ROUTE SURVEY OF LAJOLO TO MAYA AND ELEKO ANFEYIN ROAD TO MAYA VILLAGE ILORIN,

MORO LOCAL GOVT, KWARA STATE

SUBMITTED TO THE DEPARTMENT OF SURVEYING AND GEOINFORMATICS

IN PARTIAL FULLFILLMENT FOR THE AWARD OF HIGHER NATIONAL DIPLOMA

IN

SURVEYING AND GEOINFORMATICS

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Acknowledgement

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

Abstract

This project report analyses route survey, and alignments design which was carried out from the road that connects Lajolo to Maya Anfeyin Road in Moro Local government. The project started with reconnaissance to be familiar with the project site. Control points were established and coordinated using GPS to minimize error. Marking of the centre line at an interval of 25m and pegging of cross sectioning points were done. Total station (SOKKIA) was used to acquire geometric data of the centre line and cross section points while details were also picked through this process. The acquired data were downloaded with Sokkia link software and processed using software's like Microsoft Excel and Notepad. AutoCAD Land Development was used in plotting and designing horizontal and vertical alignments of the said route. The plans were produced in hard copy and finally, a comprehensive project report was written.

The methodology involved reconnaissance, data acquisition using advanced surveying instruments such as total stations and GNSS receivers, and data processing with industry-standard software like AutoCAD Civil 3D. Key aspects of the survey included horizontal and vertical alignment studies, cross-sectional profiling, and identification of existing utilities and environmental constraints.

This project underscores the importance of route surveys in infrastructure development, ensuring efficient design, cost-effective implementation, and long-term sustainability of transportation networks.

limitations, and inadequate collaboration. This study not only underscores the importance of addressing these challenges but also provides a roadmap for leveraging radio to foster a more informed and supportive community.

CHAPTER ONE

Introduction

1.1 Background of the Study

Surveying plays a key role in the development of engineering project such as hydroelectric schemes, irrigation, alignment of roads, tunnels and transmission lines, locations and construction of dams, aqueduct (a structure like bridge that takes water across a valley), development of cities, flood controls and development and maintenance of harbours. In all these projects, the role of surveyor is to render services to the design engineers to provide information relevant to the design and construction of the project. Surveying is very important for planning and as well for acquisition of the required data for route alignment, with special attention on road network, for rehabilitation and construction of roads. (Roy, 2008).

Surveying include the determination of the measuring data, reduction and interpretation of the data to useable form and conversely the establishment of relative position and size according to the given measurement requirements. There are many operations in surveying which are boundary survey, topographic survey, hydrographic surveying, mine surveying, construction surveys, photogrammetry and remote sensing, route surveying.

Engineering surveying can be as the survey carried out to provide special information for construction projects which are usually drawn to large scale. Engineering surveying has assumed the goal of dimensioning the physical environment. Greater part of its responsibility is seen from the various type of surveying, which are geared towards promoting accessibility, route ways, convenience, economy and spatial delineation of both natural and social environment.

Route surveying which is the main focus of this project is defined as the topographical and constructional survey that are necessary for the location and construction of communication lines, transportation, roads, canals, highway, pipelines etc. Generally, route surveying can be applied to the survey required to establish the horizontal and vertical alignment for transportation facilities. In most cases the transportation facilities comprise a network that includes the transport of people or goods by way of highways, railways, canals, pipelines, and transmission lines.

Road which is the most common mode of transportation facilitates our movements from one location to another, also to delivered manufactured and farm produce from the production points to the end users. Roads in Nigeria can be classified into three major groups which are:-

1. Federal Roads (Inter State Roads)
2. State Roads (Intra state Roads)
3. 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 governments 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 Statement of the Problem

It has been discovered that the Route from Lajolo junction to Maya Anfeyin ,Ilorin, Kwara State in Moro Local Government Area was partly constructed and has been in deplorable condition for long, such that it requires urgent reconstruction to make it better. In order to reduce the frequency of these problems both at present and in the future, there is the need for acquisition of geometrical data and provision of profile and cross-sectioning information which would assist engineers for the proper design and rehabilitation of the route to ensure the safety of those that are plying the road, hence, the need for this project

1.3 Significance of The Project

The project was carried out to provide information (geometric data) for future usage for reconstruction or perhaps the extension of the route which when carried out is expected to decongest traffics and enhance social and economic interaction between the areas it linked. It also availed the opportunity of putting into practice the theoretical knowledge of engineering survey obtained from the classroom

1.4 Aim

The aim of this project was to provide both horizontal and vertical alignment of the route which will be used in computing the volume and also in designing of the road.

1.5 Objectives

In order to achieve the aim, the following objectives were followed:

i. To identify the ground controls to be used for orientation and subsequently establish the required control beacons at every 1 kilometer along the concerned route.
ii. To mark the chainage along the route using specified interval of 25m
iii. To produce comprehensive plans showing longitudinal, cross section and details along the route using appropriate scale.

1.6 Scope of the Project

The scope of the project covered the following operation:

i. Reconnaissance
ii. Test of instrument
iii. Control check
iv. Marking of chainage points at every 25m along the route
v. Longitudinal section at 25m interval
vi. Detailing of all features (both natural and artificial features) within the right of way. vii. Data downloading, Data processing/computation (volume, total length and linear accuracy) and analysis.
viii. Alignment designs
ix. AutoCAD drafting (Plotting of the vertical coordinates against the horizontal coordinates to obtain the longitudinal profile of the Centre line points) and presentation
x. Report writing

1.7 Project Specification

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 zero observations and the angular difference from both faces should not be more than thirty Seconds (30").The angular misclosure is determined by 30" here 'n' Is the total number of station observed

(iii) Establishing traverse points by using pegs together with nails and Bottle corks.

(iv) Spirit levelling must commence on a known benchmark and closed back on another known benchmark. Formulae for its misclosure are ±24m mvk, where 'k' is the total distance covered in kilometres.

(v) Levelling must be observed at every 25m intervals on both sides of the Centre line and at 5m interval on both sides of the centre line for the cross sectioning. Edges of drainage at both sides should be heightened.

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

(vii) Setting out curve by using deflection angle method within third other Survey.

(viii) The accuracy of the project must fall within the order of the project.

1.8 Personnel

The following names are the members of HND23 (Group 6B) that was assigned to carry out this project:

