Terrain Analysis, For Determining The Best Location For A Swimming Pool, In Waziri Umaru Federal Polytechnic, Birnin Kebbi, Kebbi State

Uwaezuoke Ifeanyichukwu Christian [1], Adewale Adebayo[2]
and Emenari Udochukwu .S

Department of Surveying and Geoinformatics
Waziri Umaru Federal Polytechnic Birnin Kebbi, Kebbi State.

Abstract: *This research work was carried out by reviewing literatures; obtaining data from the field using Global Positioning System (GPS) Receiver Promark3 at Stop and Go mode, the data obtained were downloaded, adjusted and analyzed using Global Navigational satellite System (GNSS) Solution. It was imported into AutoCAD 2007 with Carlson 2008, where the perimeter was plotted. Surfer (8) software was used to plot the contour and later imported into the Carlson software where it was overlaid on the boundary, the mesh, direction of water flow on the site and 3dimension surface were also plotted in Surfer 8. Analysis was carried out based on the plotting and the need for the swimming pool. The researchers have suggested likely positions for the swimming pool and also selected one as the best fit.*
Keywords: *Terrain analysis, Swimming pool, location, Polytechnic, Birnin Kebbi.*

I.   Introduction

The environment consist of undulations, hill and valleys, in order to successfully execute any meaningful project on this surface, there is a need for a proper knowledge of it constituents, the location of existing structures, possibly valleys and drainages. The title of the research has two key phases whose meaning cannot be overlooked; these phases are Terrain Analysis and Swimming pool.

What is Terrain analysis?   Terrain analysis is the process of collecting, analyzing, evaluating, and interpretation of geographic information of the natural and man-made features of the terrain, combined with other relevant factors, to predict the effect of terrain on human activities, Wilson & Gallant (2000)

It is also a set of techniques used to derive terrain parameter of the Digital Elevation model (DEM), i.e. a process of quantifying the morphology. Terrain analysis is as old as the knowledge of man to solve the problems of the built and un-built environment. It enormous uses includes Extracting terrain parameters for geomorphology, Modeling water flow for hydrology or mass movement (for example avalanches and landslides), Creation of relief maps, Rendering of 3D visualizations, 3D flight planning, Creation of physical models (including raised relief maps), Rectification of aerial photography or satellite imagery, education (terrain correction) of gravity measurements (gravimetry, physical geodesy), Terrain analysis in geomorphology and physical geography, Geographic Information Systems (GIS), Engineering and infrastructure design, Global positioning systems (GPS), Line-of-sight analysis, Base mapping, Flight simulation, Precision farming and forestry, Surface analysis, Intelligent transportation systems (ITS), Auto safety, Advanced Driver Assistance Systems (ADAS), Archaeology, etc. Ünal & Türker,(2002). In like manner, there are various methods of obtaining data for terrain analysis some of these are; LIDAR (Light Detection And Ranging) – measuring distances by illuminating a target with a laser and analyzing the reflected light, Stereo photogrammetry from aerial surveys, Block adjustment from optical satellite imagery, Interferometry from radar data, Real Time Kinematic Global Positioning Systems(GPS), Topographic maps, Theodolite or Total station, Doppler radar, Focus variation, Inertial surveys- the process of ascertaining position and gravity field parameters from measured accelerations. Surveying and mapping drones- Drones can fly lower and slower than traditional aircraft, allowing higher quality aerial imagery to be collected without leaving the user's private property.

Range imaging- Range imaging is the name for a collection of techniques that are used to produce a 2D image showing the distance to points in a scene from a specific point, normally associated with some type of sensor device. The resulting image, the range image, has pixel values that correspond to the distance. Li and Gold (2005) What is a swimming pool? A swimming pool is a man-made container filled with water intended for swimming or other water-based recreation. It can be built either above or in-ground, and be constructed from materials such as concrete, metal, plastic or fiberglass. Pools can be decorative or custom shape and size.

