CHAPTER ONE

1.0 INTRODUCTION

Height determination is an essential aspect of surveying that involves determining the vertical location of a point relative to a reference datum. Surveyors typically use different techniques to determine the elevation of a point, including trigonometric levelling, barometric levelling, and digital levelling (Simbolon et al., 2017). Levelling is a widely used method for determining the elevations of ground points relative to a reference datum. It involves measuring the vertical distance between the ground point and the reference datum to obtain what is known as the reduced level. This is an important procedure that is used in various fields such as mapping, engineering design, construction, and setting out. The reference datum used in levelling is usually the mean sea level, which is assumed to be an equipotential surface. This means that points on this surface have the same gravitational potential energy. As such, the mean sea level is adopted as the reference surface for vertical control surveys (Schofield & Breach, 2007; Uren & Price, 2010).

Leveling Schofield and Breach (2007) opined that levelling is a technique used to determine the vertical location of a point on or beneath the surface of the earth relative to a reference datum, while planimetry refers to the horizontal position of a point relative to a coordinate system. The authors also noted that these two procedures are separate and distinct, as each involves different equipment, procedures, and techniques. This idea is further supported by Ghilani and Wolf (2014), who stated that levelling is primarily concerned with determining the elevations of ground points, whereas planimetry is focused on determining the position of those points in a horizontal plane. The choice of height system is critical in many applications, especially those that require accurate determination of elevation. For instance, in civil engineering projects such as road construction, it is important to know the elevation of the terrain to design the road profile, drainage, and culverts. The orthometric height system is widely used in such projects as it provides a meaningful height reference that is directly linked to the earth's gravity field. However, other height systems, such as the ellipsoidal height system, are used in different applications. The ellipsoidal height system is based on the normal to the reference ellipsoid and is commonly used in satellite positioning systems such as GPS. The choice of height system depends on the application, and it is important to understand the differences between them to avoid errors in height determination (Torge, 2001). Orthometric heights are determined by measuring the vertical distance between the point of interest and the geoid. This can be achieved through traditional techniques such as spirit levelling, trigonometric levelling, and GPS measurements (Odumosu et al., 2018). In spirit levelling, a series of measurements are taken with a level instrument, and the heights are computed based on the height of the instrument and the readings taken at the different locations. Trigonometric levelling involves measuring the angles and distances between two points and computing the height difference between them using trigonometric functions. GPS measurements use satellite signals to determine the height of a point above the ellipsoid and geoid is computed with high accuracy (Ghilani & Wolf, 2014). The process of levelling involves using a levelling instrument to measure the vertical distance between the ground point and the reference datum. The levelling instrument consists of a spirit level and a graduated staff. The spirit level is used to ensure that the staff is held World Scientific News 189 (2024) 87-101 -89- vertically, while the graduated staff is marked with a series of divisions that enable the observer to measure the vertical distance between the ground point and the reference datum. There are several methods for leveling observations in modern days, they include geometric leveling and trigonometric leveling methods (Lee & Rho, 2021). The choice of method to use largely depends on the accuracy desired, nature of the work to do and the availability of instrument to use.

Total Station The total station is a surveying instrument that combines the angle measuring capabilities of theodolite with an electronic distance measurement (EDM) and processing capabilities to calculate and determine horizontal angle, vertical angle and slope distance to the particular point (Lin, 2014). The determination of the coordinates for an unknown point in relation to a known coordinate is achievable through the utilization of a total station, provided that a direct line of sight can be established between the two points (Putra et al., 2023). The process involves measuring angles and distances from the total station to the points under survey. Subsequently, trigonometry and triangulation are employed to calculate the coordinates (X, Y, and Z or northing, easting, and elevation) of surveyed points concerning the position of the total station (Reyes, 2021). To get data on the distance of a point, the Total Station emits a wave, then the object will reflect the wave and be received back by the tool. Then the software inside the tool will automatically calculate the distance from where the tool stands to the measured point. To determine an absolute location, a total station requires line of sight observations and must be set up over a known point or with line of sight to two or more points with known location (Solomon, 2014).

1.2 STATEMENT OF THE PROBLEM

In height determination we have a number of instruments of different precisions and relatively different field procedures which ends with different precisions. The highest precision in levelling is obtained by the use of digital levelling. Total station is less precise but how much is it imprecise compared to conventional digital levelling? The use of digital levels saves 3 computational and observation time. It is therefore expected to be less tedious than the conventional digital levelling. The question is how much tedious is it? Does it give the same precision compared to conventional analogue digital levelling? These are some of the problems which are going to be discussed in this project.

1.3 AIM AND OBJECTIVES OF THE PROJECT

1.3.1 AIM OF THE PROJECT

The primary aim of this project is to compare the accuracy and reliability of digital leveling and total station equipment in determining height measurements.