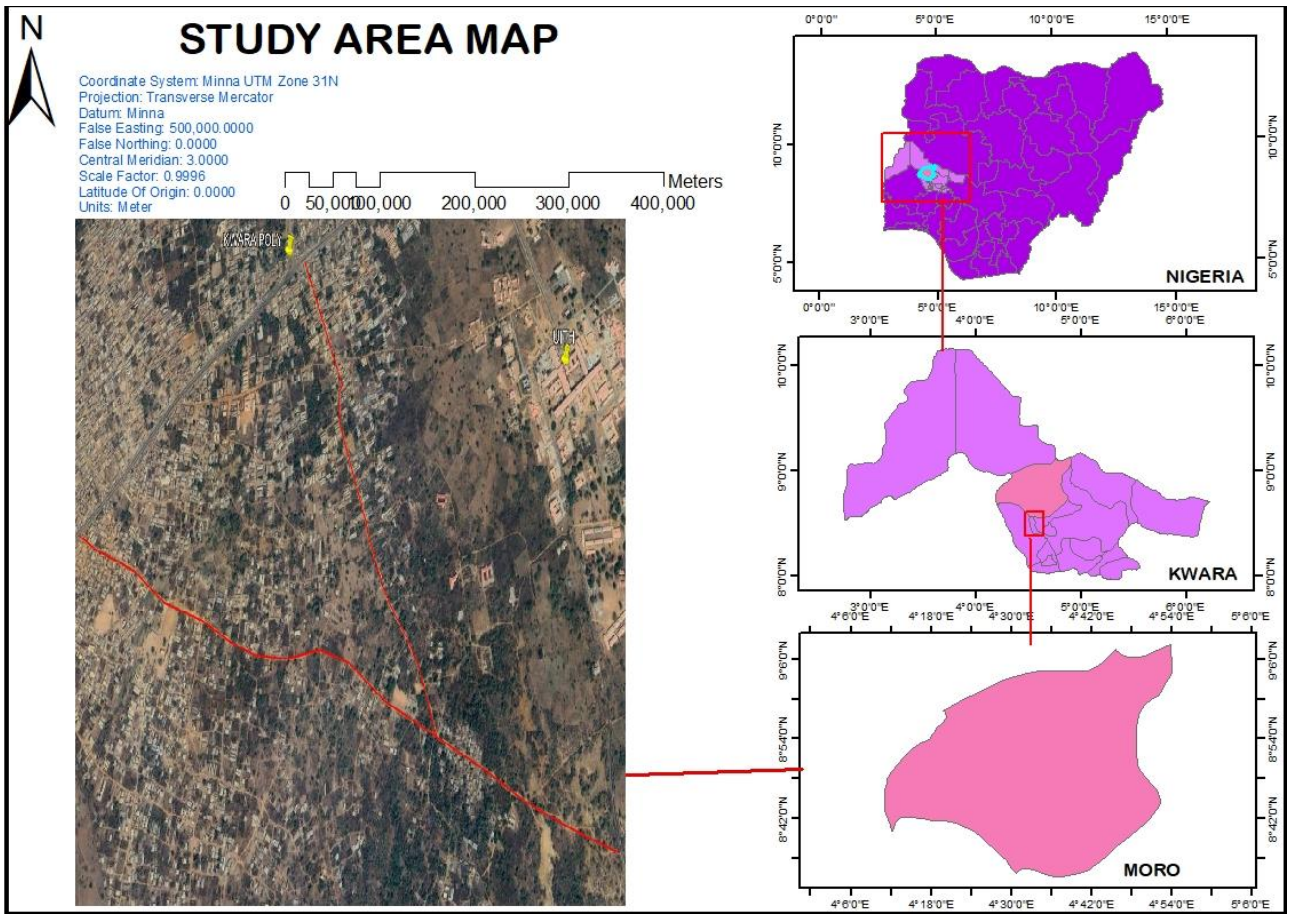
1. ISAAC JOY SALOMI HND/23/SGI/FT/0068
2. AROWOLO NURUDEEN AYINDE HND/23/SGI/FT/0067
3. DAHUNSI OLAWUNMI COMFORT HND /23/SGI/FT/0069
4. ADELOLU DANIEL ADEWALE HND/23/SGI/FT/0070
5. OJERINDE ROMOKE HABEEBAT HND/23/SGI/FT/0112
6. ABASS KAFAYAT OPEYEMI HND /23/SGI/FT/0060
7. ABDULLAHI YUSUF SOFIYULLAHI HND/23/SGI/FT/0117
8. BAMIGBOSE IDOWU MAYOWA HND/23/SGI/FT/0066

1.9 Study Area

The Road which connect Lajolo to Maya Anfeyin Road in Moro Local government was an ancient road which connect the two towns. The study area is dominated with residential development, other land uses that exist includes agricultural, commercial, industrial among others.

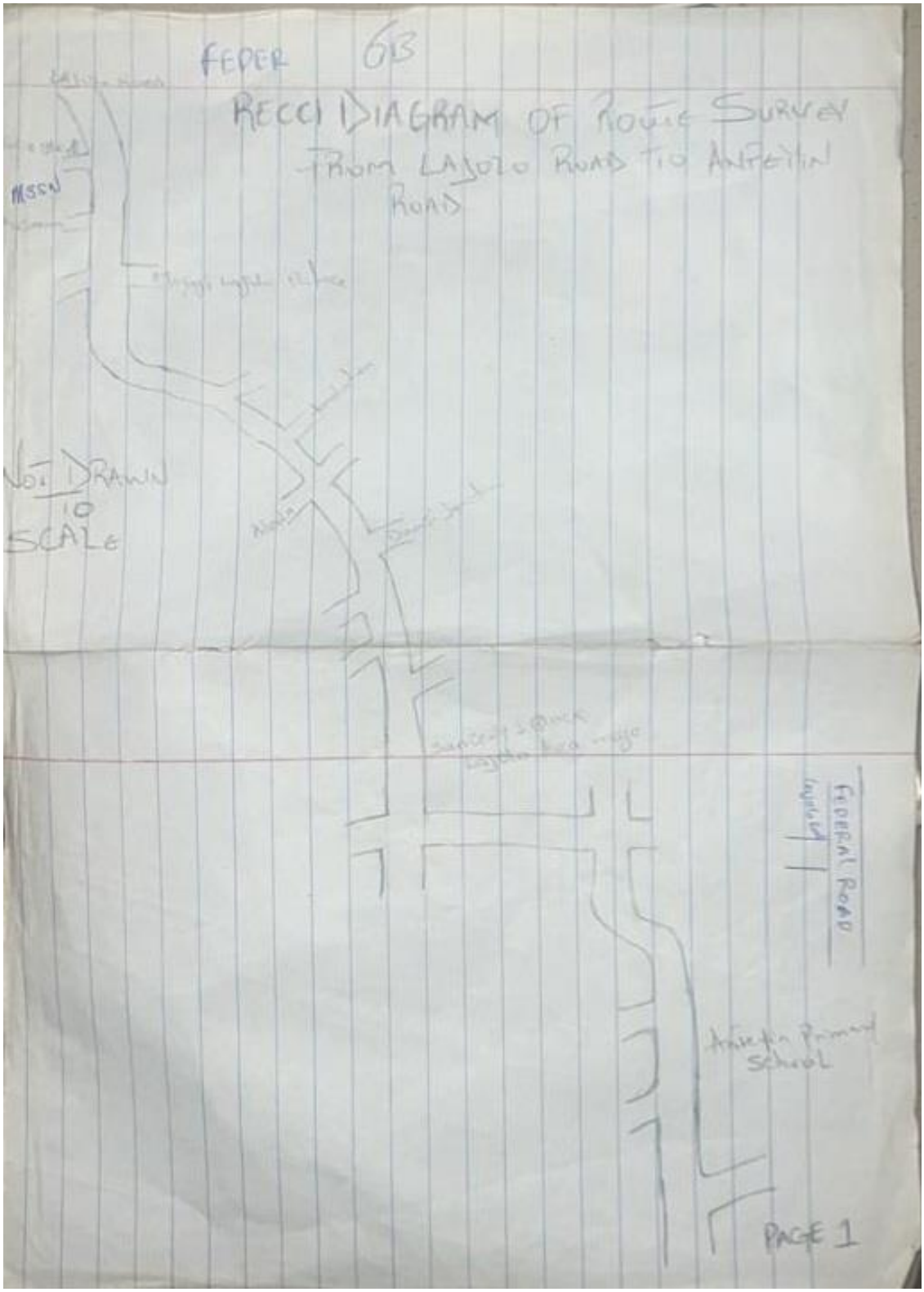
Geographical Extent and Location of the Study Area

The project site lies between latitude (ϕ) range (8˚ 32’ 35.44” to 8˚ 31’ 33.44”N)and longitude (λ) range (4˚ 38’ 06.61”E to 4˚ ,38’ 47.19”E) respectively. The site covers approximately 4.5km in total



The Project Route is verged red (Source: Google Earth Imagery, February, 2024)

FIG 1.1 THE STUDY AREA (NOT TO SCALE)


FEDER 613
RECCI DIAGRAM OF ROUTE SURVEY
FROM LAGOS ROAD TO ANFEGA
ROAD
NOT DRAWN
TO
SCALE
FEDERAL ROAD
PAGE 1

CHAPTER TWO

Literature Review

2.1 Research Analogy

Basak N.N (2010), defined surveying as the art and science of determining the relative position of various points or stations on the surface of the earth by measuring the horizontal and vertical distances, angles and taking the details of these point and by preparing a map or plan to any suitable scale.

Route survey is type of engineering surveying, which provides height along a proposed route with offsets at the both sides of the centreline of the route. This serves the purpose of location, design and construction of the route networks.

Route survey, therefore, can be explained as a survey made along a line or narrow belt or strip for location, design, and construction of any route of transportation such as highways, railways sewage and oil. It is also very useful in surveys which require the establishment of both vertical and horizontal alignment for cross-country development of utilities.

