

**ISOLATION AND IDENTIFICATION OF PATHOGENIC BACTERIA FROM  
VEGETABLES SALAD SAMPLES SOLD IN VARIOUS FOOD COURT (BUKA)  
LOCATED IN THE UNIVERSITY OF BENIN, BENIN CITY**

**BY**

**EFE JOHN OMOSUMWEN**

**LSC1605530**

**A PROJECT WRITTEN IN THE DEPARTMENT MICROBIOLOGY, FACULTY OF  
LIFE SCIENCE, IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE  
AWARD OF BACHELOR OF ENGINEERING (HONS) IN MICROBIOLOGY, OF THE  
UNIVERSITY OF BENIN, BENIN CITY.**

**July, 2021**

## CERTIFICATION

This is to certify that this research titled "Geospatial Data Need For Geometric Design Of Road Using Police Station Road Ovia North East Local Government Area, Benin City Edo State" was carried out by "DADA JOHN OLADAYO" and presented to the Department of Civil Engineering, Faculty of Engineering, University of Benin, Benin City, in partial fulfillment of the requirements for the award of Bachelor of Engineering (B.Eng) in Civil Engineering. It was conducted under suitable conditions, was carefully supervised and subsequently approved as having met the requirements for the award of Bachelor of Engineering degree in Civil Engineering

---

Engr. ORIA-USIFO EHIS

(PROJECT CO-ORDINATOR)

---

DATE

---

Engr. Dr. NGOSI THIMEKPEN

(HEAD OF DEPARTMENT)

---

DATE

---

Prof. H.A.PAUDU

(PROJECT SUPERVISOR)

---

DATE

## DEDICATION

This report is dedicated first to the almighty God who has given me sufficient strength, wisdom and grace to compile this report to the best of my abilities. It is also dedicated to my parents Mr. and Mrs. Dada who has shown me unconditional love and support right from the very beginning till this present stage.

## ACKNOWLEDGEMENT

I would love to express my profound gratitude to God almighty, the ultimate source of life, for His unending love, grace, knowledge, and strength which has sustained me thus far

Special thank goes to my project supervisor, Prof. H.A.P Audu for his care, guidance and advice throughout the course of this project work. I am really grateful Sir

Also, I would like to thank the Head of Department, Dr. S. Iyeke for his leadership in making the Department what it is now. To my loving mama, Engr. Dr. Ngozi Kayode Ojo, and other lecturers who have gone extra mile to impart knowledge in me. They are, Prof O.C Izinyon, Prof. S.O Osuji, Prof O.U Orie, Dr. J.O Okovido, Dr. Ngosi Ihimekpen, Dr. R.I Umasabor, Dr. L.O Bobor, Dr. R.O Ogirigbo, Engr. J.E Ekhodiachi, Engr. U. Ukeme, Engr. E Oria-Usifo, Engr. P. Ogbeifun, Engr. S.A Adegbemileke, Engr. O. Osasu, Engr. B. Omosefe, Engr, K. N Oghoyafedo and Eng O. Oriakhi

My appreciation goes to my parents, Mr. Olaniyi M. Dada and Mrs. Dorcas O. Dada for their support, advice, and love throughout. They did not give up on me. Also my ever supportive sisters Rachael and Elizabeth Dada thanks for being there. My wonderful cousins, Dada Victoria and Dada Seyi for being all in all for me.

I would also like to thank members of Adventist Student Fellowship (ASF) including Eze C. Eze Precious, Oluchi, Grace. Fidelis, Brobbery, and a host of others for being there as a family to me. Not forgetting these special individuals who in their tight schedule supported me in my work and encouraged me, Adebimpe, Akhere, Kehinde, Henry and Stephen.

I would also like to give a special shout out to my concrete family, they are the best everyday every time. My project colleagues, who through thick and thin we've been through together.

I would not fail to recognize my amazing friends Miracle, Rajunor, Essiet, Abdul, Ojeifo, Dominic, and others who have supported me and made my journey in Uniben a wonderful experience. I am really grateful, because you all made it a memorable one and I look forward to better experiences.

## ABSTRACT

This research work evaluated the geospatial data need for the design of a good road profile using Global navigation satellite system as a tool that will serve the purpose of safety, capacity and aesthetics considerations

Before getting the geospatial for the geometric design of the study area, thorough survey of the site was carried out using the dumping level to obtain the coordinate of the point along the study area, The GNSS was used to obtain the geospatial data of the study area, The design consideration includes: the composition of the traffic, the speed and the management of accessible road.

Based on the use, the offset from both sides of the road is determined from the centerline point where the road will be placed. A road offset of 2.85 meters results from the carriageway width of 6.5 meters for the Police station road. A 1.75m-wide shoulder was made available to use as a parking lane, walkway, and covered drain. Ample care was made in the plot to prevent any road segments from crossing in the university of Aerial photography or remote sensing data obtained from space satellites that depict a graphical perspective of the land region are other significant design aids employed for this project.

Geospatial data are designed to uniquely specify the positions of features on the earth's surface Geospatial data must be acquired in order to plan, construction, and manage the mad infrastructure, which is vital to humans use. These data come from a variety of sources, BNH including aerial photos, topographic maps, satellite images, and hand-drawn maps. For the collection, processing, and display of geographic data, optimal techniques are applied, which result in significant time and financial savings.

## TABLE OF CONTENTS

Cover Page	i
Certification	ii
Dedication	iii
Acknowledgement	iv
Abstract	v
Table of Contents	vi
List of Table	x
List of Figure	ix
CHAPTER ONE:	1
1.0 INTRODUCTION	1
1.1 Background	1
1.2 Statement Of The Problem	2
1.3 Aim And Objectives	3
1.4 Scope of Work	4

1.3 Justification Of Study	4
CHAPTER TWO:	6
2.0 LITERATURE REVIEW	6
2.1 Road Classification	6
2.2 Nagpur Classification	8
2.2.1 National Highway	8
2:2.2 State Highway	8
2.2.3 Major District	9
2.2.4. Other District Roads	9
2.2.5 Village Roads	9
23 Modem-Lucknow Classification	9
24. Roads Classification Criteria	10
2.5 Highway Planning	14
2.5:1 Urban Road Patters	17
2.5.2 Highway Planning Studies	17

25 Highway Alignment	19
2.6.1 Factors Controlling Alignment	21
27 Global Navigation Satellite System	23
272 How Does GPS Technology Work	26
2.7.1 What Are The Three Element Of GNSS	27
2.7.3 What Are The Use GNSS	28
2.7.4 There Are Five Main Uses Of GNSS	28
2.75 How Accurate is GNSS	29
CHAPTER THREE:	31
3.0 METHODOLOGY	31
3.1 Ground Survey Method	31
3.1.1 Levelling	31
3.1.2 Geodetic Levelling	31
3.1.3 Profile Levelling	31
5.2.1 Cross Section	32

3.2.2 Acquisition of Geospatial Data	33
3.2.3. Traversing Using GNSS	33
3:24 Geospatial Data From Aerial Photographo and Photomosaics	34
3.3.1 Making Route Of Centreline ON Point	36
3.32 Traversing Of The Centreline	38
34 Challenges Ecountered On Site	38
CHAPTER FOUR	40
4.0 RESULT AND DISCUSSION	40
4.1 Using Geospatial Data In Geometric Design	41
4.2 Discussion Of The Result Of Traversing	42
43 Discussion of Aerial Map Applicability To Geometric	43
4.4 Design Considerations	44
CHAPTER FIVE	46
5.0 CONCLUSION AND RECOMMENDATION	46
5.1 Conclusion	46

5.2 Recommendation

46

REFERENCES

48

## LIST OF TABLES

TABLES	PAGES
4.1 The graphical readings with GPS, satellite, longitude, latitude, and accuracy	40
4.2 The Result of Levelling operations for police station road	41
4.3 Manual Standard for sight distance according to federal highway manual	45
4.4. Federal highway manual for road curve and radius (S.I Unit)	45

## LIST OF FIGURES

FIGURE	PAGES
Fig. 3.1 Viewpoints positioning using GPS receiver	34
Fig 3.2 The satellite imageries of the site where the project	36

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background

Road is a wide way that leads from one place to another and is specially prepared for the use of vehicles. Roads play a very important role in the country's socio-economic development. Therefore, pavements require maintenance from time to time to serve their purpose and provide comfort to road users (Aziz, 2007). The extent to which a country is covered by a road network is an indicator of the mobility of people, goods, and services within a country, and network quality measures the ease and cost of travel. Moreover, it is clear that transport plays an important role in shaping the density of many countries, as modern industrial and commercial activities depend on well-developed and efficient transport systems. The road network in Nigeria is currently estimated at about 194,000 km, with about 17% federal government, 16% state government and 67% local government (Ishaya, 2017).

