientation direction as bisected and the parameters displayed. At this juncture, the instrument had been oriented and observation started. The target was taken to the first chainage of the center line of the route.

Horizontal coordinates of the centerline points at 25m interval were determined along the route. Every point visible from the control points were coordinated before the instrument was shifted to the first temporary point. On the temporary point, the same procedures were repeated until no other point is visible and the instrument station thereby changed. However, the 25m interval was not maintained whenever there is noticeable change in the course of the route and therefore data were acquired along such curve.

3.6.3 Detailing

This was carried out in order to fix and to determine the true position of the natural and artificial features existing along the route. The details were taken along the route by holding the reflector at the edge of detail and turn the telescope of the instrument to bisect the prism of the reflector. After observation has been taken, the coordinate display on the instrument screen is stored in the instrument memory. And adequate Recce diagram was drawn to aid the proper plotting of the detailing. At least three points were picked in detail like buildings. The procedures were repeated at every detail around the route. The features fixed include the uncompleted buildings, the adjoining roads, stream, well and completed building electric poles, trees, fences, etc.

Total station was used to acquire the location data (x,y,z) of the features

3.6 Total Station Data Downloading

The data acquired through Total Station was downloaded using Bluetooth connecting from the total station storage to the laptop.

CHAPTER FOUR

Data Processing And Result Analysis

4.1 Data Processing Procedure

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

On notepad, data were well spaced to differentiate one column from the other and unwanted information deleted. On Microsoft excel, data were prepared for scripting purpose in AutoCAD.

4.2 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 launched.
- ii. Click on file, then click on “all file” and select the group data.
- iii. On open “test import wizard”, select “delimited” 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.
- v. Cut and copy and arrange in its appropriate positions if there is any misclosure

4.3 Plan Production

Plan and profile production using AutoCAD Civil 3D provides a comprehensive overview of the tools and techniques necessary for creating detailed plans and profiles for civil engineering projects. This typically covers the step-by-step process of generating plan and profile, starting from importing survey data to creating alignments, profiles, and sheets.

The steps are as follows:

1.Creating points

The X, Y, and Z data are used to create point. The data could be in any of the following format:

.pm.

.csv

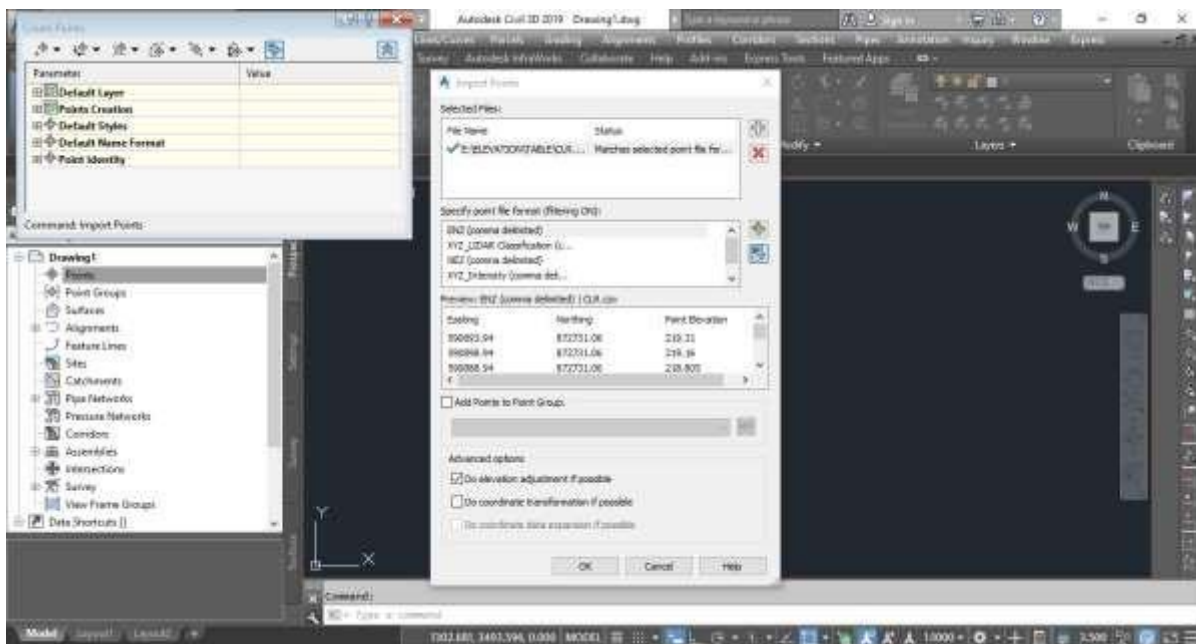
.xyz

.auf

.nez

.pnt

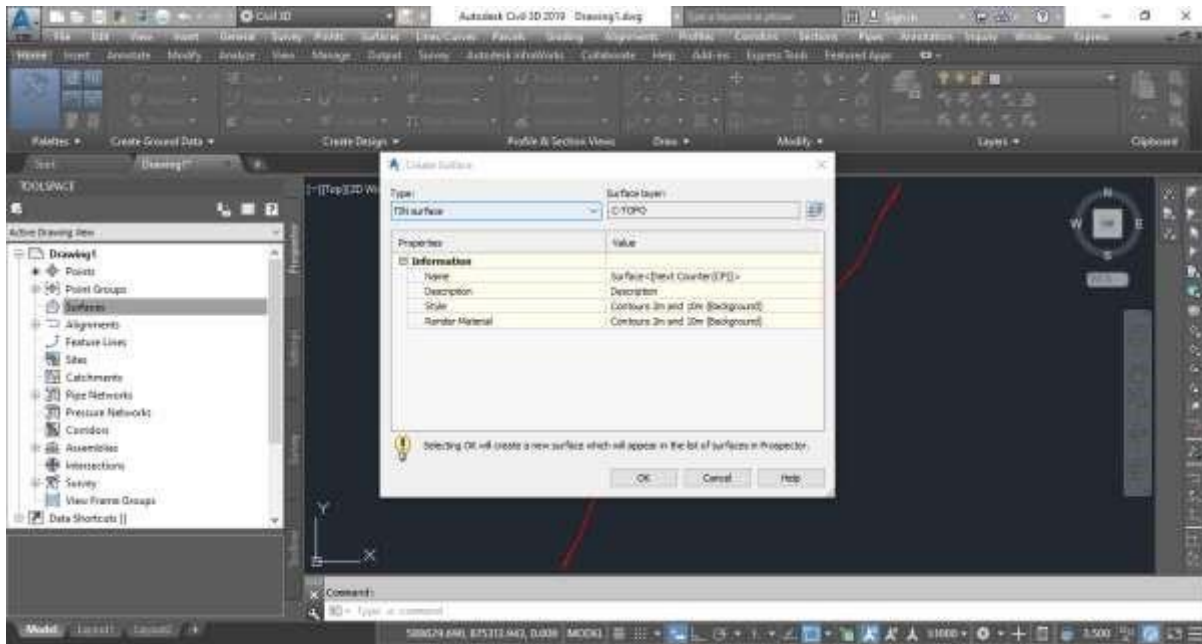
To import the point, open the tools pace, click on prospector at the right of the toolspace, then right click on points to create points. The create points toolbar will then appear, click on import points to import the data. The import point tool will then appear, click on add files then browse to the folder which