Apart from the general scope of surveying which include:

Planning and Decision making: That is, knowing the purpose of survey, deciding on survey methods, equipment scale, costing e.t.c.

Data acquisition or Field work: This involves actual making of measurement and recording of data in the field.

Data processing or Computations: This involves preparing calculations based on the recorded data from the field to determine the locations, areas, volumes, directions, and so on.

Data representation or Mapping: this involves plotting measurement as processed to produce a map, plan, or chat.

Stake-out: That is, setting monuments and stakes to delineate boundaries, or guide construction operation.

Scope of Route survey as an aspect of engineering survey includes:

Geometric Design of Routes

Setting –out of Routes

Longitudinal and Cross-section

Area calculation

Setting –out of Structures (As –Built Survey).

Surveying is indispensable to the engineer when planning, designing and constructing a project, so all engineers should have a thorough understanding of the limits of accuracy possible in the construction processes. This knowledge, combined with an equal understanding of the limits and capabilities of surveying instrumentation and techniques, will enable the engineer to complete the project successfully in the most economical manner and in the shortest possible time.

Engineering surveying, which was the main task in this project, was defined by M. **Seedat (2012)** as the type of survey which is associated with the engineering design (topographic, layout and as built) often requiring geodetic computations beyond normal civil engineering practice. It is required in planning and execution of nearly every form of

construction. The equipments commonly used for this are theodolites, GNSS (GPS) and levelling instruments.

Engineering survey has assumed the goal of dimensioning the physical environment. Greater part of its responsibility is seen from the various types of surveying which are geared towards promoting accessibility, route ways, convenience, economy and spatial delineation of both natural and social environment. 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:

1. To provide large scale topographical map/ plan and other measurement at the concept and design stage. Since this data forms the basis for an entire project, the reliability of the design depends to a great extent on the precision and thoroughness with which the original site survey is carried out.
2. To provide precise framework at the construction stage control from which it is possible to position the works and, most importantly, to ensure that engineering project are built in their correct relative and absolute position (this is known as setting out). In addition to these, data for the measurement of the work is also collected to enable volumes of the material to be estimated during construction.
3. To monitor structural movement on major retaining structure at the post construction stage.

History testifies that transportation is necessary to draw a country, state town or settlement to civilization by making communication among neighbors easier. Various means of transportation exist; they are transportation by air, by land and transportation by water. Land

transportations involve by rails, and roads. Road accounts for about 95% of all surface transportation in Nigeria. Road make possible socio-economic and cultural relationship among communities and create avenue for the good and management of the environment.

Good transportation, in and of itself, will not assure success in the marketplace, as the availability of transportation is a necessary but insufficient condition for economic growth. However, the absence of supportive transportation services will serve to limit or hinder the potential for a nation or region to achieve its economic potential. Thus, if a society expects to develop and grow, it must have a strong internal transportation system consisting of good roads, rail systems, as well as excellent linkages to the rest of the world by sea and air. Thus, transportation demand is a by-product derived from the needs and desires of people to travel or to transfer their goods from one place to another. It is a necessary condition for human interaction and economic competitiveness. (**Garber** 2009)

Transportation has contributed immensely to the economic development of the world in terms of:

1 Migration of people

2 Movement of goods and services

3 National integrations

4 Division of ideas and technology.

Modern methods of road construction were first developed in the 18th century. Innovations of the time included waterproof surfaces and better drainage systems. The modern engineers make use of variety of materials and construction techniques to build roads that can

handle the high volumes and stresses of modern automobile and truck traffic. One of the stages in construction of modern roads is to carrying out route surveying which is discussed below.

Encarta Encyclopaedia (2008) defined route surveying as the type of survey carried out in establishing the horizontal and vertical alignment of a particular area needed for social utilities like roads, railways, bridges, transmission lines, pipelines, canals etc. It is one of the first and last tasks performed on a project before a preliminary route map is prepared.

Detailing is defined as the process of fixing topographical features to the survey line. Any of these under listed methods could be used:

(1) Chain survey method (tie line and offset)

(2) Plane table survey method

(3) Compass survey method

(4) Tacheometric method

(5) By the use of total station

(6) By the use of DGPS

Punmia et al defined route survey as survey along a comparatively narrow strips of territory for the location, design and construction of any route of transportation such as highways and railroads, viaducts, canals and flumes, pipeline for water,sewage,oil and gas, telephone and transmission line. It includes all field work and requisite calculations together with maps, profiles and other drawings.

Generally, route surveying involves the following task; traversing, levelling, longitudinal and cross sectioning, curves, volume of earth calculation and designing.

Ron Singh (2000), said route surveys refers to those control, topographic, and construction surveys necessary for the location and construction of highways, railroads, canals, transmission lines, and pipelines.

Roy (2005) defined route surveying as a survey along a comparatively narrow strip of territory for the location, design and construction of any routes of transportation or communications. The route survey involves traversing, levelling, detailing, curve designation and setting out.

Ghilani and Wolf (2012) noted that route surveys are usually done with the aim of determining the best route between two terminals and fixing alignment grades and other details along the selected route which consists of the following surveys:

I. Reconnaissance

II. Preliminary survey of one or more locations along the route in the reconnaissance report

III. Location surveys,

IV. Construction survey

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, it may nevertheless be said that the purpose of the route survey are to:

(i) Select one or more tentative general route for the roadway or utility.

(ii) Gather enough information about the general route to make it possible for designers to select the final location of the route.

(iii) Mark this final location.

In engineering surveying, either or both of the above formats may be utilized in the planning, design and construction of works, both on the surface and underground. At a later stage, surveying techniques are used in the dimensional control or setting out of the designed constructional elements and also in the monitoring of deformation movements. **(W. Schofield 2001)**

Robert (2000) stated that designing of route without a large scale and up-to-date mapping through dense vegetation is a challenge. He further explained that aerial photograph is very unpunctual and may not give the expected results but air borne lidar of remote sensing techniques could be more accurate, faster, reduce the required ground survey control.

Route survey was carried out during the Ogunpa channelization project which was constructed in Ogunpa in Ibadan by an indigenous construction company in 2005/2006. Before the project, a channel was constructed to follow the course of the Ogunpa river, instead of changing its course. Therefore, drainages were badly damaged. As a result, this gives room to flooding. However, subsequent measures were done to correct these faults after a proper route survey of the area. Below are the weaknesses of the contract/project:

i. Changing the course of the drainage instead of following the course of Ogunpa River, as a result of this, flood and huge damages were done.

ii. Double expenditure was incurred on the project, since the project has been constructed before the flooding.

Below are some of the strengths of the project:

i. the route survey carried out in that area eliminated and stop the flooding and damages in a fast and economized way

ii. A precise and accurate job corrected the error and likely any future damages that may want to occur.

An example of route survey is surveying of the longest tunnel in the world. The Swiss surveying company, working on the new rail links through the Alps (NRLA), a key component in Europe's growing network of high-speed railway which when completed in 2017 will cut travel time between Zurich and Milan by more than 25 percent. (the centre of the new system is the Gottland Base Tunnel at 57km long. It is the longest tunnel in the world), relaying that route survey in various medium poses various challenges, for instance, tunnel construction sometimes causes alteration by changing the load in the surrounding rock. The resulting deformation occupy relatively small areas called convergence zones and typically occur in known fault zones or areas with visible cracks or falling rock. Surveyors monitor these areas by collecting periodic cross section measurements. (Idemudia 2007)

Most of the roads we ply were as a result of the application of route survey, for example: right of way (ROW) and acquisition survey was carried out by Setraco Nigeria Limited on Abuja-Keffi road (52km) for the purpose of expanding the road. Automated survey method was used and some of the survey instruments used were GPS and its accessories, Total stations, EDM,

Digital level etc. the survey was completed in July 2000, due to delay in paying compensation to the affected land owners, further encroachment were recorded within the right of way.

Dentata and Sawoe Nigeria limited were responsible for that of Jibiakaro Namoda-Gusau road (161km), some of the survey instruments stated above were also used. This was done to determine: the extent of the area that is needed for expansion of the road, the details of all the properties and buildings that fall within that area, knowing the details of owners of such properties for the payment of compensation for the right owner and also it aid in determining an estimate of the amount to pay as compensation (Idemudia, 2007).