However, these roads have suffered from many problems. The main problems are erroneous design, inadequate drainage systems, and a poor maintenance culture that greatly reduced the usefulness of the road. These are road potholes, washed sidewalks, etc. along most roads in Nigeria. These problems make the delivery of products and services from rural areas to urban centers to consumers and produce difficult, costly and more cumbersome, often resulting in lost labor time and commodity and higher cost of service. Most of the people in the country are in various desperate states, many of which are dangerous, and contribute to the economic burden of high road user costs, loss of life and property, and loss of highway investment. It is disappointing to find that the in order for a road to be built in a place, important information about the place,

such as the nature of the terrain, the climatic conditions, the activities that are common in the area, the culture and traditions of the inhabitants, the presence of important monuments and buildings, etc, is required. Is required. We need to collect data. Because the data is location-based, it constitutes spatial data for locations. (Ehiorobo, 2009) Also in Nigeria today, large government agencies tend to award road construction contracts directly to contractors without going through consulting engineers. Construction companies often build roads based on the geometric profile of the final work without considering the details of the municipalities through which the roads pass. This has caused roads to fail rapidly, a significant loss of scarce government resources, delays for passengers due to congestion and extreme cases, and accidents leading to waste of life and property (Consulting Engineers Association of Nigeria, ACEN, 2004). The amount of data that can be obtained about an area can be of great help in building roads that meet the specific needs of the community. However, obtaining spatial data is expensive. and so, large amount of funds is accrued to it as contingency in total station and the theodolite, in addition the technical and non-technical manpower involved. These equipments are also bulky and fragile. Thus, there is a high risk of damages or impairment to accuracy during site use of these equipments (Ehiorobo 2006).

## **1.2**

### **STATEMENT OF THE PROBLEM**

Nowadays, most roads are built based on generalized specifications of road design not minding the peculiarity of the area on which the road is to be built. This usually generates problems in the long run especially when a road is under-utilized or overburdened. When a road is under-utilized, it infers that scarce government resource has been sunk into a project where for a minimized cost, an optimum solution to the transportation need of the area would have been

gotten. On the other hand, when a road is overburden, it leads to high rate of repairs of the road, increased frequency of accidents, breakdown of vehicles due to failed portion along the roadway, delays due to traffic jam and other expense incurred by the individual or government. This is also a waste to useful resources. (Xiao and Proverbs, 2003)

Consequently, there is a need to ensure that road designs Is customized to meet the peculiarity or specifics of the area on which it is to be constructed. The geospatial data of an area can help to provide in-depth information about an area that can generate a balance road system, befitting of the area and can stand the test of time having consider the specifics of the area.

Often times, however, generating the geospatial data of an area, especially for preliminary design purpose and evaluation is very expensive, time-consuming and requires very sophisticated equipment like the total modern digital station. This project therefore considers how simple equipment can be used in geospatial data acquisition in order to reduce cost and quicken planning X and budgeting process, by the government or her parastatals.

### **1.3 AIM AND OBJECTIVES OF THE PROJECT**

The aim of this project is to determine the significance of geospatial data to the design of a good road profile using a GNSS.. The following objectives were borne in mind in carrying out this work to:

1. Acquire the geospatial data of the study area
2. Provide adequate plan and profile of Police Station road in order for the government to access in the eventual construction of the road.

3. Using the GNSS to get the coordinates of each points in the road and also get the satellite imaginaries of the said road.
4. Discuss the importance of geospatial data to other area of highway high cost equipment design and engineering.

#### **1.4 SCOPE OF WORK**

The acquisition of geospatial data is of paramount importance in this project. These data may be acquired from a number of sources which include existing topographic maps, satellite imageries and presented using optimal methods and based on obtained results, conclusion were drawn and recommendations made.

#### **1.5 JUSTIFICATION OF STUDY**

Because of the high number of crashes occurring on roads, it is necessary to intensify the search for new tools that help in understanding their causes. In recent years, many researchers have focused their attention on geometric design consistency (DC), which is defined as the relationship between the geometric characteristics of a highway and those that the driver expects to encounter. In their perception of such characteristics of the road, drivers are influenced, on one hand, by the experience of the what they have found in the road section they have just travelled, and, and on the other, by the accumulated experience gained in previous trip with similar characteristics to the current drive. Since motorist adapt the way they drive to the geometric condition they encounter, good DC reduces the likelihood of errors and unsafe maneuvering while driving. For example, a long tangent followed by a sharp curve in a road placed on level terrain (Voigt 1996, Wu et al. 2013, Ona et al. 2014).

## CHAPTER TWO

### LITERATURE REVIEW

Road is a wide way leading from one place to another, especially one with a prepared surface that vehicles can use. Road play a very important role in the socioeconomic development of the country. Therefore, road pavement needs to be maintained from time to time to achieve its purpose and contributes comfort to the road users (Aziz, 2007).

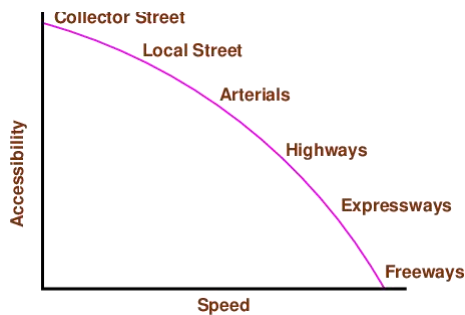
#### 2.1 Road Classification

The roads can be classified in many ways. The classification based on speed and accessibility is the most generic one. Accordingly, the roads can be classified as follows in the order of increased accessibility and reduced speeds (A.L William 2014).

1. Freeways: Freeways are access-controlled divided highways. Most freeways are four lanes, two lanes each direction, but many freeways widen to incorporate more lanes as they enter urban areas. Access is controlled through the use of interchanges, and the type of interchange depends upon the kind of intersecting road way (rural roads, another freeway etc.)
2. Expressways: They are superior type of highways and are designed for high speeds (120 km/hr is common), high traffic volume and safety. They are generally provided with grade separations at intersections. Parking, loading and unloading of goods and pedestrian traffic is not allowed on expressways.
3. Highways: They represent the superior type of roads in the country. Highways are of two types - rural highways and urban highways. Rural highways are those passing through

rural areas (villages) and urban highways are those passing through large cities and towns, ie. urban areas.

4. Arterials: It is a general term denoting a street primarily meant for through traffic usually on a continuous route. They are generally divided highways with fully or partially controlled access. Parking, loading and unloading activities are usually restricted and regulated. Pedestrians are allowed to cross only at intersections/designated pedestrian crossings.
5. Local streets: A local street is the one which is primarily intended for access to residence, business or abutting property. It does not normally carry large volume of traffic and also it allows unrestricted parking and pedestrian movements.
6. Collector streets: These are streets intended for collecting and distributing traffic to and from local streets and also for providing access to arterial streets. Normally full access is provided on these streets. There are few parking restrictions except during peak hours.



(Fig 2.1) Speed vs Accessibility

## 2.2 Nagpur classification

In Nagpur road classification, all roads were classified into five categories as National highways, State highways, Major district roads, Other district roads and village roads (Paton N.W 2014).