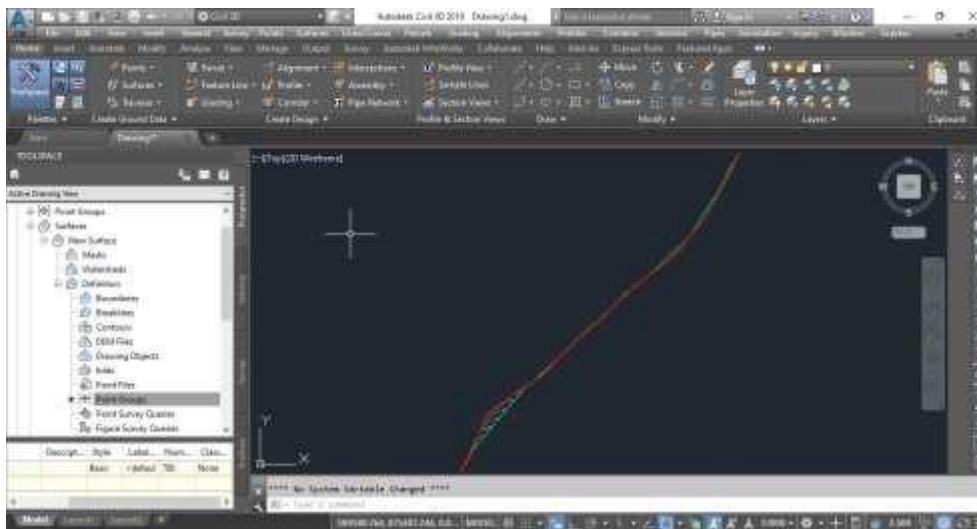
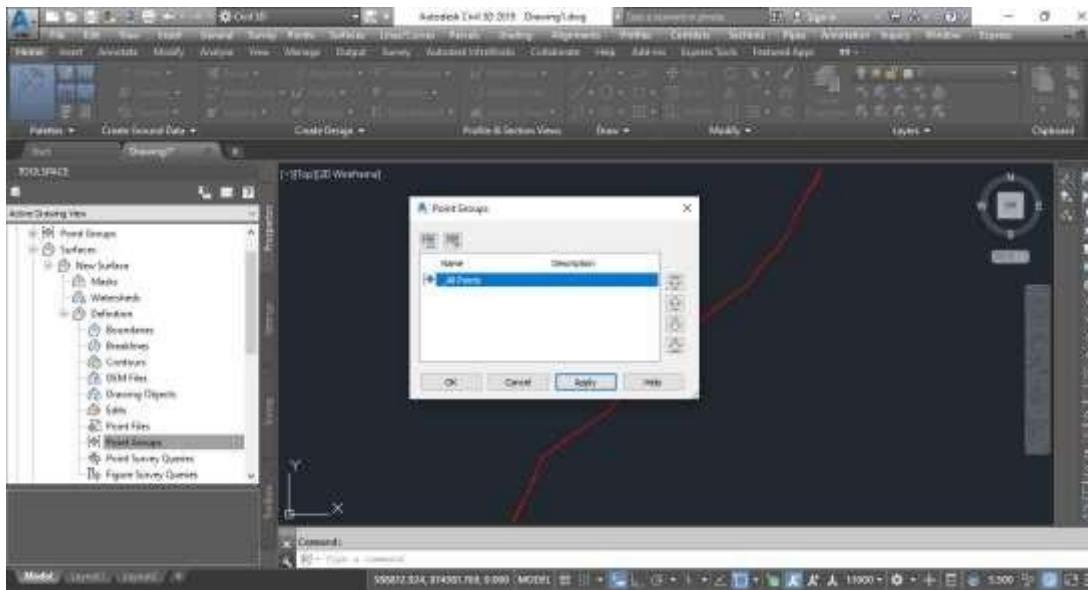
Contains that data. Select the data, click ok, then select point format, and click ok. Close all the dialogue and zoom to extent to display the points.

2. Creating Surface

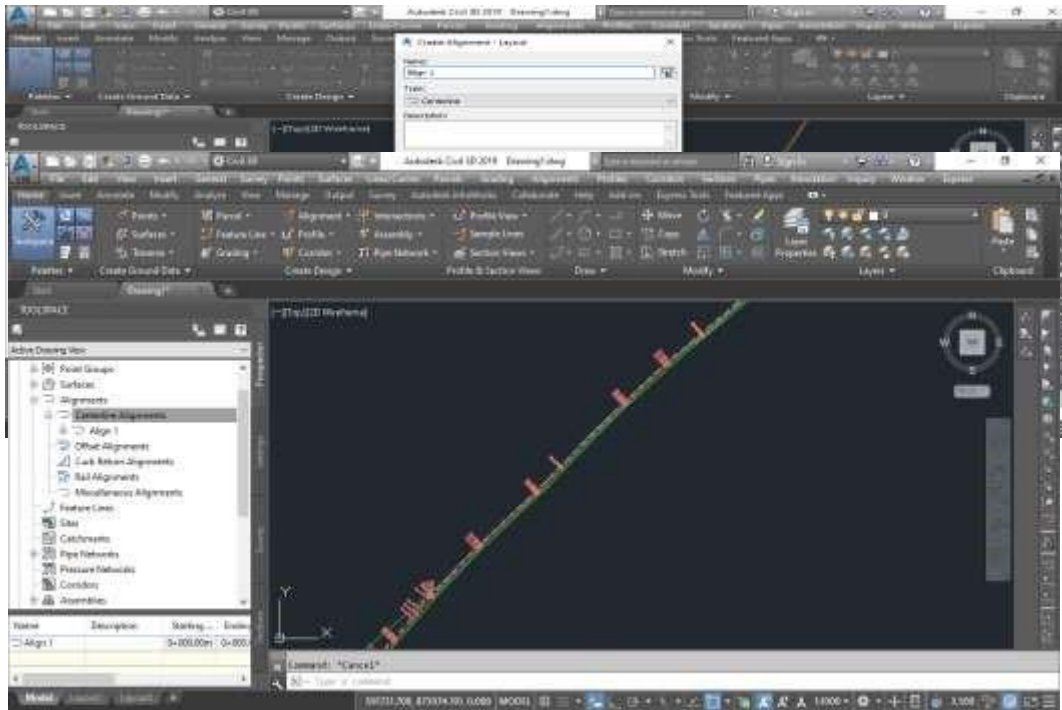
After the points have been created, the next is to create surface. On the tool-space, right click on surface and select create surface, then "create surface" dialogue will appear, type the name of the surface e.g. New Surface and click ok.