The "great bath" is the earliest public water tank (Swimming Pool) in the ancient world. It existed over 5000 years ago in the Pakistani city settlement of Mohenjo-Daro. The tank itself measures approximately 12 meters north-south and 7 meters wide, with a maximum depth of 2.4 meters. The most prominent pool history

comes from the ancient Greeks and Romans. A major change in the quality of life occurred in these times as individual wealth increased and, with this increase in the standard of living, came luxuries like pools. In AD 305 the Romans built an incredible pool that was over 900,000 square feet. This pool was used for bathing and was also heated by giant fires in the basement beneath the floors of the pool; the columns and walls pumped the heat up to the pool above. However, Competitive swimming was first introduced in the early 1800′s in Britain by the National Swimming Society, at that time, there were man-made indoor pools in London and the National Swimming Society of England used them for swimming competitions. These events became popular in England and led to the formation of the Amateur Swimming Association in 1880. Swimming pools can be found in almost every country throughout the world, even some of the smallest.

Locating the site for a good swimming pool require some information these are the underlying soil should be stable and easy to dig, dry site, with good surface and subsurface drainage. Good drainage conditions will depend on the slope of the land and the nature of the soil. Loam, commonly called "garden soil," is ideal for a pool site in many parts of the country since it's easy to dig. The walls of the excavation will be stable and not likely to collapse. Surface drainage need not be a problem if pool is not built in a low-lying area from which water cannot drain, during storms, muddy water collecting, there can be spill over into the swimming pool, water running off a slope or down a natural drainage path can fill the pool with mud and debris. Pool water drainage involves disposing of the pool water and disposing of the water from the filter when it is serviced.

Specifications of a swimming
- The Size- Perimeter, area and volume E.G Olympic size 50m*25m*2m
- Recirculation- Flow rate, Turn over and Filtrations
- Use – Anticipated Swimmer load (maximum, average and Minimum)
- Water Supply – Source, Quality, Quantity available and Characteristics of the water supply
- Equipment – Detail description of filtration and recirculation equipment
- Calculations – Hydraulic computations including head loss in the piping and recirculation equipment
- Waste water disposal- Type, direction and capacity of waste water disposal system

Statement Of Problems

Waziri Umaru Federal Polytechnic Birnin Kebbi is one of the foremost institutions in Kebbi state offering Surveying and Geoinformatics. In 2010, the Higher National Diploma program was accredited by National Board for Technical Education and Surveyors Council of Nigeria, it is expected that students graduating from the department should acquire skills in a branch of Surveying know as Hydrographic Survey to enable them compete with their counterpart in other institutions offering same. If this is to be achieved, it is paramount to have a swimming pool in the school where students can be train on how to acquire swimming skills such that even if they find themselves in the field where such branch of Surveying is required, they can favorably fit in. This is of immense important especially in those parts of the world where religious believe, won't allow hotel owners to build a swimming pool where such practices can be held, even if the schools don't have one. Therefore, the need for a terrain analysis for the study area for the construction of a swimming pool for the Department of Surveying and Geoinformatics cannot be overlooked.

Aim: Terrain analysis, for determining the best location for a swimming pool, in Waziri Umaru Federal Polytechnic, Birnin Kebbi, Kebbi State.

Objectives
1. To carry out reconnaissance survey of the research area.
2. To use GPS Receiver (Promark 3) in acquiring data needed for the terrain analysis
3. To Process the data obtained from 2 above (Using GNSS solution).
4. To prepare the contour, wire mesh and 3D surface of the terrain
5. To present the results in both analogue and digital format.