### 2.2.1 National highways

1. They are main highways running through the length and breadth of India connecting major ports, foreign highways, capitals of large states and large industrial and tourist centers including roads required for strategic movements.
2. It was recommended by Jayakar committee that the National highways should be the frame on which the entire road communication should be based.
3. All the national highways are assigned the respective numbers.
4. For e.g. the highway connecting Delhi-Ambala-Amritsar is denoted as NH-1, where as a bifurcation of this highway beyond Fullundar to Srinagar and Uri is denoted as NH-1\_A.
5. They are constructed and maintained by CPWD.
6. The total length of National highway in the country is 58,112 Kms, and constitute about 2% of total road networks of India and carry 40% of total traffic.

### 2.2.2 State highways

1. They are the arterial roads of a state, connecting up with the national highways of adjacent states, district headquarters and important cities within the state
2. They also serve as main arteries to and from district roads.
3. Total length of all SH in the country is 1,37,119 Kms.

### 2.2.3 Major district roads

1. Important roads within a district serving areas of production and markets, connecting those with each other or with the major highways.
2. India has a total of 4,70,000 kms of MDR.

### 2.2.4 Other district roads

Roads serving rural areas of production and providing them with outlet to market centers or other important roads like MDR or SH.

### 2.2.5 Village roads

1. They are roads connecting villages or group of villages with each other or to the nearest road of a higher category like ODR or MDR.
2. India has 26,50,000 kms of ODR+VR out of the total 33,15,231 kms of all type of roads.

## 2.3 Modern-Lucknow classification

The roads in the country were classified into 3 classes (Abel, 2014):

### a. Primary Roads

1. Expressways
2. National highways

### b. Secondary roads

1. State highways

2. Major district roads

**c. Tertiary roads**

1. Other district roads
2. Village roads

## **2.4 ROADS CLASSIFICATION CRITERIA**

Apart from the classification given by the different plans, roads were also classified based on some other criteria. They are given in detail below.

- i. Based on usage

This classification is based on whether the roads can be used during different seasons of the year.

1. All-weather roads: Those roads which are negotiable during all weathers, except at major river crossings where interruption of traffic is permissible up to a certain extent are called all weather roads.
2. Fair-weather roads: Roads which are negotiable only during fair weather are called fair weather roads.

- ii. Based on carriage way

This classification is based on the type of the carriage way or the road pavement.

1. Paved roads with hard surface: If they are provided with a hard pavement course such roads are called paved roads. (eg: stones, Water bound macadam (WBM), Bituminous macadam (BM), concrete roads)
2. Unpaved roads: Roads which are not provided with a hard course of at least a WBM layer they is called unpaved roads. Thus earth and gravel roads come under this category.

iii. Based on pavement surface

Based on the type of pavement surfacing provided, they are classified as surfaced and unsurfaced roads.

1. Surfaced roads (BM, concrete): Roads which are provided with a bituminous or cement concreting surface are called surfaced roads.
2. Unsurfaced roads (soil/gravel): Roads which are not provided with a bituminous or cement concreting surface are called unsurfaced roads.

iv. Other criteria

Roads may also be classified based on the traffic volume in that road, load transported through that road, or location and function of that road.

1. Traffic volume: Based on the traffic volume, they are classified as heavy, medium and light traffic roads. These terms are relative and so the limits under each class may be expressed as vehicles per day.
2. Load transported: Based on the load carried by these roads, they can be classified as class I, class II, etc. or class A, class B etc. and the limits may be expressed as tonnes per day.

3. Location and function: The classification based on location and function should be a more acceptable classification since they may be defined clearly. Classification of roads by Nagpur Road plan is based on the location and function which we had seen earlier.

The geometric design of highways deals with the dimensions and layout of visible features of the highway. The emphasis of the geometric design is to address the requirement of the driver and the vehicle such as safety, comfort, efficiency, etc. The features normally considered are the cross section elements, sight distance consideration, horizontal curvature, gradients, and intersection. The design of these features is to a great extent influenced by driver behavior and psychology, vehicle characteristics, traffic characteristics such as speed and volume. Proper geometric design will help in the reduction of accidents and their severity. Therefore, the objective of geometric design is to provide optimum efficiency in traffic operation and maximum safety at reasonable cost. The planning cannot be done stage wise in this case like that of a pavement, but has to be done well in advance (Abdelmoty, 2014).

A number of factors affect the geometric design and they are discussed in detail in the following sections.

#### A. Design speed

Design speed is the single most important factor that affects the geometric design. It directly affects the sight distance, horizontal curve, and the length of vertical curves. Since the speed of vehicles vary with driver, terrain etc. a design speed is adopted for all the geometric design.

Design speed is defined as the highest continuous speed at which individual vehicles can travel with safety on the highway when weather conditions are conducive. Design speed is

different from the legal speed limit which is the speed limit imposed to curb a common tendency of drivers to travel beyond an accepted safe speed. Design speed is also different from the desired speed which is the maximum speed at which a driver would travel when unconstrained by either traffic or local geometry.

Since there are wide variations in the speed adopted by different drivers, and by different types of vehicles, design speed should be selected such that it satisfies nearly all drivers. At the same time, a higher design speed has cascading effect in other geometric designs and thereby cost escalation. Therefore, an 85th percentile design speed is normally adopted. This speed is defined as that speed which is greater than the speed of 85% of drivers. In some countries this is as high as 95 to 98 percentile speed.

#### B. Topography

The next important factor that affects the geometric design is the topography. It is easier to construct roads with required standards for a plain terrain. However, for a given design speed, the construction cost increases multiform with the gradient and the terrain. Therefore, geometric design standards are different for different terrain to keep the cost of construction and time of construction under control. This is characterized by sharper curves and steeper gradients.

#### C. Other factors

In addition to design speed and topography, there are various other factors that affect the geometric design and they are briefly discussed below:

1. **Vehicle:** The dimensions, weight of the axle and operating characteristics of a vehicle influence the design aspects such as width of the pavement, radii of the curve, clearances, parking geometrics etc. A *design vehicle* which has standard weight, dimensions and operating characteristics are used to establish highway design controls to accommodate vehicles of a designated type.
2. **Human:** The important human factors that influence geometric design are the physical, mental and psychological characteristics of the driver and pedestrians like the reaction time.
3. **Traffic:** It will be uneconomical to design the road for peak traffic flow. Therefore, a reasonable value of traffic volume is selected as the design hourly volume which is determined from the various traffic data collected. The geometric design is thus based on this design volume, capacity etc.
4. **Environmental:** Factors like air pollution, noise pollution etc. should be given due consideration in the geometric design of roads.
5. **Economy:** The design adopted should be economical as far as possible. It should match with the funds allotted for capital cost and maintenance cost.
6. **Others:** Geometric design should be such that the aesthetics of the region is not affected.

#### 4.5 HIGHWAY PLANNING

Highways play an important role in China's economic development, especially in mountainous regions. In reality, design of mountainous highways can be a challenging task due to complex geological and topographic conditions. From the safety perspective, it is also important that road geometric design defects and potential accident blind spots can be reasonably

identified from the design. To this end, this study formulated an innovative Geographic Information System (GIS)-based geometric design quality assessment model for mountain highways. First, a fault tree analysis (FTA) was conducted to identify a series of highway design risk factors. Second, a decision-making trial and evaluation laboratory (DEMATEL) technique was employed to derive the factors' weight and sensitivity. Third, road driving suitability, traffic safety sensitivity, design risk factors, and effective distance were taken into account to formulate a design quality assessment model. Forth, two case studies based on a mountainous highway located in southwest China were conducted to validate this model. The case studies established that improving geometric design quality can significantly improve the road traffic safety of mountainous highways. It is also revealed that the existence of steep slopes, tunnels, and rapid horizontal and vertical alignment change can considerably compromise the geometric design quality (GDQ), therefore, configuring these parameters is worth of further investigation. Last but not least, this study provides essential knowledge to the regime of accident prevention, high-risk road section location and mapping, traffic safety management, and design of smart transport systems. (Hong Zhang 2021)

Planning is a prerequisite for any engineering activity or project; this is particularly true for the development of a highway network or system in a country.