Then expand the New Surface, expand "Definition", then right click on "Point Groups" and click "Add", the "Point Group" dialogue will then appear and "All points" and then ok. Now the surface has been created.



2. Creating alignment



The next thing after creating the surface is to create alignment. To create alignment, click on

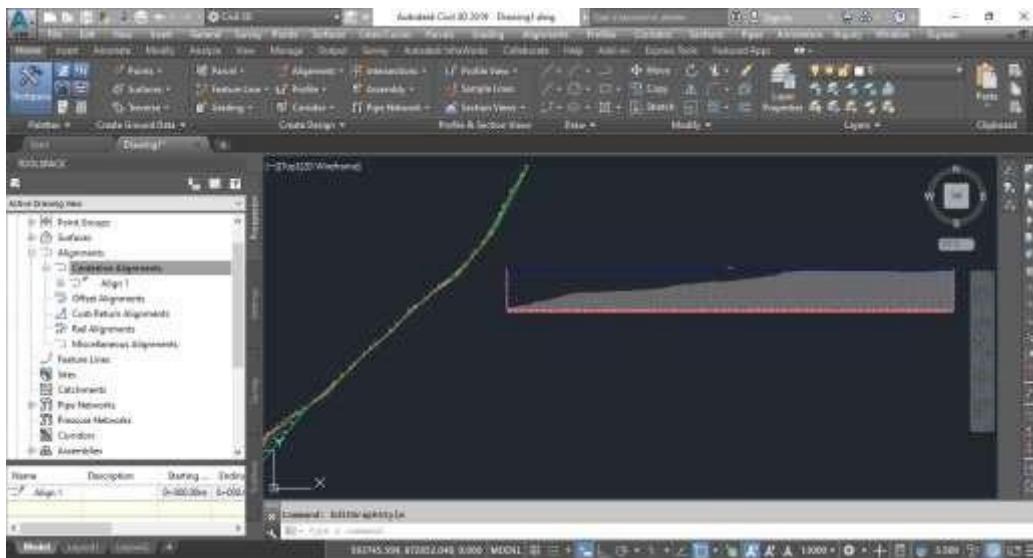
“Home” menu, click on alignment, then “Alignment Creation Tools”, the “Create Alignment layout” will appear, then name the alignment e.g. Align 1, then click ok. The "Alignment Layout Tools -Align 1" will then appear, select "Tangent-Tangent (With Curves)" then zoom to the starting point and click on the center points till the last , then press escape and close the "Alignment Layout Tools -Align 1" window . With that, the alignment has been created.

Profile

Once the alignment has been drawn, the profile can be plotted. To do this, click on the

Home ribbon click on “profile” then “create profile from surface”, the create profile from surface window will then appear. Click on “add” to add the surface then click “Draw in profile view”, then ‘Create Profile View – General’ will also appear, you can type the name of the profile or accept default, then click next, next, next, next, next, next and then click

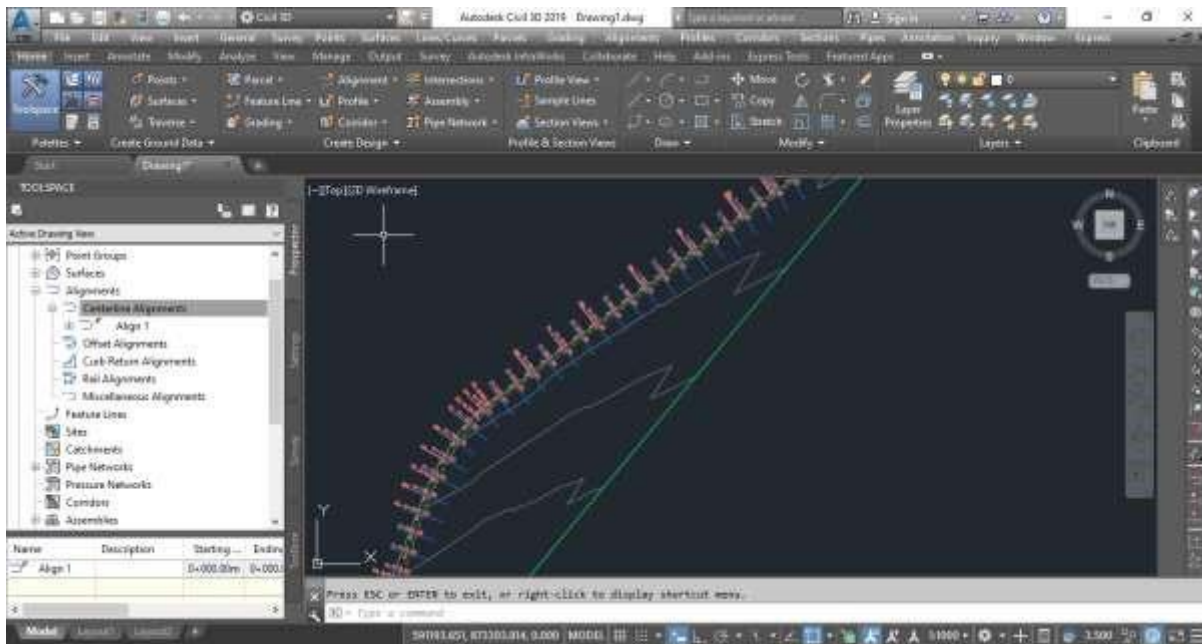
“Create Profile View”, you can then select profile view origin which can be any desired space on the drawing page. Now the profile has been plotted.