Route surveying, being an aspect of engineering work is a survey that starts from the design and ends after the construction stages and it could be explained as the survey carried out in establishing the horizontal and vertical alignments of a particular area needed for social utilities like highways, railways, transmission lines, pipelines and canals. (Mikhail 2001).

In conclusion, according to Ghilani and Wolf (2006), Route survey are made to plan, design and construct highways, railroads, pipelines and other linear projects. They normally begin at one control point and progress to another in the most direct manner permitted by field conditions.

According to Uren (1994), a longitudinal section provides information only along the canter line of a proposed project, for works such as pipeline, which usually are only of a narrow extent in the form of a trench cut along the surveyed canter line, a longitudinal section provides sufficient data for construction to be planned and carried out. As for cross sectioning, this is essential because once any new road formation or construction is proposed, it is certain to involve cut and fill, then there is urgent need to define the limits of both before construction

starts. 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.

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.

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 on a mopboards using methods of instrument surveying (plane-table, tachometric, and aerial photo topographic surveying) or exploratory surveying.

Anderson (1985) explained that Survey of some type is required for practically all phases of route alignment, planning, design and construction work. During the planning stage, a topographic survey of the site is performed and maps are prepared to be used in the development of plans for the project. The control network established for these topographic and property survey, contain many of the horizontal and vertical control points which will eventually form the basis for subsequent construction surveys.For small projects involving widening or minor improvement of an existing facility, the survey may be relatively simple and may include only the obtaining of sufficient information for the designer to prepare plans and

specification defining the work to be done. For more complex project involving multilane highways on new locations, the survey may require a myriad of details, including data from specialist in related field to determine the best location, to prepare plan, specification and estimates for construction and to prepare deed description and maps for appraisal and acquisition of the necessary right of way.

In order to plan and perform the survey needed to acquire these types of data, the surveyor must be familiar with:

1 The geometry of horizontal and vertical curves and how they are used in the routes alignment procedure

2 The methods of acquiring terrain data utilized in the route design procedure

3 The procedure followed in processing terrain data to obtain earthworks volumes

4 Establishing on the ground a system of stakes or other markers, both in plane and elevation from which measurement of earthworks and structure can be taken conveniently by thee construction force

5 Given line and grade as needed either to replace stakes disturbed by construction or to reach additional points on the structure itself

6 Making measurement necessary to verify the location of completed parts of the structure (the as-built survey) and to determine the volume of work actually performed.

New developments in equipment such as electronic surveying system, and laser equipped alignment instrument provide powerful tools which have many applications in these areas. The detailed methods employed on these surveys vary greatly with the type, location and size of structure and with the preference of the engineering and construction organizations. Much

depends on the ingenuity of the surveyors so that the correct information is given without confusion or needless effort.

Martin Rodgers (2003) explained that Highways are vitally important to a country's economic development. The construction of a high quality road network directly increases a nation's economic output by reducing journey times and costs, making a region more attractive economically. The actual construction process will have the added effect of stimulating the construction market.

Mikahil (1985) explained that route surveying can be defined as the topographical and constructional survey that are necessary for the location and construction of communication lines, transportation, roads and canals, highways, pipelines etc.

According to Wright (1996) a highway survey which is also part of route survey may be accomplished either by conventional ground survey techniques or by remote sensing techniques. The basic task of a surveyor in highway survey using conventional method is to carry out route survey along the route which is the survey made along a line or narrow belt or strip of territory for location, design and construction of a route of transportation. The essence of the route surveying was to determine the ground configuration and the location of objects along the proposed route, establishing the line on the ground, computing volume of earthworks and also for designing purpose.

According to Roy (2004), most countries have major roads of medium capacity that connect cities, states and so on. They may have multiple lanes of traffic, a medium or central

reservation between lanes of opposition traffic and partial access control. They are usually restricted to vehicle that can be as simple as two –lane shoulder less road.

Another type of route surveying is pipeline route survey, according to Land Partners Limited (2008); pipeline route and ground feature survey can be completed by several methods like conventional ground field survey, photogrammetry, airborne laser scanning or sometimes a combination of methods depending on project scope or site constraints.

During pipeline route survey, all aspects of pipeline design needs to be taken into consideration. These aspects includes environmental, cultural heritage and landowner issue, local, state and federal planning requirements, the location of existing infrastructures and services, existing easement and cadastral boundaries, and most importantly, construction constraints along desktop studies.

When undertaking a route survey, the surveyor's role is to determine the pipeline location on the ground whilst taking into consideration the various issues identified during desktop selection and specific client requirements. These issues include construction, environmental factors, topography, existing infrastructure, cadastral and statutory constraints.

Considering the types of route surveying given above, route surveying comprises all operations required for design and construction of engineering works such as highways, pipelines, canal and railroad. With the advent of total station and other modern electronic surveying instruments route surveying can be carried out within a short period of time and higher accuracy with less constraint. And data can be processed and presented in a digital form.

Route surveying projects have been carried out by different engineering and surveying firms using different field techniques and methods of surveying which depends on the specification of the project accuracy, availability of resources, technical knowhow of the professionals involved, time and so on.

The following are some of the information that could be gotten for route survey plan.

1 It helps in determining the terrain of the study area

2 It helps in designing of road

3 It provides precise framework at the construction stage

4 It aids and enhances engineering works

5 It helps in volume computations.

In Highway Design Manual 6th edition, it was explained that the geometric design of roads is the branch of highway engineering that is concerned with the positioning of the physical elements of the roadway according to standards ad constraints. The basic objectives in geometric design are to optimize efficiency and safety while minimizing cost and environmental damage. Geometric design also affects an emerging fifth objective called "liveability" which is defined as designing roads foster broader community goals, including providing access to employment schools, businesses and residences, accommodate a range of travel modes such as walking, bicycling, transit and automobiles, and minimizing fuel use.

During the reconnaissance phase and pre-construction survey, the preliminary centre line has been established on the ground. During that phase, basic decisions regarding horizontal and vertical alignment have already been made and their effects on haul, constructions and environmental costs. The road design is the phase where those field

decisions are refined and documented. Geometric roadway design can be broken into their main parts; the alignment, profile and cross sectioning.

The alignment is the route of the road, defined as a series of horizontal tangents and curves. The profile is the vertical aspect of the road, including crest and sag curves, and the straight grade lines connecting them, vertical curve. While the cross section shows the position and number of vehicle and bicycle lanes and sidewalks along with their cross slope or banking. Cross-sections also show drainage features, pavement structure and other items outside the category of geometric design.

CHAPTER THREE

Research Methodology

3.1 Research Design

All operations both on the field and in the office carried out to obtain all spatial data using appropriate automated surveying methods are dealt with in this chapter. The spatial data obtained from the field are the X, Y, Z coordinates of objects. The procedures and techniques employed in executing this project would be discussed in subsequent sections of this chapter. These include reconnaissance, office planning, field reconnaissance, test of total stations, data acquisition, total station configuration, total station observations, traversing, longitudinal profiling and cross sectioning and detailing.