The objectives of highway planning are:

- (i) Planning a highway network for safe, efficient and fast movement of people and goods.
- (ii) Keeping the overall cost of construction and maintenance of the roads in the network to a minimum.
- (iii) Planning for future development and anticipated traffic needs for a specific design period.

(iv) Phasing road development programmed from considerations of utility and importance as also of financial resources.

(v) Evolving a financing system compatible with the cost and benefits.

To fulfill these objectives, the following principles have to be borne in mind:

(i) The proposed road links should be a part of the planned road network for the state/nation.

(ii) The importance of the road shall be based on the traffic demand, and hence its type should fall under the standard classification.

(iii) The maintenance needs of the roads should receive prompt attention by setting aside funds for this purpose.

(iv) Statutory provisions for traffic regulation should be in place.

**Urban roads are classified based on their function and location:**

(i) Expressways— for movement of heavy volume of traffic.

(ii) Arterial streets—for connecting the central area to expressways.

(iii) Sub-arterial streets—similar to arterial roads but with less spacing.

(iv) Collector streets—for collection and distribution of traffic through local streets in residential areas.

(v) Local streets—to access private property like residences, shops and industries. Traffic originates here or ends here.

### **2.5.1 Urban Road Patterns:**

Although road patterns in a country are historically inherited, later additions can be planned bearing in mind the requirements of the day.

Road patterns are of great use in urban highway planning. The choice of a road pattern depends upon the extent of land use or the distribution of residential, industrial and business areas in a city, the nature of the terrain, and the planner's preferences

### **2.5.2 Highway Planning Studies:**

Highway planning involves the assessment of the length of road required for a given area, which may be a city, district, state or a country; further, it includes the preparation of a master plan for the area taking into consideration future needs, and phasing the programme in annual or five-year plans, based on the priorities and utility.

For assessing the required road length for the area, field studies are to be carried out to collect the necessary data.

These are:

#### **(i) Economic Studies:**

Details of the existing facilities, their utility, distribution of the existing population in the area, population growth trends, existing products in the agricultural and industrial sectors, future trends of development in these sectors, existing communication and education facilities, and the per capita income are to be collected.

**(ii) Road Use Studies:**

Details of the existing road facilities, traffic volume in vehicles per day, traffic flow patterns, classes of traffic such as passenger cars, busses and trucks, loads carried, average speeds, anticipated future trends of traffic growth, and other traffic-related studies are to be conducted.

**(iii) Engineering Studies:**

These include study of the topography, soil, road life and special problems, if any, relating to construction, drainage and maintenance.

**(iv) Financial Studies:**

Various financial aspects such as the sources of funding, estimated revenue from taxes on vehicles, toll tax, and indirect benefits of raising the living standards of the people due to the proposed road network are considered.

A systematic study of all these data will help the planner in the preparation of a Master Plan to serve the needs of the area for a specified design period of say, 20 to 25 years.

These studies also help in fixing priorities of various routes or sectors based on their utility per unit length. Based on the priorities and the maximum utility per unit length, the entire development plan for the design period will be phased in 5-year intervals, depending upon the availability of financial resources. This is known as phasing of the Master Plan for road development.

For calculating the optimum road length, a system called saturation system or maximum utility system is used.

This system is based on the principle of qualifying the utility of a proposed road network based on the villages and towns of different populations it serves, as also the weight of agricultural or industrial products it carries. (engineeringnotes.com)

## **2.6 Highway Alignment:**

The laying out of the centre line of a proposed highway on the ground is called its 'alignment'. A new road should be aligned carefully since any change in alignment may not be possible or may be expensive at a later stage, owing to increased land acquisition costs and roadside structures constructed after the road has taken shape.

### **Requirements of an Ideal Alignment:**

#### 1. Directness:

The aligned route between end points should be as direct as possible and result in the minimum possible length under the circumstances.

#### 2. Ease of Construction, Maintenance and Operation:

The alignment should be such that it is easy to construct, maintain and operate the highway. The curves and gradients should be easy.

#### 3. Safety:

Safety for the road-users should be the primary consideration; the stability of natural slopes and man-made slopes for embankments and cuttings should be ensured to prevent possible accidents.

#### 4. Economy:

The overall cost of construction and maintenance of the road, as also the operation cost of the vehicles should be as low as possible.

#### 5. Special Considerations:

Depending upon the purpose of the highway and the characteristics of the terrain, special considerations may be needed as in the case of hill roads or ghat roads.

##### **A. Horizontal Alignment:**

This is the alignment of the roadway in the horizontal plane; although it is ideal to have a straight route between end points, it is practically impossible owing to several constraints. A change in direction necessitates the use of horizontal curves for smooth flow of traffic.

##### **B. Vertical Alignment:**

Although it is ideal to have a roadway at the same elevation throughout, this is almost impractical and gradients or slopes along the length become mandatory. A change in gradient calls for curves in the vertical plane; vertical curves should be designed and constructed for smooth flow of traffic based on several criteria.

#### **2.6.1 Factors Controlling Alignment:**

The selection of alignment of a proposed new highway route will be based on a careful consideration of the following factors:

### **1. Obligatory Points:**

These are the points through which the alignment has to necessarily pass for maximum utilization of the road. While aligning a new highway route between two end points, it would be necessary to make it pass through places of importance. This may be based on the population that can be served, or places of business or industrial importance.

### **2. Topographical Features:**

Topographical features like a lake or a hillock may require the alignment to be taken around them. In the case of a big hill the option of constructing a tunnel through it for maintaining a straight alignment can be considered. The relative costs of these options have to be studied to finalize the alignment.

### **3. Geometric Design Aspects:**

Factors such as radius of curve, longitudinal gradients, sight distances, road intersections, design speed, lateral friction, and super-elevation govern the alignment to a considerable degree; radii of horizontal curves and longitudinal gradients should facilitate easy maneuvering of vehicles.

### **4. Cross-Drainage Needs:**

The alignment should be such that bridges are located at right angles to the direction of flow of the stream or river

### **5. Deviations Dictated by Circumstances:**

Although a straight horizontal road is the best option, it is highly monotonous for a driver; so, to divert attention on a straight road and break the monotony, a slight bend or curve may be created at least once in a kilometre or two to make the driver alert. Obstructions such as places of

worship (such as established temples and churches), monuments of historical interest, public buildings such as hospitals and educational institutions and utility services like water supply and sewerage lines and overhead transmission lines may necessarily have to be bypassed.

This may dictate deviation in the alignment of the roadway, leaving sufficient margin for these hindrances. Sometimes, the alignment may have to be changed to bypass expensive private property or agricultural or industrial area.

#### **6. Proximity to Materials and Labour:**

Proximity to the sources of materials for road-making and the availability of cheap labour may be a criterion for fixing the alignment.

#### **7. Economic Considerations**

Before an alignment is chosen, two or three alternative routes may have to be investigated and their overall cost – initial outlay and maintenance cost over a design period – compared. The route with the best economy is then selected.

#### **8. Political Considerations:**

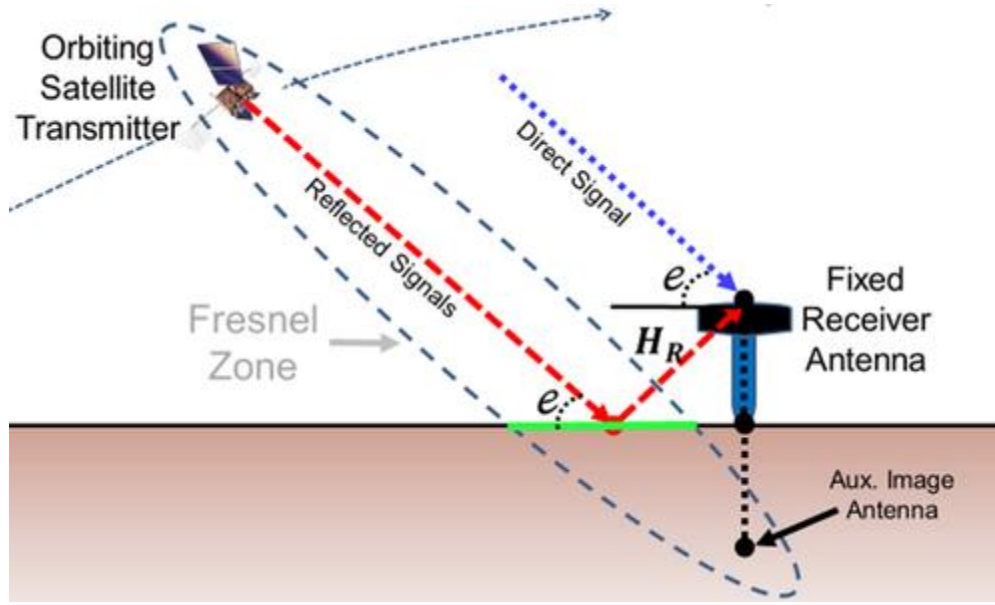
Sometimes, political considerations may dictate the choice of alignment, setting aside even economic considerations. Of course, the other important criteria have to be necessarily borne in mind.