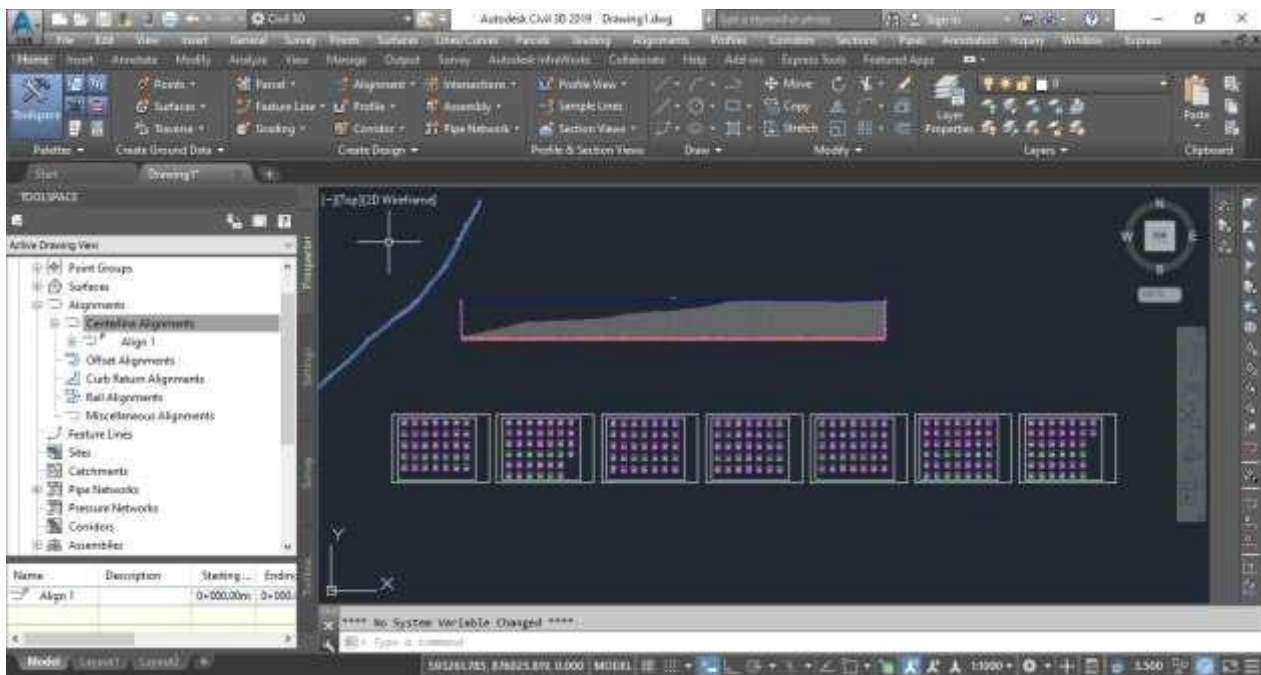
Sample line

To create sample lines for the cross section, click on the “sample line” on the home ribbon the select the alignment created earlier, the “create sample line group” window will appear, give it a name of accept default and click ok. On the “sample line tools” window, click on

“sample line creation method” and select “by range of stations”, the " "Create Sample Lines - By Station Range" window will appear, enter the left swath width and right swath width, then press ok and the escape. Now, the sample line has been created.



Cross section



Once the sample line has been drawn, the cross section can be plotted. To plot the cross section, click on “Section View” on the home ribbon and then, click “Create Multiple Views” then, the "Create Multiple Section Views - General" window will then appear, you can name it or accept default, then click next, next,

next, next, next then click “Create Section Views”, then select any desired empty area on the drawing page for the section view origin. The cross section has been plotted.

4.5 RESULT ANALYSIS

This was done to compare the results obtained with the minimum allowable accepted for the order of survey job according to survey rules and departmental instructions. The analysis of the result table is shown in the appendices.

The route survey traverse started from TBM 1 and closed back on TBM 4

Table 4.1: Abstract of TBM coordinates

TBM NO.	EASTINGS (m)	NORTHINGS(m)	HEIGHTS(m)
TBM 1	680079.673	944607.829	350.254
TBM 2	680498.890	943188.23	350.119
TBM 3	681274.349	942704.360	352.702
TBM 4	678881.884	943974.523	324.328

CHAPTER FIVE

COST ESTIMATION, SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 COST ESTIMATION

This stage the total cost spent on the project from day one to the final stage.

Table 5.1.1: Direct cost parameters

S/N	DIRECT COST		
1	Reconnaissance (1 day)		
	PERSONNEL	Rate	Total Amount (₦:K)
	1 x surveyor	10500	10500
	1 x assistant surveyor	7500	7500

	1 x technical officer	6500	6500
	3 x skilled labour	4000	12000
	Basic equipment	5000	5000:00
	Transportation (vehicle, Driver and fuel)	10000	10000:00
		Sub-total	51,500
2	Monumentation (1 day)		
	PERSONNEL		
	1 x assistant surveyor	7500	7500
	1 skilled labour	4000	4000
	Transportation (vehicle, Driver and fuel)	10000	10000
	Basic equipment	5000	5000:00
	Beacon (6)	1000	6000
		Sub-total	32,500
3	Data acquisition (2 days)		
	PERSONNEL		

	1 x assistant surveyor	7500	7500
	1 x technical officer	6500	6500
	3 x skilled labour	4000	12000
	Total Station and accessories	15000	15000
	Transportation (vehicle, Driver and fuel)	10000	10000
		Sub-total	51,000

5	Data Processing (2 days)		
	PERSONNEL		
	1 x Surveyor	10500	10500
	1 x Assistant surveyor	7500	7500
	1 x Technical officer	6500	6500
	Computer / Accessories	15000	15000
		<i>Sub-total</i>	39,500
7	Technical Report (1 day)		
	PERSONNEL		
	1 x surveyor	10500	10500
	1 x assistant surveyor	7500	7500