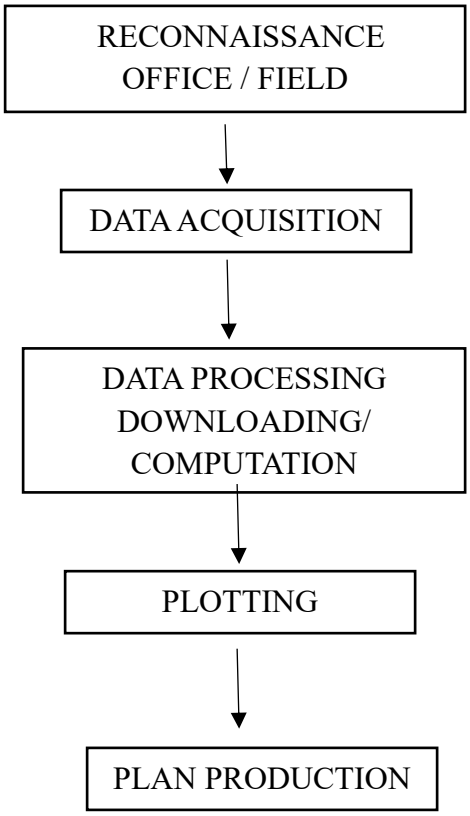
3.2 Planning

The essence of a good planning cannot be overemphasized. The resources and time spent on planning are never futile and it is the foundation of the project planning. Reconnaissance survey is a vital aspect of surveying that involves both the planning and preliminary inspection of the project area before the commencement of the real survey exercise. It is done for the purpose of planning on how to execute the project, selecting station, locating controls, etc. It involved the use of available records such as plan, topographical map sheet, charts, and other relevant information about the project area. Meanwhile the benefit of the reconnaissance survey can never be overlooked since it enables the surveyor to foreseen the favour, problems, challenges or obstacle that are likely to be encountered during the real survey work. This in turn could help the surveyor in utilizing judiciously the available resources (i.e. time, energy, fund etc.) towards solving the problems. The two phases of reconnaissance are:

i. Office planning

ii. Field reconnaissance (Data search).

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.

3.2.1 Office Planning

This involved the collection of relevant materials and information needed for the successful execution of the project at hand. This was done to help in determine the expected accuracy, necessary instrument to be use, choice of scale and personnel.

The main information that was sourced for in this project were the collection of existing control stations, coordinates and instruments from Department, Surveying and Geoinformatics, Ilorin and test of instruments to ascertain its condition before use. The table 3.1 below shows the coordinate of control stations used for the project.

Table 3.1: Coordinate of the Existing Ground Controls Used

POINT ID	EASTINGS(m)	NORTHINGS(m)	HEIGHTS (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

3.2.2 Reconnaissance

This is an important and first aspect in any survey project carried out to obtain the general view of the study area in terms of the nature of the terrain and to adequately plan the best ways to the set aim and objectives of the project. The importance of reconnaissance to any survey work of any size and nature cannot be over-emphasized. Experience has proved that time spent in carrying out a good reconnaissance is not a wasted time since it contributes to the quick execution of any survey exercise and promotes easy survey work. Reconnaissance simply connotes the summation of all activities preceding the actual execution of a survey job. It involves taking a general study or view of an area of operation with a view of knowing how best the operation is to be carried out in terms of energy and time. As this project was concerned, the reconnaissance was carried out in two stages. The stages were the office planning and field reconnaissance.

3.3 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:

3.3.1 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.

3.3.3 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

3.4 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.

3.4.1 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 jucnture, 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 3.2: 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:

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

n=1

$30"\sqrt{1} = 30"$

Obtained accuracy is: = $+00^0$ 00' 20"

Horizontal Collimation Error = **0^o 00' 08"**

Vertical Index Error = **0^o 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 shows how the survey was carried out to achieve the desired result on the field. The activities involved are GPS observation, longitudinal and cross section and detailing.

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

3.5.1 Control Check

3.5.1.1 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 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 3.3: 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 3.4: Back Computation from the Existing Coordinates of the Starting Control Pillars

From Stn	Bearing ° ′ ″	Dist(m)	E(m)	N(m)	Eastings (m)	Northings (m)	Height (m)	To Stn
					679748.116	944715.534	350.785	Point 01
Point 02	282 25 39	238.49m	233.205	-49.918	679981.321	944665.616	349.954	Point 02
Point 03	287 42 21	240.18m	-234.669	51.141	680215.990	944716.757	348.872	Point 03

3.5.2Traversing (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 form 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.

3.5.3 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 bisected 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

This is the process of transferring the captured data stored in the memory of the instrument via the data transfer port of the equipment through the cable (downloading cable) to the computer for further processing and analysis.

Data processing includes numerical calculation, classification of data and the transmission of data from one place to another. Below is the procedure used for data processing:

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 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.
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

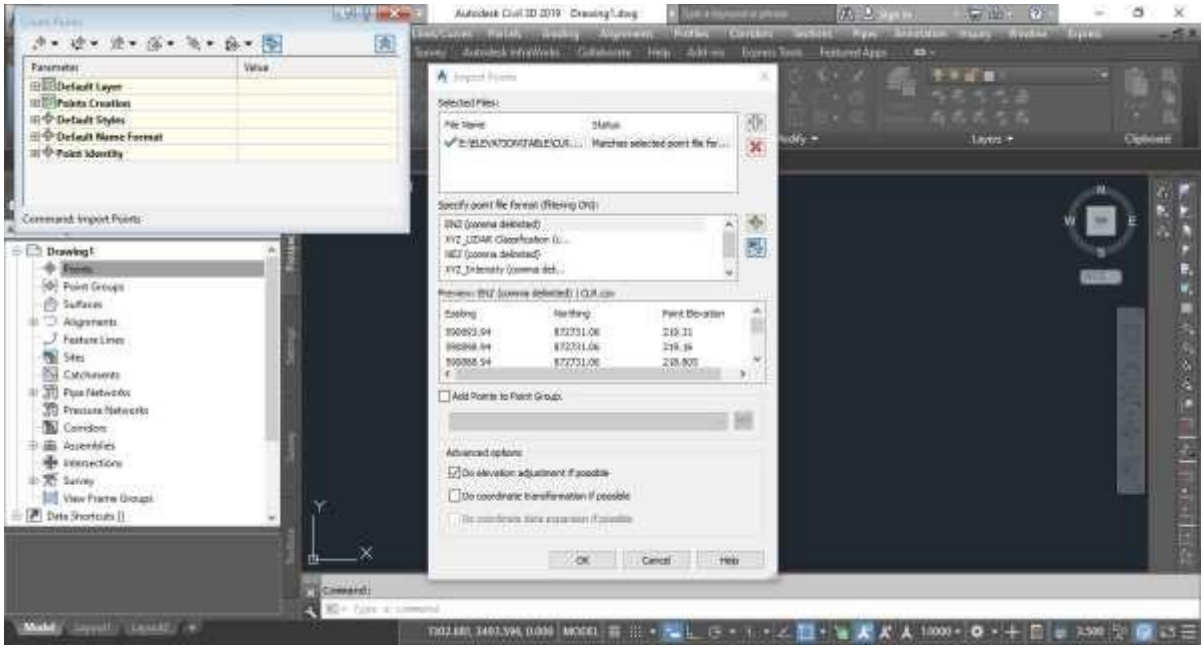
.xyz

.auf

.nez

.pnt

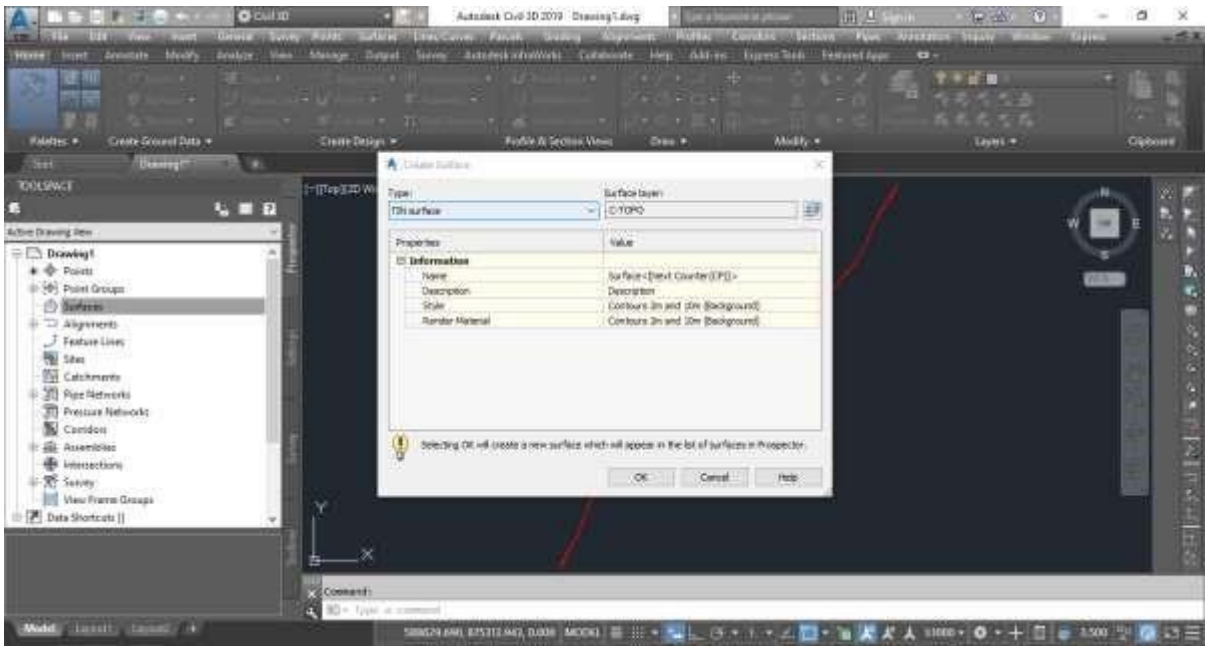
To import the point, open the tools pace, click on prospector at the right of the toolspace, then right click on points to create points. The create points toolbar will then appear, click on import points to import the data. The import point tool will then appear, click on add files then browse to the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