### **2.8 GLOBAL NAVIGATION SATELITE SYSTEM (GNSS)**

Global navigation satellite system (GNSS) signals are vulnerable to radio frequency interference (RFI) and spoofing. RFI detection has become trivial with many detection algorithms available and built into GNSS receivers; this is not the case with spoofing. GNSS spoofing can involve

generating false GNSS signals with one or more altered components of GNSS satellite transmissions: radio frequency (RF) carrier, pseudorandom noise codes, and/or the broadcast navigation messages. We present GNSS interferometric reflectometry (GNSS-IR) signature-based defense: a new methodology to defend wireless space-based positioning, navigation, and timing (PNT) transmissions against spoofing by leveraging existing, fixed GNSS receivers used in GNSS-dependent critical infrastructure and key resource sectors. GNSS-IR signature-enabled defense provides spoofing and RFI detection without any changes to existing architecture by conducting input validation of GNSS receiver observables against the generated GNSS-IR truth calibration signatures. This paper includes an overview of the theory, methodology, and results of live-sky signature variability experiments (Steven Lewis 2021).

GNSS-IR involves the forward and inverse analysis of the interferometric patterns resulting from the superposition of reflected and direct line-of-sight (LOS) radio waves transmitted from GNSS satellites. A receiver processes these transmissions producing observables that are used for positioning and timing [pseudorange or code phase is the main observable]. The code and carrier phases, along with the resultant received signal power, are impacted by the interactions between the direct and indirect signals and noise.



The empirical model of the combined signal power of the direct, line-of-sight, and reflected signals is as follows (Larson & Small, 2016):

$$SNR(e) = A(e) \sin\left(\frac{4\pi H_R}{\lambda} \sin e + \phi\right). \quad (1)$$

As the elevation ( $e$ ) of a transmitting satellite changes with respect to the local horizon, the reflected signals of wavelength ( $\lambda$ ) are primarily impacted by the near-reflection or First Fresnel Zone (FFZ) characteristics and properties (Figure 1). These include the dielectric constants, surface roughness, and the distance between the antenna and reflector(s) ( $H_R$ ). The reflected, sometimes called multipath, signals experience attenuation and delay, impacting the amplitude ( $A$ ) and phase delay ( $\phi$ ), respectively. The power and phase differences between the reflected signals and direct signals cause constructive and destructive interference in the auto-correlation function (ACF) of the receiver. The resultant combined signal power produces dampened sinusoidal interference patterns. Furthermore, with a fixed or stationary receiver and transmitting

satellites that have repeating ground tracks (such as in the GPS), these signatures repeat every sidereal day. While not fully explored in this paper, a similar phenomenon is seen in the interferometric code and carrier observations. It is important to point out that we have chosen to use the term signal-to-noise ratio (SNR) for simplicity, and not carrier-to-noise density, C/N0; a thorough and detailed explanation of these terms can be found in Joseph (2010). SNR is normally expressed in decibels, so the formulas below are to be converted to logarithmic scale when necessary:

$$SNR_{dB} = 10 \cdot \log_{10}(SNR) \cdot (2)$$

GNSS interferometric reflectometry was first used in ocean altimetry experiments described in (Anderson, 2000) and leveraged previous work of the Passive Reflectometry and Interferometry System (PARIS) (Vallmitjana, 2001). The use of GNSS multipathed signals has broadened to a wide array of new applications such as hydrology and vegetation studies (Larson & Small, 2014, 2016). More recently, an open-source, flat surface geometric optics simulator was released to the public and an extended physical optics simulator was developed (Geremia-Nievinski et al.). Both have exposed GNSS-IR research and exploration to new disciplines to include cybersecurity of wireless channels as presented in this paper.

These GNSS-IR signatures are unique to each satellite-receiver pair due to the unique multipath conditions around the receiver antenna. By defining “truth” or expected signatures, one can then implement input validation of new, received signal power, code, and carrier observations to provide wireless channel security much like RF fingerprinting (Ureten & Serinken, 2007)

**2.7.1 What are the three elements of GNSS?** GPS is made up of three different components, called segments, that work together to provide location information.

The three segments of G are:

Space (Satellites) — The satellites circling the Earth, transmitting signals to users on geographical position and time of day.

Ground control — The Control Segment is made up of Earth-based monitor stations, master control stations and ground antenna. Control activities include tracking and operating the satellites in space and monitoring transmissions. There are monitoring stations on almost every continent in the world, including North and South America, Africa, Europe, Asia and Australia.

User equipment — GPS receivers and transmitters including items like watches, smartphones and telematics devices

### **2.7.2 How does GNSS technology work?**

GPS works through a technique called trilateration. Used to calculate location, velocity and elevation, trilateration collects signal from satellites to output location information. It is often mistaken for triangulation, which is used to measure angles, not distances.

Satellites orbiting the earth send signals to be read and interpreted by a GPS device, situated on or near the earth's surface. To calculate location, a GPS device must be able to read the signal from at least four satellites.

Each satellite in the network circles the earth twice a day, and each satellite sends a unique signal, orbital parameters and time. At any given moment, a GPS device can read the signals from six or more satellites.

A single satellite broadcasts a microwave signal which is picked up by a GPS device and used to calculate the distance from the GPS device to the satellite. Since a GPS device only gives

information about the distance from a satellite, a single satellite cannot provide much location information. Satellites do not give off information about angles, so the location of a GPS device could be anywhere on a sphere's surface area.

When a satellite sends a signal, it creates a circle with a radius measured from the GPS device to the satellite.

When we add a second satellite, it creates a second circle, and the location is narrowed down to one of two points where the circles intersect.

With a third satellite, the device's location can finally be determined, as the device is at the intersection of all three circles.

That said, we live in a three-dimensional world, which means that each satellite produces a sphere, not a circle. The intersection of three spheres produces two points of intersection, so the point nearest Earth is chosen.

### **2.7.3 What are the uses of GNSS?**

GPS is a powerful and dependable tool for businesses and organizations in many different industries. Surveyors, scientists, pilots, boat captains, first responders, and workers in mining and agriculture, are just some of the people who use GPS on a daily basis for work. They use GPS information for preparing accurate surveys and maps, taking precise time measurements, tracking position or location, and for navigation. GPS works at all times and in almost all weather conditions.

### **2.7.4 There are five main uses of GNSS:**

Location — Determining a position.

Navigation — Getting from one location to another.

Tracking — Monitoring object or personal movement.

Mapping — Creating maps of the world.

Timing — Making it possible to take precise time measurements.

**Some specific examples of GNSS use cases include:**

Emergency Response: During an emergency or natural disaster, first responders use GPS for mapping, following and predicting weather, and keeping track of emergency personnel. In the EU and Russia, the regulation relies on GLONASS technology (a GNSS alternative) and telematics to send data to emergency services in the case of a vehicle crash, reducing response time. Read more about GNSS tracking for first responders.

Entertainment: GNSS can be incorporated into games and activities like Pokémon Go and Geocaching.

Health and fitness: Smartwatches and wearable technology can track fitness activity (such as running distance) and benchmark it against a similar demographic.