	1 x secretary	5000	5000:00
	Computer / accessories	15000	15000:00
		<i>Sub-total</i>	38,000

TOTAL (DIRECT COST) 212,500 MOBILIZATION/DEMOBILIZATION = 5% of
Direct Cost

$$= 0.05 \times 212,500$$

$$= \underline{\text{N}10,625}$$

CONTINGENCY ALLOWANCE

= 5% of Direct Cost

$$= 0.05 \times 212,500$$

$$= \underline{\text{N}10,225}$$

$$\text{GRAND TOTAL} = \underline{\text{N}212,500} + \underline{\text{N}10,625} + \underline{\text{N}10,625}$$

$$= \underline{\text{N}233,750}$$

$$\text{VAT (@5% GRAND TOTAL)} = 0.05 \times 233750$$

$$= \underline{\text{N}11,687.5}$$

TOTAL COST PAYABLE GRAND TOTAL + VAT

$$= \underline{\text{N}233,750} + \underline{\text{N}11,687.5} = \underline{\text{N}245,437.5}$$

5.2 SUMMARY

The project covered a total length of 4.5km. The field work however involved the following processes; Reconnaissance, Monumentation, Traversing, and Detailing. Sokkia Total Station and its Accessories was used for the data acquisition and its software for downloading and transforming the acquired data respectively. The adjusted coordinates were used for the production of the final plans.

5.3 PROBLEM ENCOUNTER

During the cause of the project, the following problems were encountered

- i. Obstruction of the signal by electric cables
- ii. Movement of vehicles along the project site.

5.4 RECOMMENDATION

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

- i. The data and results obtained from this project could be used for further construction analysis
- ii. The results obtained can further be used for more research work along/within the road limit

- iii. Practical of such should be given to students not for final year project alone as it broaden student knowledge of engineering aspect of surveying
- iv. Application of computer programming should be fully implemented so as to make the student carry out the data processing exercise faster and efficiently
- v. The school authority should provide adequate equipment especially, digital instruments to the students so as to improve the accuracy and the speed of the project execution

5.5 CONCLUSION

The field work, processing and presentation was a success and this was due to proper planning and precaution taken at every stage of the project, and the entire information for the design and construction of the road was obtained within a short period.

The aim of this project was achieved at the end of the exercise whereby a vertical, horizontal alignment and cross section plan was produced.

Appendices

NORTHING EASTING HEIGHT HEIGHT

680057.200	944604.780	347.497
680060.610	944605.900	347.566
680064.130	944607.790	347.687
680070.800	944590.570	347.207
680068.170	944589.670	347.215
680064.980	944588.220	347.224
680071.650	944572.880	347.781
680075.060	944574.000	347.925
680077.700	944574.780	348.045
680082.470	944564.630	348.800
680078.630	944562.840	348.623
680074.450	944561.610	348.342
680080.470	944543.830	349.877
680084.210	944544.170	350.369
680088.500	944544.630	350.909
680094.640	944525.860	353.391
680091.230	944525.620	352.883
680087.700	944525.280	352.370
680088.940	944518.760	353.083
680070.800	944514.590	350.893
680071.910	944510.280	351.441

NORTHING EASTING

680095.520	943435.790	341.017
680117.910	943425.260	342.678
680116.600	943423.600	342.592
680115.170	943421.820	342.497
680135.480	943408.970	343.819
680136.910	943410.520	343.917
680138.880	943412.520	344.035
680168.600	943387.870	345.979
680167.730	943385.330	345.921
680166.200	943383.220	345.823
680196.350	943360.230	345.719
680197.670	943361.670	345.766
680199.310	943363.780	345.833
680227.140	943344.770	345.729
680225.600	943343.210	345.736
680223.190	943341.320	345.715
680240.090	943327.460	346.915
680241.410	943328.570	346.882
680242.940	943330.230	346.834
680272.120	943303.920	347.967
680270.480	943301.820	347.928

680088.850	944514.880	353.378	680268.280	943299.590	347.860
680091.660	944501.180	354.617	680288.400	943281.980	348.663
680096.390	944502.090	355.175	680275.680	943269.540	347.942
680100.790	944503.430	355.724	680277.230	943267.120	348.071
680105.120	944495.490	356.046	680291.160	943279.780	348.882
680135.700	944501.260	356.748	680294.580	943277.700	349.070
680135.930	944498.380	356.654	680295.560	943279.360	349.046
680106.780	944492.510	356.071	680296.880	943281.800	348.994
680106.510	944479.120	356.017	680319.170	943267.960	350.200
680103.100	944478.000	356.000	680317.420	943265.740	350.212
680099.030	944476.880	355.709	680315.670	943262.970	350.244
680109.360	944455.360	354.881	680335.650	943251.550	350.405
680113.650	944455.710	354.984	680336.960	943253.540	350.299
680117.390	944456.170	355.082	680338.050	943256.090	350.177
680124.980	944432.090	354.328	680366.200	943239.510	350.133
680122.240	944430.750	354.194	680364.990	943237.400	350.183
680118.940	944429.080	354.031	680363.240	943234.520	350.263
680131.160	944402.920	353.546	680394.580	943218.840	350.032
680134.570	944404.370	353.738	680395.670	943220.500	350.057
680138.090	944405.380	353.916	680396.870	943223.050	350.097
680148.130	944374.560	353.516	680408.490	943210.710	349.502
680144.390	944372.890	353.151	680408.170	943206.620	349.131
680141.090	944371.550	352.827	680398.170	943202.040	348.874
680148.330	944352.660	352.428	680399.060	943200.170	348.702
680151.300	944353.340	352.752	680414.110	943207.530	349.163