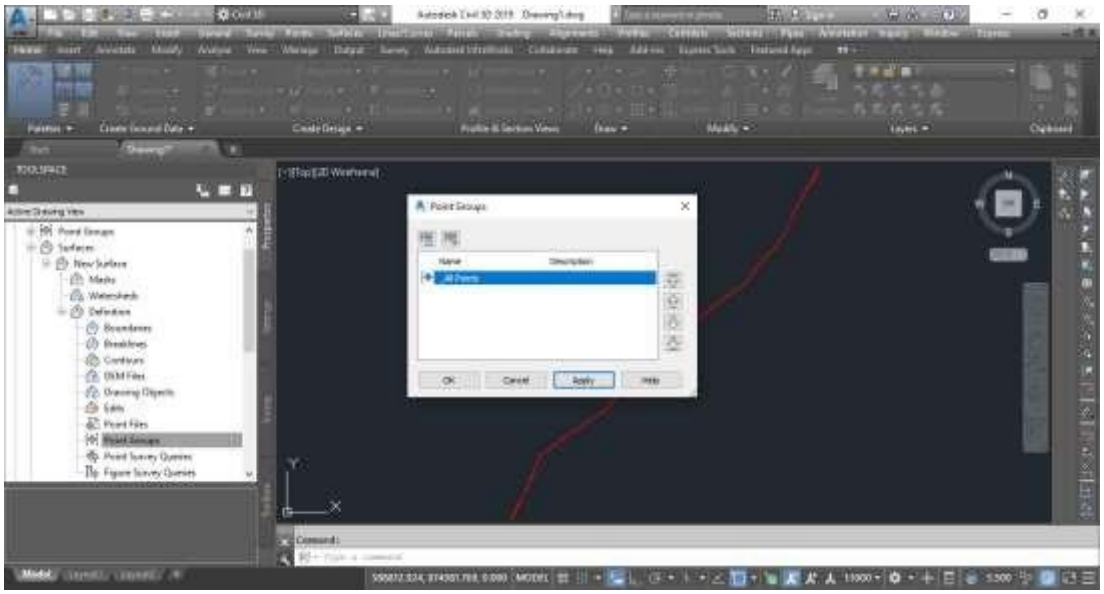
Contains that data. Select the data, click ok, then select point format, and click ok. Close all the dialogue and zoom to extent to display the points.

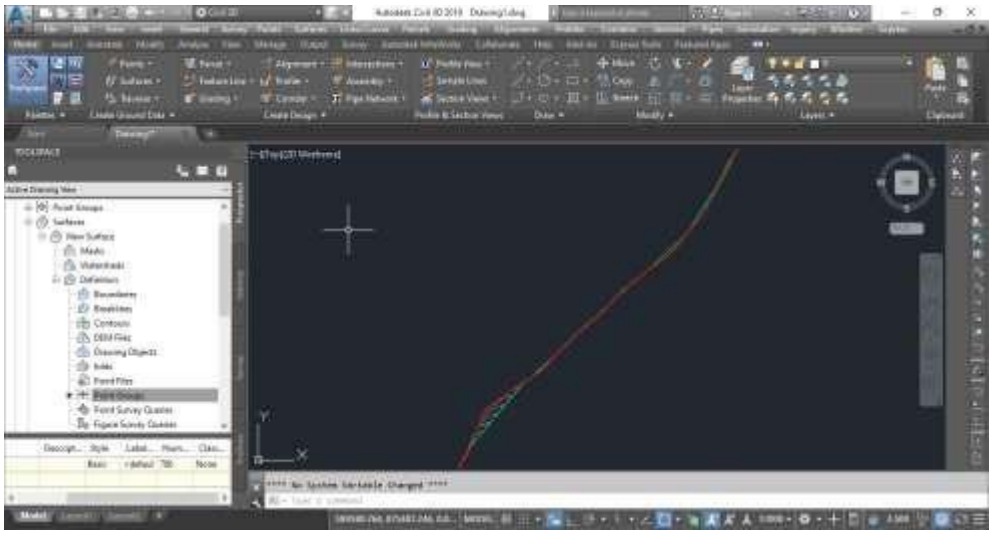
2. Creating Surface

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.

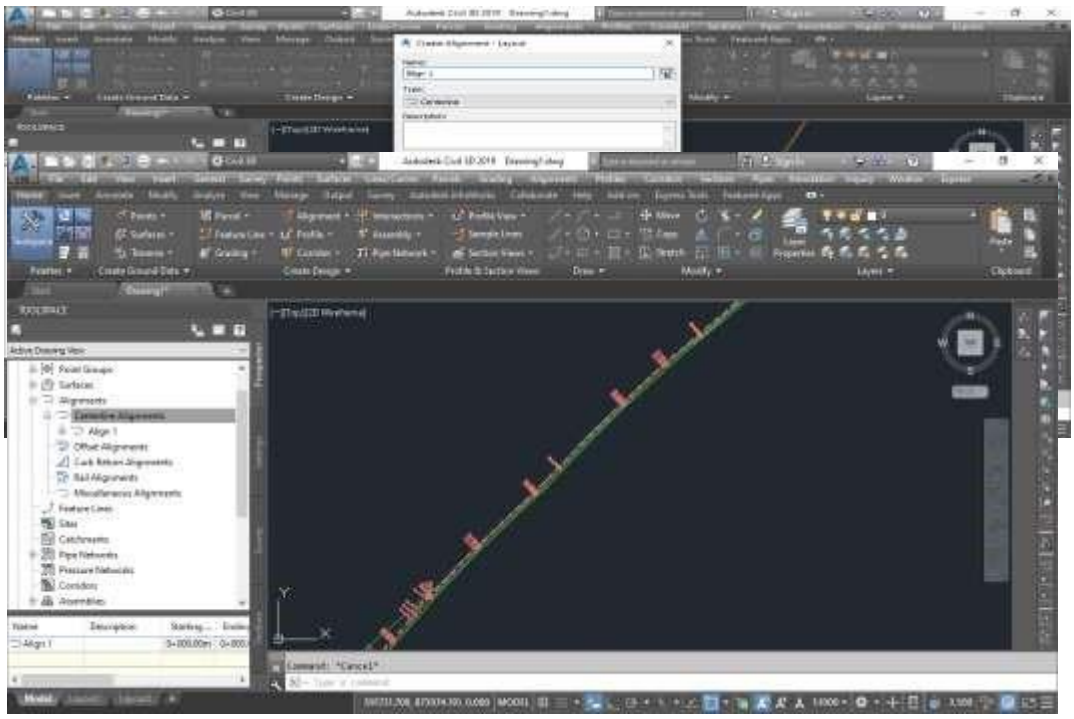


Then expand the New Surface, expand “Definition”, then right click on “Point Groups” and click “Add”, the “Point Group” dialogue will then appear and “All points” and then ok. Now the surface has been created.