Study Area

The research area, Waziri Umaru Federal Polytechnic Birnin Kebbi, Kebbi State took off on 1st October, 1977 then, called The Sokoto State College of Technology when Kebbi State was still under Sokoto State, and was established out of the need to fill in the vacuum for technological skills and man power within the region. The institution is bounded between Birnin Kebbi Arugungu road in the East, Sani Abacha Bypass in the West, Kebbi State Secretariat in the North, and Patrick Aziza road in the South, with area coverage of approximately 4630575.3760m^2. It spread along latitude and longitude (12^0 27'56.63''N, 040 13'12.29''E), (12^0 28'33.14''N, 04^0 14'46.65''E), (12^0 27' 30.80''N, 040 14' 46.65''E) and (12^0 27' 00.70''N, 04^0 13' 43.25''E)
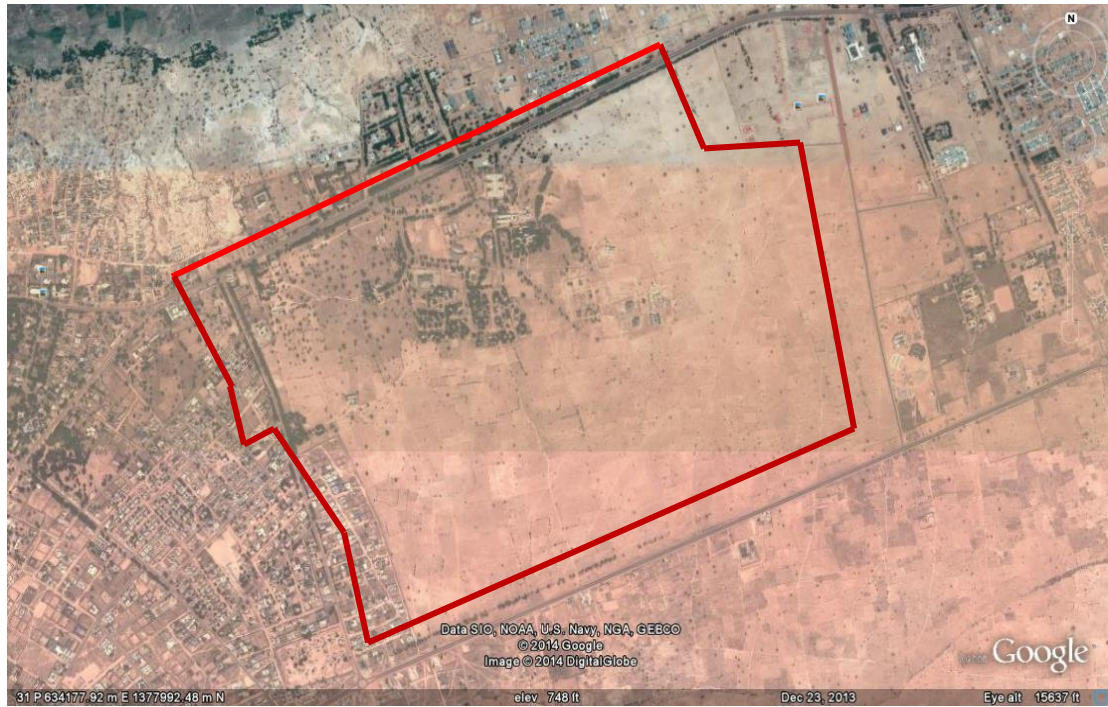
Fig. 1.1 Google image showing the boundary of the Study Area.

II. Methodology

The process involved in acquiring data for this study consist of reconnaissance survey in order to be familiarize with the challenges involved in the study.

Instrument/ Softwares Used
The following are instrument/software used in carrying out the study;
- Complete set of GPS Receiver (Promark 3)
- Laptop Computer HP Pavilion dv6
- HP A_O Plotter
- Tripods
- Global Navigation Satellite System (GNSS) Solution
- AutoCAD 2007 with Carlson 2008
- Surfer 8

Data Acquisition
In acquiring data for this study the instrument used was Complete GPS Receiver (Promark 3),the approximate centre of the study area was determined where the base station was setup at static mode and allowed to tract enough satellite from space for a period of one hour while logging is to take place every 5minutes, after which the Rover was switch on and set at static mode, logging at 5minutes interval and fixing for 15minutes.This was the method used for the perimeter survey which comprises of fifty four (54) stations, administrative boundary and spot heights data were also captured so as to aid in properly understanding the behavior and the nature of the ground.