680155.370	944354.460	353.187	680415.210	943209.080	349.305
680162.060	944332.700	354.345	680416.410	943211.190	349.509
680159.650	944331.920	354.139	680429.760	943203.950	348.806
680156.680	944331.350	353.866	680428.670	943202.720	348.680
680162.370	944311.910	355.042	680427.350	943201.170	348.530
680165.010	944312.590	355.283	680437.730	943194.360	347.865
680167.210	944313.260	355.458	680439.050	943196.020	348.019
680176.460	944288.300	356.606	680440.030	943198.130	348.231
680173.490	944287.520	356.357	680457.790	943188.580	347.669
680170.190	944286.730	356.089	680456.700	943186.590	347.462
680187.420	944245.990	354.680	680455.170	943184.590	347.319
680190.060	944246.890	354.865	680480.430	943171.760	347.632
680193.140	944247.900	355.087	680481.640	943172.870	347.694
680208.150	944213.340	354.193	680482.520	943174.420	347.775
680204.850	944212.440	354.132	680505.690	943160.580	347.355
680201.770	944211.430	354.081	680504.270	943158.920	347.241
680204.880	944180.810	354.408	680502.410	943157.030	347.115
680207.960	944180.600	354.355	680529.120	943139.890	347.873
680210.930	944180.390	354.303	680531.420	943143.330	347.891
680201.290	944169.070	354.791	680532.400	943145.760	347.898
680197.880	944169.500	354.885	680565.290	943128.100	347.896
680194.570	944170.370	354.959	680563.650	943124.550	347.993
680179.200	944159.800	355.810	680561.800	943120.340	347.691
680181.850	944157.820	355.787	680588.610	943104.970	346.714
680184.830	944156.840	355.720	680590.030	943107.850	346.899

680185.960	944125.100	356.975	680591.560	943111.950	347.168
680183.420	944125.200	357.020	680624.240	943091.070	346.846
680181.110	944125.410	357.060	680622.710	943087.860	346.796
680177.880	944083.150	358.291	680620.520	943084.980	346.726
680181.290	944082.830	358.379	680656.600	943065.550	346.156
680185.700	944082.520	358.495	680658.240	943068.100	346.186
680192.220	944050.360	358.040	680659.440	943071.320	346.255
680189.690	944050.350	357.954	680687.250	943056.170	346.440
680185.610	944050.330	357.821	680686.160	943053.510	346.576
680194.020	944014.200	355.825	680684.520	943050.850	346.681
680197.430	944014.880	356.098	680711.010	943034.260	348.573
680201.610	944015.780	356.429	680713.200	943037.480	348.355
680211.890	943979.880	354.320	680715.060	943040.810	348.106
680209.590	943978.870	354.184	680755.020	943015.210	347.394
680206.400	943978.090	354.016	680753.050	943013.320	347.336
680207.210	943966.920	353.442	680750.640	943010.980	347.303
680183.580	943958.410	351.421	680774.370	942996.040	345.985
680184.590	943953.660	351.240	680776.340	942998.480	346.030
680210.100	943961.840	353.325	680777.660	943000.590	346.074
680217.150	943935.220	353.679	680799.300	942985.200	345.112
680219.890	943936.450	353.883	680797.990	942983.420	345.045
680224.180	943937.570	354.204	680796.120	942981.540	345.000
680240.580	943888.090	356.371	680817.890	942962.490	343.314
680237.060	943887.190	356.259	680819.430	942964.600	343.274
680234.310	943885.850	356.172	680820.630	942966.930	343.282

680247.270	943841.560	355.148	680841.190	942946.220	340.531
680250.680	943842.900	355.272	680842.940	942949.000	340.541
680254.310	943843.580	355.364	680843.810	942951.430	340.648
680264.900	943813.210	355.743	680871.820	942940.820	339.949
680261.270	943811.870	355.668	680870.520	942937.720	339.751
680258.520	943810.530	355.613	680869.650	942934.290	339.527
680269.250	943773.410	356.614	680896.810	942916.600	339.236
680273.210	943773.650	356.523	680898.890	942919.820	339.607
680276.400	943774.330	356.456	680901.520	942922.810	340.001
680282.850	943732.770	354.815	680913.490	942904.170	338.329
680279.330	943731.760	354.810	680929.890	942878.030	335.986
680274.600	943731.410	354.872	680934.450	942867.540	335.983
680287.080	943696.180	352.907	680939.070	942868.340	336.066
680290.050	943696.520	353.013	680931.280	942889.210	336.862
680293.020	943696.750	353.270	680934.120	942892.760	337.206
680302.630	943663.390	354.506	680937.080	942896.200	337.563
680300.100	943662.610	354.415	680964.000	942884.150	337.170
680298.020	943661.270	354.386	680963.130	942881.710	336.976
680311.800	943630.140	356.517	680962.590	942879.500	336.855
680315.100	943630.600	356.495	680990.050	942867.890	337.360
680317.190	943631.270	356.468	680990.810	942869.660	337.446
680326.800	943597.800	356.436	680991.800	942871.320	337.532
680325.150	943597.460	356.424	681021.450	942862.930	339.024
680323.060	943597.120	356.414	681020.910	942860.940	338.927
680333.780	943562.220	354.855	681020.250	942859.940	338.847

680335.980	943563.110	354.946	681053.690	942840.510	338.274
680338.180	943563.010	354.992	681055.010	942842.060	338.411
680355.820	943530.350	355.667	681057.420	942843.840	338.578
680352.860	943528.340	355.803	681065.750	942828.620	337.591
680349.790	943526.340	355.716	681064.430	942827.280	337.505
680360.920	943522.290	355.698	681062.230	942826.060	337.427
680376.220	943524.350	355.195	681072.730	942817.030	336.837
680376.230	943520.920	355.306	681074.160	942817.920	336.895
680363.360	943518.650	355.643	681074.920	942819.140	336.971
680373.330	943504.100	355.986	681088.050	942814.110	336.642
680370.140	943502.650	355.933	681086.950	942812.230	336.521
680367.180	943500.860	355.863	681085.860	942810.340	336.396
680389.230	943466.670	356.517	681104.150	942807.540	335.511
680391.210	943467.680	356.641	681104.030	942808.980	335.634
680393.410	943468.680	356.773	681104.250	942810.860	335.776
680409.470	943445.410	356.675	681129.570	942810.640	334.676
680406.510	943443.630	356.364	681129.140	942808.540	334.461
680404.860	943441.740	356.134	681128.820	942805.880	334.197
680410.630	943432.370	355.897	681153.940	942801.670	332.702
680410.590	943416.330	354.891	681154.270	942802.780	332.853
680403.810	943404.470	353.904	681155.140	942804.440	333.063
680405.360	943401.710	353.803	681183.240	942797.930	332.880
680412.470	943413.020	354.773	681182.590	942796.600	332.740
680419.390	943418.140	355.260	681182.150	942795.380	332.616
680422.020	943419.690	355.419	681188.670	942789.100	332.229