2. Creating alignment



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

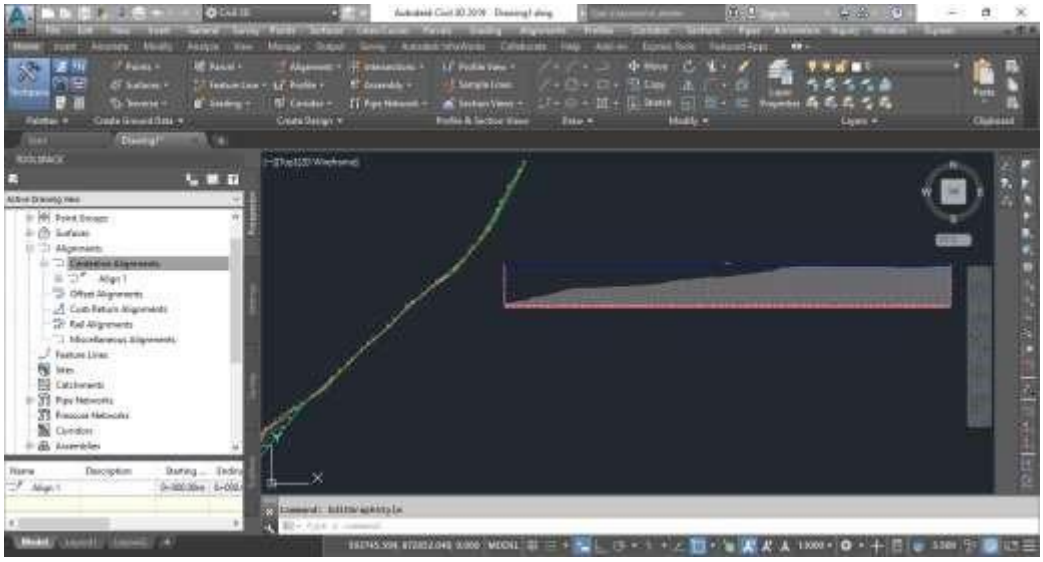
“Home” menu, click on alignment, then “Alignment Creation Tools”, the “Create Alignment layout” will appear, then name the alignment e.g. Align 1, then click ok. The "Alignment Layout Tools -Align 1" will then appear, select "Tangent-Tangent (With Curves)" then zoom to the starting point and click on 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

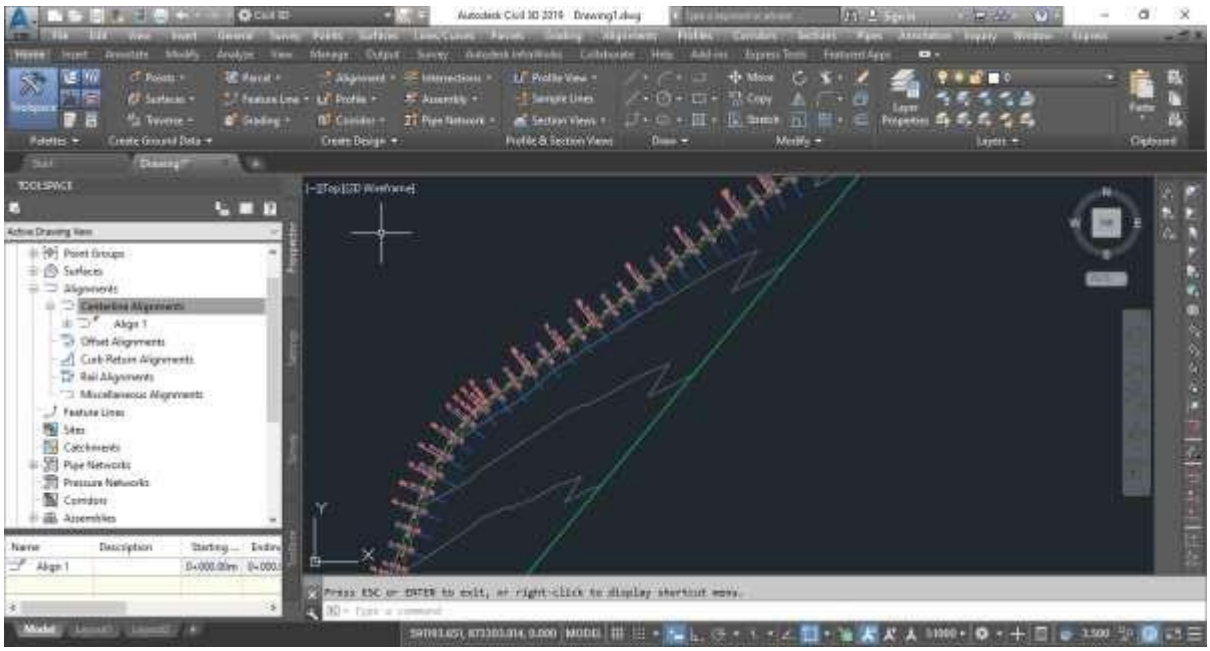
view", then 'Create Profile View – General" will also appear, you can type the name of the profile or accept default, then click next, next, next, next, next, next and then click "Create Profile View", you can then select profile view origin which can be any desired space on the drawing page. Now the profile has been plotted.



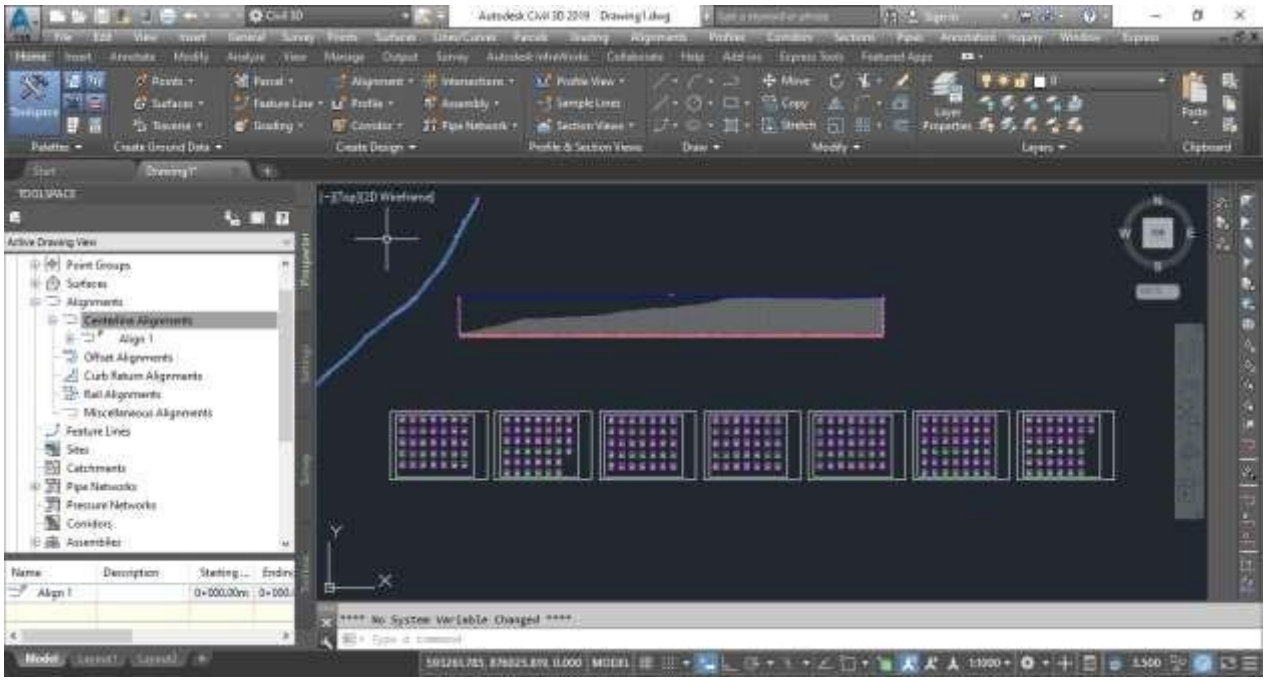
Sample line

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

Conclusion and Recommendations

5.1 Summary

The project covered a total length of 4.325km. The field work however involved the following processes; Reconnaissance, Monumentation, Traversing, and Detailing. Total Station (Sokkia) 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.

5.2 Problem Encounter

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

i. Movement of vehicles along the project site.