Data Processing/Plotting
The raw data obtained from the site where copied from the external memory to the C drive of the Laptop and then imported to GNSS solution software where the data was processed, analyzed and adjusted, the report showed that all the points are fixed. The Northing, Easting and Heights of all the points were copied and pasted in excel and save with a file name as CSV Comma delimited. This file was then imported into AutoCAD 2007 with Carlson 2008 attachment in order to plot the boundaries. Contour was plotted in Surfer 8 and exported to AutoCAD 2007.

Analysis

A careful study of the Topography of the area from the plotting reveals that there are two possible locations where a standard size swimming pool of at least 50m by 25m by 2m can be sited in the area.

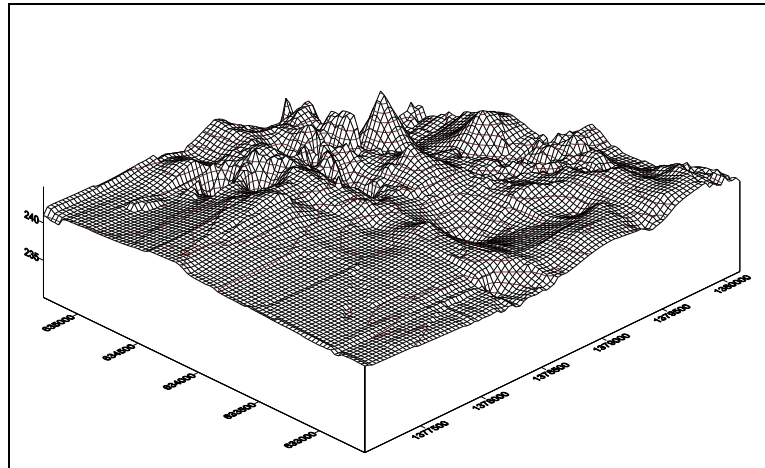Please find attached in softcopy format the perimeter and contour shown in AutoCAD 2007 with Carlson 2008.
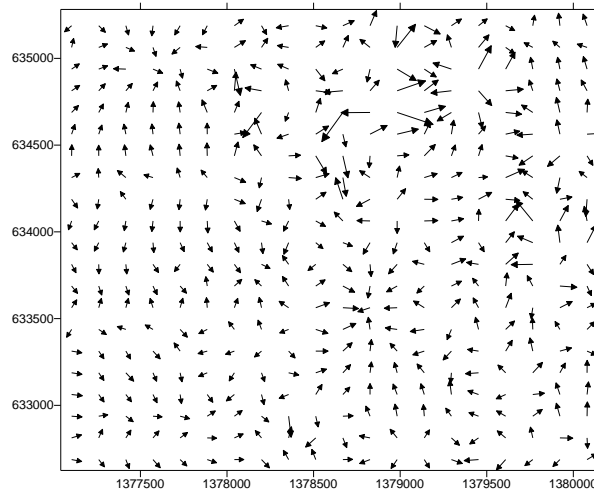

Fig1. Showing Mesh of the whole site

Fig2. Showing the direction of flow of water on the whole site
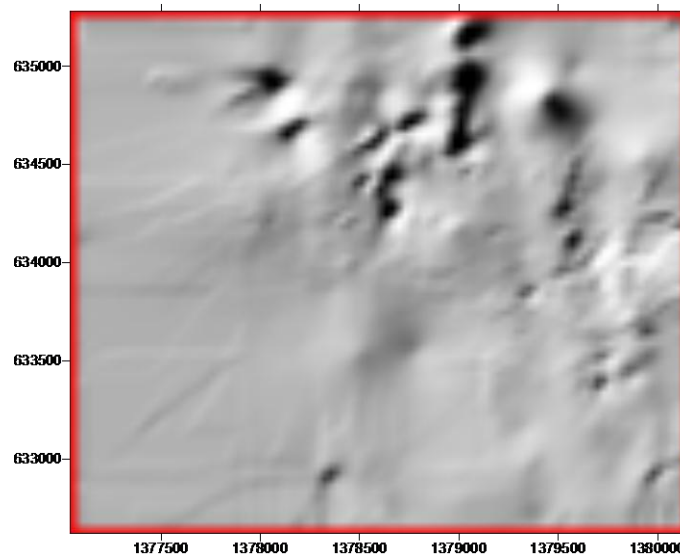