Construction, mining and off-road trucking: From locating equipment, to measuring and improving asset allocation, GNSS enables companies to increase return on their assets. Check out our posts on construction vehicle tracking and off-road equipment tracking.

Transportation: Logistics companies implement telematics systems to improve driver productivity and safety. A truck tracker can be used to support route optimization, fuel efficiency, driver safety and compliance.

Other industries where GNSS is used include: agriculture, autonomous vehicles, sales and services, the military, mobile communications, security, and fishing.

### **2.7.5 How accurate is GNSS?**

GNSS device accuracy depends on many variables, such as the number of satellites available, the ionosphere, the urban environment and more.

## **2.8 Previous Work Done**

Geospatial technology such as photogrammetry and global navigation satellite system (GNSS) have been an integral part of highway mapping for decades. However, geospatial technologies continue to evolve, and new technologies are becoming more accessible for a wide range of highway construction application. Tools such as unmanned aircraft system (UAS), lidar, aerial imagery, GNSS, automated machine guidance, and their derivative products offer many benefits to the highway construction industry. These benefits includes improved efficiencies and streamlined processes, as well as more accurate and reliable data. The Key to using these technologies successfully to optimize benefits is to correctly select the appropriate tool for the application and understand limitations. In many cases, data from each of these technologies will be integrated for a project to develop the necessary survey products. (U.S department of Transportation, 2019)

## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.1.1 GROUND SURVEY METHOD**

The creation of horizontal and vertical controls typically goes hand in hand with this technique.

First, second, and third order controls are categorized as horizontal controls.

Field survey techniques are utilized to get accurate field measurements for the design itself.

These consist of the subsequent procedures.

#### **3.1.2 LEVELLING**

In order to calculate the difference in elevation, vertical lengths must be measured directly or indirectly. They are typically measured in relation to a level surface, known as the datum, which is typically mean sea level. The Level and a graded staff are the instruments utilized. Starting at a benchmark that serves as a point of reference, back sight and foresight are used to navigate the course. These rear sights and foresights are then scaled down according to the altitudes of the various points once at the office.

#### **3.1.3 PROFILE LEVELLING**

Profiles or Longitudinal sections are sections which comply with some precise traces defining parts of new constructions. They are normally run alongside lines defining parts of new constructions. They are usually run along strains defining parts of new construction. They usually run along the centerline of proposed works of slender width e.g roads, pipelines and strength lines. They provide information which aid in determining the most suitable and financial ranges and gradients to which the floor must be labored in its longitudinal section. They supply

important points at any points along the section on the quantity of reduce or fill go well with the formation level. The instrument used for the levelling operation include a 50m tape, a kern-type dumpy level instrument and a levelling staff. The instrument was first set close to the transient benchmark point from which the first back sight was once taken earlier than consequent intermediate sight and foresight have been taken. At strategic factors the place intermediate sight could not be seen, the instrument is moved and every other back sight is taken from the closing foresight and then again the whole system continues to the end of the street.

The reduce levels along the police station road had been computed using the height of instrument approach in this mission work.

### **3.2.1 CROSS SECTIONS**

For works such as roads, bridges, canal, etc. the slope of the ground at right angles to the centerline must be obtained. This is typically finished from move sections. Cross sections are brief area strains sets out at right attitude to the principal profile line. Usually go sections are taken in such a way that they prolong past the limits of a proposed construction. They supply facts which aid in deciding the most appropriate and financial tiers to which the ground have to be worked in its transverse direction. They furnish important points for calculating the position, height and slopes of any critical embankments. They supply important points for calculating calculation of earthwork quantities for costing motive and the appropriate provision of earth transferring plants.

### **3.2.2 ACQUISITION OF GEOSPATIAL DATA**

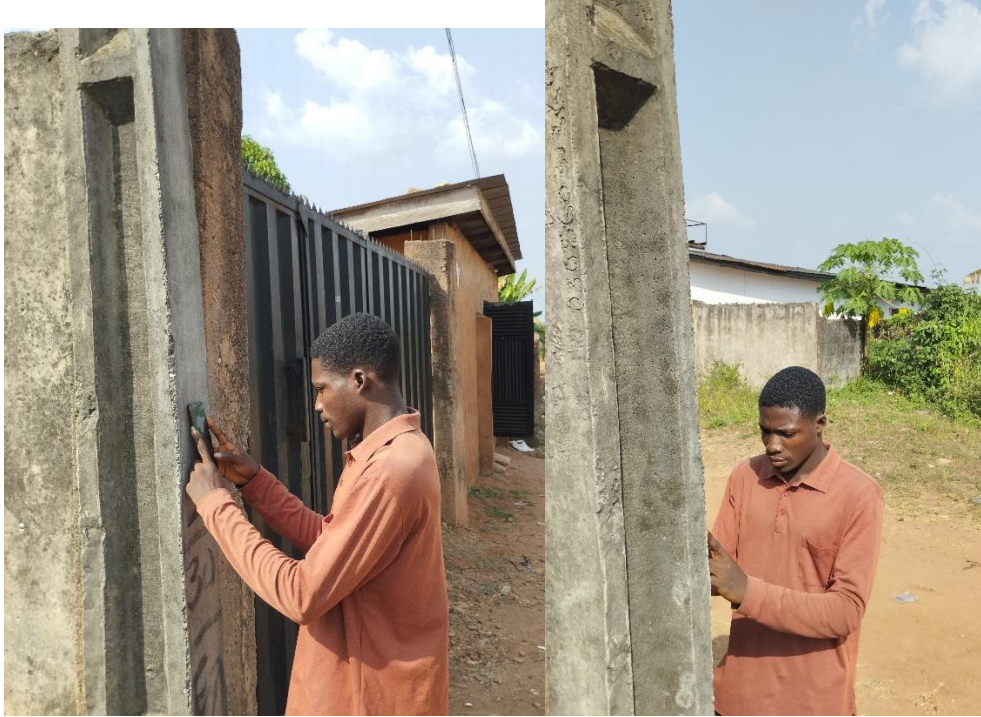
Geospatial data are data of a geographical vicinity which incorporate the distances, the bearings, coordinates and how these all relate to giving the area it wonderful configuration. They are

decided from floor survey, photogrammetric and remotely sensed data. Coordinates of quite a number points on this task were gotten the use of a handheld geographical positioning system (GPS) gadget which additionally gave the elevation of each involved point alongside the span of the street. Having gotten the elevation at the transient benchmark the degree of a variety of points on the street have been taken the usage of the dumpy degree instrument. Data gotten from the levelling operation have been then used to plot the longitudinal profile of the road

### **3.2.3 TRASVERSING USING GNSS**

The global navigation satellite system machine is electronic equipment used to decide the coordinate of a point. It presents the northing and easting of a location as properly as the latitudes and longitudes. It also gives the elevation above advise sea level of the aspect upon which it is placed.

The effectiveness of the GNSS device is a feature of the volume of space satellite television for laptop it can link up with to get a true coordinate of the place, and the impediment determined in the area. When there is an obstruction to satellite tv for pc signal in the area, a phenomenon known as multi-party error arises. These obstructions may also additionally be due to the present day of immoderate upward jostle buildings, tall bushes and vegetation, immoderate fence etc. The greater of these obstacles, the lesser the accuracy of the device.