680425.100	943421.480	355.623	681190.650	942789.660	332.355
680437.880	943392.220	353.514	681192.630	942790.560	332.479
680435.020	943390.990	353.467	681198.080	942776.980	331.185
680432.170	943389.650	353.429	681196.660	942775.860	330.989
680451.020	943357.330	351.681	681194.240	942775.520	330.837
680453.880	943359.110	351.759	681201.930	942754.100	328.977
680456.180	943360.670	351.816	681203.460	942755.100	329.159
680470.040	943338.940	351.850	681205.440	942755.550	329.324
680481.350	943345.950	352.633	681210.320	942747.060	328.804
680483.010	943343.750	352.795	681209.230	942745.500	328.598
680473.360	943334.860	352.093	681207.910	942743.730	328.365
680465.880	943331.730	351.949	681214.320	942738.450	327.985
680457.480	943314.660	352.223	681221.300	942729.520	327.126
680455.370	943318.080	352.048	681222.280	942730.630	327.220
680463.770	943336.040	351.741	681223.710	942732.180	327.353
680481.010	943296.400	353.116	681234.410	942726.360	326.957
680484.530	943297.410	353.195	681233.650	942724.480	326.916
680487.830	943297.870	353.270	681232.780	942722.380	326.870
680491.520	943258.620	352.706	681247.980	942720.340	326.507
680493.710	943259.410	352.760	681248.300	942721.780	326.548
680495.690	943260.080	352.807	681248.300	942723.550	326.616
680506.070	943227.830	352.367	681251.940	942721.350	326.389
680503.980	943227.710	352.254	681257.740	942702.910	325.246
680501.010	943227.030	352.074	681261.150	942703.470	325.072
680508.510	943223.750	352.277	681256.450	942722.260	326.249

680509.080	943218.770	352.159	681267.010	942724.510	325.967
680525.720	943216.410	352.622	681267.110	942726.060	326.056
680525.390	943214.530	352.429	681267.330	942727.830	326.150
680511.890	943206.060	351.163	681286.380	942725.700	326.200
680509.360	943205.280	351.010	681286.060	942724.260	326.063
680505.840	943204.600	350.816	681285.630	942721.940	325.832
680512.900	943175.320	348.532	681311.670	942709.330	324.348
680514.880	943176.210	348.656	681311.880	942711.540	324.650
680517.300	943176.890	348.781	681311.980	942713.980	324.984
680521.140	943153.020	347.522	680061.040	944608.670	350.745
680516.140	943162.730	347.814	680077.180	944567.920	351.276
680521.420	943163.860	348.063	680088.210	944535.790	354.613
678832.000	944021.720	324.000	680096.920	944507.400	358.048
678835.410	944023.720	324.000	680102.180	944486.630	358.920
678839.800	944025.510	324.000	680111.880	944459.020	358.135
678850.970	944013.720	324.000	680125.470	944421.800	357.007
678846.910	944011.270	324.000	680139.490	944386.800	356.470
678844.280	944008.280	324.000	680151.850	944353.790	355.824
678869.000	943993.890	322.570	680162.220	944322.750	357.683
678871.190	943997.110	322.460	680173.590	944289.400	359.490
678873.270	943999.330	322.350	680184.060	944259.910	358.249
678908.810	943978.020	320.126	680192.750	944236.280	357.346
678906.740	943973.150	320.313	680201.650	944214.090	357.095
678904.340	943968.930	320.480	680209.260	944185.250	357.244
678945.340	943956.830	320.283	680202.270	944171.290	357.704

678946.320	943959.490	320.374	680185.240	944163.360	358.497
678947.740	943962.700	320.501	680181.960	944132.930	359.662
678982.030	943949.800	319.503	680183.460	944089.810	361.305
678981.160	943947.580	319.255	680184.470	944060.500	361.119
678979.860	943944.260	318.992	680250.120	943845.330	358.362
679009.190	943932.550	319.259	680272.440	943772.650	359.545
679010.390	943934.430	319.454	680278.550	943734.410	358.053
679010.820	943937.090	319.661	680303.000	943654.660	357.968
679038.850	943921.060	319.506	680324.640	943588.610	359.134
679037.330	943918.070	319.182	680354.520	943526.030	358.826
679035.570	943915.510	318.970	680421.680	943422.460	358.622
679040.610	943922.060	319.646	680467.300	943336.160	354.850
679047.840	943931.160	320.610	680480.640	943304.700	356.159
679049.940	943928.850	320.457	680486.230	943284.700	356.080
679042.490	943919.970	319.514	680491.940	943261.720	355.761
679086.440	943889.630	318.663	680496.190	943246.040	355.630
679084.580	943885.970	318.168	680501.440	943229.470	355.189
679081.070	943883.410	317.608	680506.360	943212.230	354.588
679102.690	943872.330	317.194	680511.960	943187.820	352.384
679104.890	943874.330	317.686	680517.890	943165.610	351.062
679107.080	943877.000	318.248	680520.810	943152.020	350.527
679117.510	943883.790	319.985	678835.840	944025.600	324.000
679120.490	943881.590	319.882	678853.200	944007.540	323.872
679110.390	943874.910	318.195	678874.510	943994.030	322.126
679133.270	943854.100	317.021	678896.140	943981.180	320.646

679130.410	943851.880	316.720	678918.640	943971.540	320.325
679126.900	943848.880	316.295	678942.570	943961.460	320.463
679163.460	943822.600	314.825	678969.370	943950.960	319.463
679165.760	943825.370	315.003	678997.710	943940.790	319.341
679167.730	943828.260	315.259	679016.800	943930.480	319.465
679184.180	943815.720	314.366	679032.030	943920.140	319.201
679195.140	943828.920	314.757	679053.670	943906.630	318.854
679199.000	943826.290	314.351	679073.320	943893.770	318.216
679187.830	943813.740	314.236	679094.740	943879.160	317.730
679201.430	943799.530	313.891	679114.180	943864.530	316.989
679200.440	943797.430	313.819	679134.720	943848.580	316.533
679198.580	943795.320	313.671	679153.060	943834.940	315.783
679259.070	943757.970	319.000	679176.690	943816.900	314.447
679263.570	943762.850	319.000	679199.560	943797.640	313.772
679266.740	943766.850	318.797	679228.150	943779.400	316.087
679334.370	943734.280	319.750	679261.260	943761.630	319.000
679332.080	943729.300	319.731	679296.000	943747.950	319.000
679330.340	943722.540	319.764	679326.230	943731.930	319.527
679385.840	943695.680	319.409	679359.660	943715.810	319.417
679389.230	943700.120	319.562	679391.990	943698.030	319.688
679392.730	943704.560	319.664	679424.210	943680.690	321.947
679396.120	943710.770	319.775	679439.000	943672.680	323.009
679404.380	943735.690	319.999	679465.940	943653.330	324.268
679400.970	943735.670	319.989	679493.440	943633.200	324.631
679394.020	943713.410	319.709	679516.850	943617.160	325.775