Fig3. Showing the 3D surface of the whole site

The first option is within residential area D, the Staff Primary and Secondary School and Residential area C with the following coordinate (632853.345mE, 1379692.520mN), (632903.345mE, 1379692.520mN), (632903.345mE,1379667.520mN) and (632853.345mE, 1379667.520mN).This location was selected based on the following reasons;

* The Height- since a swimming should be located where water can easily by discharged and be at a location where runoff (flood) cannot easily flow into the pool when there is heavy down pour.
* Its proximity to the sport area and residential area.
* Easy access to bore hole water from the residential area
* The second option is located close to College of Environmental Studies under construction, Entrepreneurship Centre and Residential area A and B with the following coordinates:
* (633642.851mE, 1378828.384mN), (633692.851mE, 1378828.384mN), (633692.851mE, 1378803.384mN) and (633642.851mE, 1378803.384). The location was selected based on the following reasons:
* It has height advantage of 242m which is almost the highest location within the area
* The proximity of the location to the College of Environmental Studies where the Department of Surveying and Geoinformatics is sited which necessitated the essence of the research work.
* Easy access to bore hole water from the residential area
* Easy discharge of water from the swimming pool in all directions.
* From above mentioned options, the second option has been selected as the best location for the siting of the swimming pool based on the following reasons:
* Proximity to the Department of Surveying and Geoinformatics for training which is about 600m as compared to the first option which is 1800m.
* The position is well elevated such that waste water can easily be discharge in any direction as compared the other option
* It is also positioned such that runoff cannot enter into the swimming pool from any direction as compared to the other.
* Apart from the usage by the Department of surveying, the polytechnic community can also benefit, since it is close to the Entrepreneurship Centre, other colleges and the most populated residential area of the Polytechnic.

III. Conclusion

Surveying and Geoinformatics is a profession with a wide range of option in specialization among which is Cadastral surveying, Mining surveying, Photogrammetry, Hydrography e.t.c. The essence of this research work is to determine the best location for a swimming pool to prepare the students from this institution in the aspect of hydrography which is seldom found in the North –West geopolitical zone of Nigeria. From the data gather, plotting's and analysis, the position color blue has been selected as the best location for the swimming pool.

IV. Recommendations

Based on the aforementioned the following recommendations are made:

* The Polytechnic management should assist the department to build the swimming pool so as to help the student to have in depth knowledge of Hydrographic Surveying which will enable them competes with their counterpart in any part of the world.
* Construction of the swimming pool can be a source of revenue generation for the school authority as it can serve as training ground for youngsters in the community.
* Before any institution will be accredited for Higher National Diploma in Surveying and Geoinformatics, National Board for Technical Education (NBTE) should make sure that there is a swimming pool in the school premises where the course is to be offer or one located in a position where students can easily be trained.

References

[1]. Chris, K. Chapter 3 Military Menu: Terrain analysis consideration, U.S Army Engineer School.
[2]. Li, Z., Zhu, Q. and Gold, C. (2005), Digital terrain modeling: principles and methodology|. CRC Press. Boca Raton.
[3]. Ünal,G. & TüKer, M. (2002), Terrain analysis for military operation using Geographic information system, Presented at the international symposium on GIS, September, 2002, Istanbul, Turkey.
[4]. Wilson, J.P., and Gallant, J.C. (2000), Terrain Analysis: Principles and Applications. New York: Wiley. pp. 1–27. ISBN 0-471-32188-5. Retrieved 2014-08-18.