**Fig. 3.1 shows the front and side viewpoints positioning using GPS receiver from and electric pole at Police Station Road**

### **3.2.4 GEOSPATIAL DATA FROM AERIAL PHOTOGRAPHS AND PHOTOMOSAICS**

These are images made from a serial platform, which might also be all airplane, balloon of Spaceship which shims a component of the earth's floor to some scale. Although aerial pictures have been taken from balloons and kites as early as the mid-1800 accrual survey was once now not weekly employed until World War L when cameras have been mounted in aircraft. Military utility of aerial pictures extended significantly in the course of World War 11 when many enchantments in aircraft, cameras, and videos have been introduced. Today, most of the Earth's surface his been recorded by way of aerial survey and these can be of remarkable help throughout the planning stage. Computers are extensively used in actual survey to improve the first-class of photographs and increase the vary of international they can provide. Aerial pics

display a high diploma of radial distortion, the topography is distorted, and unmilled sections are made for the distortion, measurement made from the photograph are now not correct. The engineer's position in aerial mapping is to furnish horizontal and vertical manage for the mapping and to furnish supplemental facts for the aerial mapping. The surveyor, below the course of the photogrammetric places aerial goals on the ground at positions that levied ample visual coverage for the photography. The surveyor or engineer either by use of GPS or Total Station provide the cartographer with a listing of coordinates and elevations her sack serial target, which are then used as control to set up the photographic mannequin the site. There are several advantages of aerial photography over ground-based commentary and these include:

- Aerial images provide an expanded advantage point
- Aerial pictures have the functionality to end action.
- It gives an everlasting recording
- It has broader spectral sensitivity than the human eye

Also aerial images have better spatial resolution and geometric fidelity than the products of many ground-based sensing methods.

Aerial images could be black and white, colour or colour infrared. ([www.colorado.edu](http://www.colorado.edu))

### **3.3.1 MAKING ROUTE OF CENTRELINE ON POINT**

Making of route centerline involves fixing the road alignment or positioning the avenue centreline on the ground. The alignment should be such that it short, secure and economical.

There are some factors that affect the selection of centreline and these Include:

1. Geographical conditions
2. Type, quantity and waft pattern of visitors anticipated
3. Topographical and geological factors
4. Controlling factors etc.

In choosing the alignment for this project, the following points were called to mind:

- The alignment took into account all control points and the shortest and most economical, compactable with the requirements of the gradients and curvature was once chosen
- Marshy grounds, steep slopes, unstable facets and areas subjected to severe climatic prerequisites and flooding had been taken into consideration.
- The need for connecting adjoining streets and land to the road was considered.
- The need for connecting adjoining streets and land to the road was considered
- The nature of the region which is dominantly residential used to be taken cognizance of due to the fact of the movement of pedestrians mainly teens transferring alongside the walkway of the street.
- The position of the university of Benin fence was seriously considered. This became quintessential as the fence is a big one and would not be cost effective to demolish and reconstruct
- Consideration was additionally given to the existence of electric powered poles which dot the stretch of the road. Adequate care was once taken to limit the variety of that is to be eliminated for financial reasons

Already in existence, a stretch of avenue of about 70m was tarred at the head of the avenue beginning from the factor of connection to the Ekosodin -Evbomore road. Most phase of the

initial work has failed. So a sparkling traversing was carried out as if the street is to be plan from the scratch.

Traversing used to be performed beginning from the median of the existing ekosodin- Evbomore dual carriageway going through exactly Police road. The GPS coordinate of the median was then taken before crossing to the centreline of the begin factor of the street (0.000).

The centreline of the street from the geometric diagram was carried out with the aid of taking the GNSS coordinate points at the centre of the road at sufficient intervals to be able to see the waving of the street stretch from Autodesk land developer environment.

### **3.3.2 TRASVERSING OF THE CENTRELINE**

The traversing of the centreline of the road was completed using a hand preserve geographical positioning machine gadget and a tape. Coordinates of the anticipated centres from police station fence on one facet to a present shape at the different facet had been taken. The GPS machine gave readings of the coordinate of the tentative centres point from the satellite alerts from outer space. The 50m tape used to supply the adequate offset from important amenities or structure along the roadway.

Connection of these points honestly offers the deflecting angles between the centrelines serving as straight along the road. These factor can be used to generate the horizontal curve through the point. From this curve, residences such as tangency, k-value, start of curve, quit of curve etc. are given automatically the usage of gorgeous software or hand calculations

### 3.4 CHALLENGES ECOUNTERED ON SITE

While carrying out this project work to acquire geospatial data needed for the geometric design of highway the usage of the hand GPS and the dumpy level, the following error occurred in the process:

- i. Multiparty Error: this is an error that influences the GPS device to the blockage of electromagnetic sign precipitated via barriers around the point the instrument is to be used. These limitations may also be trees, tall buildings, electric powered poles or masks etc. The presence of these obstacles impairs the accuracy of the device.
- ii. By design, the accuracy of the GPS gadget expands as the quantity of house satellite it can hyperlink with increases. This requires that the holder of the gadget stay in one position for a lengthy length of time and be static. Acts like these may also not be possible because of time constraint and fatigue on the phase of the holder of the instrument.
- iii. The Kem-type dumpy degree used for the levelling operation used to be not examined for accuracy the usage of the two-peg takes a look at method. The two peg take a look at is a technique for testing the level of accuracy successful of being given through the instrument.
- iv. Due to muddy and waterlogged nature of the roadway, chainage was done by using pacing and in some cases, points of dimension do manifest in sinking spots. Here, the chainage factors were shifted a little to the nearest difficult spot.

## CHAPTER FOUR

### RESULT AND DISCUSSION

4.1 The Table below shows the geographical readings with GPS, Satellites, longitude, latitude and accuracy

**TABLE 4.1 GIVING THE COORDINATE FROM THE GNSS READING**

Point	latitude	Longitude	Altitude	Satellite	E	N	Description
1	6.4111	5.6153	88.30m	22/33	789315.925m	709384.118m	Elect. Pole
2	6.4108	5.6157	98.70m	21/34	789345.319m	709354.061m	Wall
3	6.4109	5.6161	91.50m	20/34	789407.527m	709365.825m	Foundation
4	6.4108	5.6165	102.10m	21/35	789441.705m	709359.108m	Gate
5	6.4108	5.6166	87.90m	24/35	789464.051m	709356.650m	Road Cent.
6	6.4108	5.6169	95.50m	17/34	789495.019m	709365.350m	Wall
7	6.4108	5.6173	99.70m	25/34	789537.695m	709351.492m	Elect. Pole
8	6.4108	5.6177	94.29m	20/34	789580.423m	709359.997m	House
9	6.4108	5.6180	96.80m	21/34	789608.383m	709361.439m	Police pole
10	6.4108	5.6183	105.30m	25/34	789643.762m	709355.170m	Road Cent.
11	6.4106	5.6188	92.80m	17/35	789705.120m	709335.010m	Tree
12	6.4106	5.6193	89.30m	26/35	789758.056m	709337.864m	Wall
13	6.4107	5.6198	97.80m	25/35	789808.572m	709345.130m	Sign Post
14	6.4107	5,6204	88.00m	25/35	789880.526m	709345.313m	Road Cent.
15	6.4109	5.6211	86.90m	22/35	789957.097m	709344.598m	Elect. Pole

#### 4.2 This Result of Levelling Operation for Police Station Road.

**TABLE 4.2 RESULTS OF THE LEVEL DATA FOR PROFILING**

CHAINAGE	BACKLIGHT	FORESIGHT	REDUCED LEVEL
BM	0.932	-	120.000
10	-	1.436	119.594
20	1.654	1.711	119.363
30	1.722	1.949	119.291
40	-	2.132	118.881
50	-	1.427	119.351
60	-	1.335	119.421
70	1.854	1.655	119.289
80	-	1.823	119.404
90	1.598	1.475	119.578
100	-	1.445	119.596
110	-	1.335	119.754

#### 4.1 Using Geospatial Data In Geometric Design.

An engineer studies the area before beginning to design the geometric profile of a highway or road in order to determine the appropriate design speed appropriate for the proposed road based on its intended use, the width of the roadway which is dependent upon the level of service (LOS) anticipated, the volume of traffic anticipated, super elevation, and lateral friction factor, among other factors. These allow for the determination of the curve's likely minimum radius discovered

on a road. The following stage is to head outside to collect geographical data, which includes the Total station data, GNSS readings, and site leveling were used to determine the lowered levels. Fieldwork likewise includes of the GNSS reading, whole station readings and levelling of the website to get the decreased levels. Drawings of the physical features present on the land where the proposed road will be built are included in a field book that is another aspect of field work. Important structures and residences, power poles, fences, reservoirs, water accessories, and other features are carefully sketched into the plan profile to show potential adjustments to the route. Aerial photography or remote sensing data obtained from space satellites that depicts a graphical perspective of the land region are other significant design aids employed for this project. This frequently provides information on the site in addition to the field book. the width of the current right-of-way, and using a measuring tape and GNSS recorder, the right-of-closest way's distance along the existing road stretch was also established.