5.3 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

5.4 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 a vertical and horizontal alignment plan was produced.

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Appendices

NORTHING	EASTING	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
680088.850	944514.880	353.378

NORTHING	EASTING	HEIGHT
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
680268.280	943299.590	347.860

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

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

680184.830	944156.840	355.720
680185.960	944125.100	356.975
680183.420	944125.200	357.020
680181.110	944125.410	357.060
680177.880	944083.150	358.291
680181.290	944082.830	358.379
680185.700	944082.520	358.495
680192.220	944050.360	358.040
680189.690	944050.350	357.954
680185.610	944050.330	357.821
680194.020	944014.200	355.825
680197.430	944014.880	356.098
680201.610	944015.780	356.429
680211.890	943979.880	354.320
680209.590	943978.870	354.184
680206.400	943978.090	354.016
680207.210	943966.920	353.442
680183.580	943958.410	351.421
680184.590	943953.660	351.240
680210.100	943961.840	353.325
680217.150	943935.220	353.679
680219.890	943936.450	353.883
680224.180	943937.570	354.204
680240.580	943888.090	356.371
680590.030	943107.850	346.899
680591.560	943111.950	347.168
680624.240	943091.070	346.846
680622.710	943087.860	346.796
680620.520	943084.980	346.726
680656.600	943065.550	346.156
680658.240	943068.100	346.186
680659.440	943071.320	346.255
680687.250	943056.170	346.440
680686.160	943053.510	346.576
680684.520	943050.850	346.681
680711.010	943034.260	348.573
680713.200	943037.480	348.355
680715.060	943040.810	348.106
680755.020	943015.210	347.394
680753.050	943013.320	347.336
680750.640	943010.980	347.303
680774.370	942996.040	345.985
680776.340	942998.480	346.030
680777.660	943000.590	346.074
680799.300	942985.200	345.112
680797.990	942983.420	345.045
680796.120	942981.540	345.000
680817.890	942962.490	343.314

680237.060	943887.190	356.259
680234.310	943885.850	356.172
680247.270	943841.560	355.148
680250.680	943842.900	355.272
680254.310	943843.580	355.364
680264.900	943813.210	355.743
680261.270	943811.870	355.668
680258.520	943810.530	355.613
680269.250	943773.410	356.614
680273.210	943773.650	356.523
680276.400	943774.330	356.456
680282.850	943732.770	354.815
680279.330	943731.760	354.810
680274.600	943731.410	354.872
680287.080	943696.180	352.907
680290.050	943696.520	353.013
680293.020	943696.750	353.270
680302.630	943663.390	354.506
680300.100	943662.610	354.415
680298.020	943661.270	354.386
680311.800	943630.140	356.517
680315.100	943630.600	356.495
680317.190	943631.270	356.468
680326.800	943597.800	356.436
680819.430	942964.600	343.274
680820.630	942966.930	343.282
680841.190	942946.220	340.531
680842.940	942949.000	340.541
680843.810	942951.430	340.648
680871.820	942940.820	339.949
680870.520	942937.720	339.751
680869.650	942934.290	339.527
680896.810	942916.600	339.236
680898.890	942919.820	339.607
680901.520	942922.810	340.001
680913.490	942904.170	338.329
680929.890	942878.030	335.986
680934.450	942867.540	335.983
680939.070	942868.340	336.066
680931.280	942889.210	336.862
680934.120	942892.760	337.206
680937.080	942896.200	337.563
680964.000	942884.150	337.170
680963.130	942881.710	336.976
680962.590	942879.500	336.855
680990.050	942867.890	337.360
680990.810	942869.660	337.446
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680323.060	943597.120	356.414
680333.780	943562.220	354.855
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680338.180	943563.010	354.992
680355.820	943530.350	355.667
680352.860	943528.340	355.803
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680360.920	943522.290	355.698
680376.220	943524.350	355.195
680376.230	943520.920	355.306
680363.360	943518.650	355.643
680373.330	943504.100	355.986
680370.140	943502.650	355.933
680367.180	943500.860	355.863
680389.230	943466.670	356.517
680391.210	943467.680	356.641
680393.410	943468.680	356.773
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680406.510	943443.630	356.364
680404.860	943441.740	356.134
680410.630	943432.370	355.897
680410.590	943416.330	354.891
680403.810	943404.470	353.904
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681020.910	942860.940	338.927
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681057.420	942843.840	338.578
681065.750	942828.620	337.591
681064.430	942827.280	337.505
681062.230	942826.060	337.427
681072.730	942817.030	336.837
681074.160	942817.920	336.895
681074.920	942819.140	336.971
681088.050	942814.110	336.642
681086.950	942812.230	336.521
681085.860	942810.340	336.396
681104.150	942807.540	335.511
681104.030	942808.980	335.634
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681129.140	942808.540	334.461
681128.820	942805.880	334.197
681153.940	942801.670	332.702
681154.270	942802.780	332.853
681155.140	942804.440	333.063

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680419.390	943418.140	355.260
680422.020	943419.690	355.419
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680437.880	943392.220	353.514
680435.020	943390.990	353.467
680432.170	943389.650	353.429
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680453.880	943359.110	351.759
680456.180	943360.670	351.816
680470.040	943338.940	351.850
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680483.010	943343.750	352.795
680473.360	943334.860	352.093
680465.880	943331.730	351.949
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680455.370	943318.080	352.048
680463.770	943336.040	351.741
680481.010	943296.400	353.116
680484.530	943297.410	353.195
680487.830	943297.870	353.270
680491.520	943258.620	352.706
680493.710	943259.410	352.760
681183.240	942797.930	332.880
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681182.150	942795.380	332.616
681188.670	942789.100	332.229
681190.650	942789.660	332.355
681192.630	942790.560	332.479
681198.080	942776.980	331.185
681196.660	942775.860	330.989
681194.240	942775.520	330.837
681201.930	942754.100	328.977
681203.460	942755.100	329.159
681205.440	942755.550	329.324
681210.320	942747.060	328.804
681209.230	942745.500	328.598
681207.910	942743.730	328.365
681214.320	942738.450	327.985
681221.300	942729.520	327.126
681222.280	942730.630	327.220
681223.710	942732.180	327.353
681234.410	942726.360	326.957
681233.650	942724.480	326.916
681232.780	942722.380	326.870
681247.980	942720.340	326.507
681248.300	942721.780	326.548

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678945.340	943956.830	320.283
678946.320	943959.490	320.374
678947.740	943962.700	320.501
678982.030	943949.800	319.503
678981.160	943947.580	319.255
678979.860	943944.260	318.992
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679038.850	943921.060	319.506
679037.330	943918.070	319.182
679035.570	943915.510	318.970
679040.610	943922.060	319.646
679047.840	943931.160	320.610
679049.940	943928.850	320.457
679042.490	943919.970	319.514
679086.440	943889.630	318.663
679084.580	943885.970	318.168
679081.070	943883.410	317.608
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680184.060	944259.910	358.249
680192.750	944236.280	357.346
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680209.260	944185.250	357.244
680202.270	944171.290	357.704
680185.240	944163.360	358.497
680181.960	944132.930	359.662
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680501.440	943229.470	355.189
680506.360	943212.230	354.588

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679133.270	943854.100	317.021
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679167.730	943828.260	315.259
679184.180	943815.720	314.366
679195.140	943828.920	314.757
679199.000	943826.290	314.351
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679200.440	943797.430	313.819
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679263.570	943762.850	319.000
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679153.060	943834.940	315.783
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679463.850	943654.870	324.171
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679522.020	943617.510	325.790
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679553.080	943590.100	327.522
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679493.440	943633.200	324.631
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679594.630	943578.880	331.000
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681063.650	942828.390	337.574
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680048.860	943454.720	339.647
680073.010	943446.310	339.478
680072.360	943444.980	339.421
680071.260	943443.420	339.342
680093.990	943432.680	340.756
680094.750	943434.230	340.891
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681178.730	942798.240	332.825
681186.560	942794.840	332.662
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681197.890	942771.670	330.572
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681239.050	942722.620	326.838
681248.850	942722.220	326.544
681260.400	942725.150	326.243
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