679388.100	943706.750	319.514	679547.870	943598.480	327.038
679435.670	943679.410	322.585	679594.630	943578.880	331.000
679434.360	943675.540	322.827	679618.700	943562.510	330.967
679432.290	943671.430	322.953	679643.750	943549.450	330.190
679462.640	943653.760	324.217	679664.500	943536.600	330.467
679463.850	943654.870	324.171	679691.520	943526.100	330.481
679465.270	943656.090	324.095	679722.620	943513.730	330.863
679491.330	943637.180	324.440	679753.490	943503.680	332.532
679489.800	943635.400	324.582	679787.980	943495.540	334.201
679488.050	943633.510	324.736	679814.430	943489.120	335.491
679518.850	943613.850	325.918	679850.580	943481.090	336.783
679520.710	943615.620	325.852	679883.180	943478.020	338.155
679522.020	943617.510	325.790	679918.640	943476.290	339.749
679556.900	943597.530	327.514	679943.300	943477.060	339.677
679555.040	943594.200	327.508	679968.840	943478.050	339.859
679553.080	943590.100	327.522	680004.080	943474.000	340.521
679598.620	943572.150	331.000	680034.320	943458.530	339.905
679600.600	943574.260	331.000	680077.330	943441.350	339.418
679602.240	943576.930	331.000	680132.260	943415.260	343.611
679630.490	943560.680	330.580	680175.910	943379.170	346.077
679629.400	943558.240	330.618	680216.670	943347.150	345.524
679627.980	943555.800	330.662	680232.670	943337.050	346.153
679653.580	943540.310	330.344	680272.360	943299.390	347.930
679655.120	943542.090	330.286	680292.470	943281.010	348.893
679656.760	943543.870	330.230	680329.900	943258.050	350.380

679686.100	943531.490	330.488	680374.380	943231.800	350.147
679684.790	943528.830	330.584	680411.570	943211.390	349.553
679683.260	943526.170	330.697	680458.910	943185.160	347.447
679721.520	943513.170	330.860	680496.980	943164.300	347.509
679722.610	943514.720	330.797	680520.920	943152.020	347.532
679723.600	943516.610	330.708	680541.250	943137.170	347.942
679730.760	943514.210	331.100	680568.720	943122.140	347.835
679736.650	943526.950	330.887	680591.360	943107.520	346.878
679739.520	943526.520	330.979	680613.880	943092.800	346.511
679734.950	943513.450	331.289	680636.490	943083.270	346.912
679750.390	943506.550	332.249	680658.350	943068.990	346.208
679749.410	943504.660	332.334	680680.540	943055.700	346.354
679748.540	943502.340	332.456	680703.390	943041.420	347.766
679783.030	943493.970	334.139	680719.590	943036.510	348.632
679784.240	943496.070	334.045	680740.790	943023.000	348.016
679785.430	943499.170	333.880	680765.510	943009.280	346.961
679828.750	943488.630	335.992	680778.440	942998.050	345.957
679828.320	943486.530	336.111	680799.760	942981.000	344.885
679827.770	943484.310	336.240	680813.580	942968.010	343.822
679836.680	943487.780	336.168	680831.230	942958.900	342.116
679843.120	943500.630	335.662	680849.680	942943.830	340.153
679845.100	943500.310	335.674	680875.700	942934.760	339.645
679838.660	943487.120	336.222	680902.200	942916.730	339.455
679855.300	943483.210	336.634	680915.010	942907.610	338.657
679854.320	943480.770	336.845	680922.200	942899.670	337.881

679853.560	943478.670	337.023	680929.870	942883.560	336.310
679882.200	943475.580	338.390	680942.980	942854.750	336.039
679882.630	943477.580	338.177	680947.540	942844.370	335.648
679883.500	943480.790	337.834	680949.890	942888.620	337.142
679913.230	943479.810	339.243	680975.590	942875.900	337.153
679912.910	943476.710	339.506	680998.420	942867.700	337.677
679912.480	943473.940	339.742	681022.450	942860.400	339.007
679955.190	943475.560	339.520	681041.770	942848.750	338.854
679955.190	943477.330	339.578	681054.010	942844.160	338.554
679955.170	943479.980	339.668	681063.650	942828.390	337.574
679990.850	943478.260	340.371	681068.640	942822.320	337.183
679990.530	943475.710	340.192	681076.250	942817.380	336.859
679990.220	943472.720	339.990	681086.180	942813.220	336.586
680002.120	943470.230	340.214	681101.940	942809.970	335.802
679995.740	943441.670	339.137	681117.030	942808.480	335.008
679998.940	943440.570	339.163	681133.880	942807.670	334.155
680007.520	943468.700	340.286	681159.440	942802.140	332.863
679999.330	943478.840	340.682	681178.730	942798.240	332.825
680000.670	943499.200	342.053	681186.560	942794.840	332.662
680006.630	943496.570	342.078	681191.320	942789.330	332.346
680004.400	943477.430	340.754	681197.890	942771.670	330.572
680030.440	943463.600	340.164	681203.250	942753.770	329.031
680029.130	943461.160	340.043	681208.680	942745.610	328.577
680027.710	943457.950	339.893	681218.750	942733.600	327.499
680047.780	943451.070	339.405	681227.580	942727.110	326.983

680048.320	943452.840	339.523	681239.050	942722.620	326.838
680048.860	943454.720	339.647	681248.850	942722.220	326.544
680073.010	943446.310	339.478	681260.400	942725.150	326.243
680072.360	943444.980	339.421	681271.630	942726.410	325.916
680071.260	943443.420	339.342	681283.960	942725.470	326.120
680093.990	943432.680	340.756	681295.000	942719.320	325.713
680094.750	943434.230	340.891	681311.100	942712.200	324.758