#### **4.2 Discussion of the Results of Traversing**

The table 4.1 above contains some of the findings from traversing operations that display the coordinates of places along the police station route. The table provides details on each location along the road, including their northing, easting, and elevation in relation to mean sea level. This is used to map the road's horizontal alignment. The centerline coordinates of each location along the road are the part of the traversing data that is most frequently used for road plotting.

Based on the use, the offset from both sides of the road is determined from the centerline point where the road will be placed. A road offset of 2.85 meters results from the carriageway width of 6.5 meters for the Police station road. A 1.75m-wide shoulder was made available to use as a parking lane, walkway, and covered drain. Ample care was made in the plot to prevent any road segments from crossing in the university of Aerial photography or remote sensing data obtained

from space satellites that depicts a graphical perspective of the land region are other significant design aids employed for this project. This frequently provides information on the site in addition to the field book. With the aid of a measuring tape, the right-of-measurement way's and nearest distance determination along the current road stretch were also made and GPS recorder.

The centerline of adjacent streets and shuts along the road, as well as electric poles, telecom poles, and water mains, were other noteworthy findings from the traversing data.

annexation, property lines, university fence at key locations on the road, and so on. The power holding company may find it useful to note the locations of electric poles in the traversing data so they can determine how much economically viable road adjusting work needs to be done. Knowing where to adjust a bend on the road will also help the road engineer save the power holding company money. The coordinates of the property lines of the buildings along the road were also significant. The government can use this information to determine the scope of the demolition work to be done and the amount of money set aside for compensation. When creating the road profile, the highway engineer can also be mindful of property line points to prevent damage to significant structures or monuments that have a bearing on the local population's culture and history.

#### **4.3 Discussion of Aerial Map's Applicability to Geometric**

The geometric contour of the road is designed in large part using the remote sensing data from the Police Station position map (fig. 4.1). The map provides a visual representation of the region, as well as nearby roadways and fences. Additionally, the design of resulting in the reduced level. The speed and precision of the data produced are considerably improved by this. (Table 4.2)

In order to achieve economy in the amount of earth work that must be done without compromising the vehicle's smooth ride, suitable measures were made when designing the vertical profile. The highway code of the Federal Republic of Nigeria was used to validate the sight distance employed for the road design and the location of the vertical curves.

#### **4.5 Design Considerations**

The volume of traffic, the kind or composition of the traffic, the speed, and the management of access are the main design factors for a road. Others include capacity, safety, economy, topography and physical characteristics. The main goal is to fill the road's lanes with as many automobiles as possible traveling at a safe speed. The intended roadway's geometric design data were designed to be commensurate with the volume, make-up, and design speed access control of the aforementioned road. To bring the job up to international standards, the usage of the appropriate codes section, as stated in tables 4.3 and 4.4, was applied. In this instance as well, the primary environmental factors Decisions were made using the activities as a measure. When designing the road, safety was given the utmost importance. and to make this as feasible as possible, the following conditions must be met:

- A. It is 3.65 meters wide (double lane)
- B. D-level service.
- C. 50 km/hr. is the design speed used.
- D. Grades and alignment are not limiting.
- E. Shoulders are 1.5 meters apart.
- F. No traffic incidents have occurred.

**Manual Standard for Sight Distance According To federal Highway Manual (S.I unit Conversion), 1973**

Design Speed (km/hr)	Stopping Sight Distance (m)	Passing Sight Distance (m)
40.50	58.97	222.72
38.90	75.77	373.62
78.70	112.95	499.22
100.50	140.79	582.58
122.80	176.99	899.35

## CHAPTER FIVE

### CONCLUSION AND RECOMMENDATION

#### 5.1 CONCLUSIONS

Geospatial data are designed to uniquely specify the positions of features on the earth's surface. Geospatial data must be acquired in order to plan, construct, and manage the road infrastructure, which is vital to human use. These data come from a variety of sources, including aerial photos, topographic maps, satellite images, and hand-drawn maps. For the collection, processing, and display of geographic data, optimal techniques are applied, which result in significant time and financial savings. The manual office computation of results using theodolites, levels, and tapes used to be very time-consuming and amusing. The usage of GPS, ETS, and Total Station, together with related computer software, have, however, made data collecting and processing less labor-intensive.

Data acquired in this project were limited to the beginning of the police station road to the end of the road.

#### 5.2 RECOMMENDATION

Clearly, modern technology is significantly influencing how data is collected, processed, and presented. The economy and the significance of digital tools like the Electronic Total Station have now been greatly benefited in Nigeria's building sector. Prior to beginning real construction, data generation for planning, design, and setting out was done using digital theodolites, digital levels, and CIPS receivers. The usage of this technology is encouraged for civil engineers, who should also factor it into project planning and construction expenses. It is proposed that the Ministry of Works and Infrastructure purchase these contemporary tools and finance their

employees' attendance at training sessions on their use, or ask resource people to organize internal training on the equipment

The Government should be able to provide such equipment in higher institutions to help the young engineers become better and create a comfortable and sustainable society for the masses. Every engineering student should be able to use at least a total station by their pembate year, so it is the responsibility of the Government to do so.

## REFERENCE

Abdelmoty A.I, Williams, M.H., and Paton, N.W (1993) Deduction and deductive c geographic data handling. Proceedings of the Third International Spatial Databases, Singapore,

Abel O.S (2010) Owolabi, A.O. Development of priority index assessment model for making pavements in Nigeria. In Proceedings of the 8th International Confermice on Managing Pavement Assets (ICMPA), Chile.

A. AMA (2007) Successful delivery of Public-Private Partnerships for infracture: development, Journal of Construction Engineering and Management, 133(12) 019-931

Aziz R (2007) Exploring critical road project delay factors in Ghana. Journal of Facilities Management, 15(2), 110-127, Retrieved from <http://doi.org/10.1016/.aej.2016.10.018>

Consulting Engineers Association of Nigeria, ACEN, (2004)

D Abel, (2014): a Database Toolkit for Geographical Information Systems rational Journal of Geographical Information Systems, vol. 3(2) pp1031116

Ehiorobo, 3.0. (2006), Introduction to Engineering Surveying. Unpublished Lecture Note Department Of Civil Engineering. University Of Benin

Engineeringnotes.com. <https://www.engineeringnotes.com> Essays, Research Papers and

Articles on Engineering Notes India

Hong zhang, (2021) measurement and prediction of urban land traffic accessibility and economic contact. International journal of environmental research and public health. Vol.19. no.22. Article ID 14867, p. 14867.

Ishaya. S. and Abaje. 18. (2017) Indigenous People's Perception on Climate Change and Adaptation Strategies in Jemma LGA of Kaduna State: Journal of Geography and Regional Planning. 1, 138 143.

N. W. Paton, S. A. Khan, A. Hayes, E. Moussouni, A. Brass, K. Billeck, C.A. Guttle, S.3. Hubbard and S. G. Oliver, (1996) "Conceptual Modeling of Genomic Information instamatics, Vol. 16, No. 6, 2000, pp. 548-557. <http://dx.doi.org/10.1093/bioinformatics/166.548>

Stephen Lewis (2021) GNSS interferometric reflectometry signature-based defence. Journal of the institute of Navigation 64(7)

Volg, M. A formal definition of binary opological relationships. Proceedings of the Third International Conference on the Foundations of Data Organization and Algorithms, Paris

William, T., Pastre, D. and Vidmont, Y. (2014) Strong integration of spatial domains und operators in a relational database system Proceedings of the Third International Symposium on Large Spatial Databasen, Singapore,

Xiao, H. and proverbs, D. (2003), "Factors Influencing Contractor's Performance: An International Investigation Engineering, construction and architectural journal, 10(5) pp322-332