1.3.2 OBJECTIVES OF THE PROJECT

The objective of this study is to assess the performance of total station instrumentation and digital levels to determine the height measurement in executing levelling for vertical control in topographic surveys for route engineering projects.

1.4 SCOPE OF THE PROJECT

This study is limited to the comparison between total station levelling and digital levelling on the four segments that are 7km in lengths. The comparison will be judged by statistical quantities such as maximum, minimum, mean and root mean square differences.

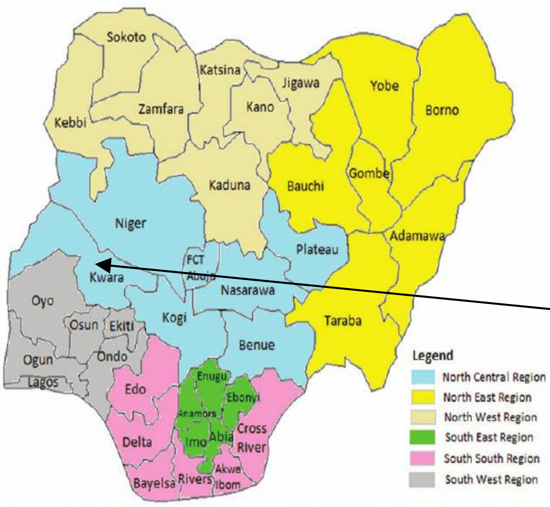
1.5 PERSONNEL INVOLVED

The project was assigned to and was successfully carried by the personnel listed below;

NAME	MATRIC. NO.	
Jimoh Halimah Titilayo	HND/22/SGI/FT/082	Writer
Ganiyu Akeem Abiodun	HND/23/SGI/FT/0076	Member
Abdul Kareem Ramota Olawumi	HND/23/SGI/FT/0078	Member
Kazeem Kabirat Damilola	HND/23/SGI/FT/0079	Member
Adeoti Qudus Adebayo	HND/23/SGI/FT/0080	Member
Adeleye Sheriffdeen Olawale	HND/23/SGI/FT/0081	Member
Abdul Qudus Shukurah Temitope	HND/23/SGI/FT/0083	Member
Ogunsuyi Babatunde Sunday	HND/23/SGI/FT/0118	Member

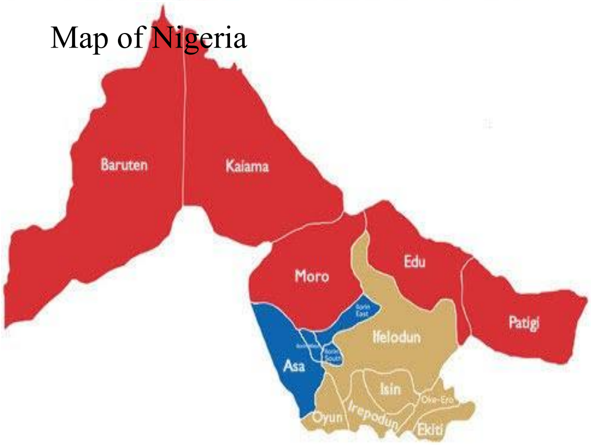
1.6 PROJECT LOCATION

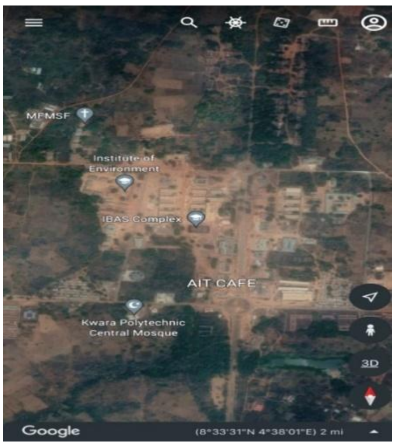
The project site is located inside Kwara state polytechnic Ilorin, Kwara state.

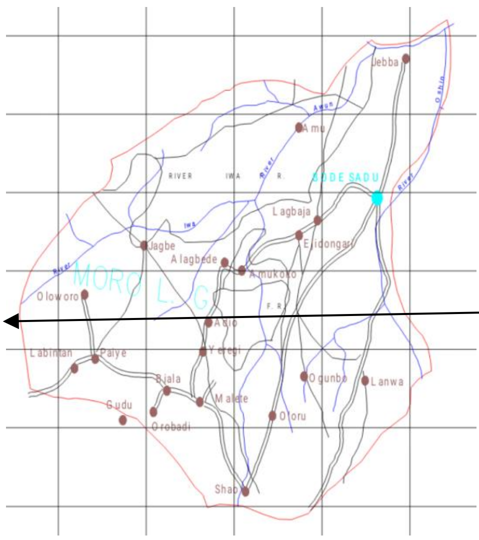


Map of Nigeria

Map of Kwara State







Map of Moro L.G.A

Google Imagery of the Study Area

Google Earth Imagery of the Study Area,