Using of GIS and Leveling Techniques for Determining the Orthometric Heights inside Mosul University

Sabah Hussein ALI[1], Nashwan Kamal-aldeen AL-OMARY[2]

[1]Remote Sensing Center, University of Mosul
[2] Water Resources Engineering, University of Mosul
e-mail:sabah196004@yahoo.com

ABSTRACT

It is possible to determine heights of selective locations through terrestrial means by tying these locations to the sea level. Practical heights in geodesy, known as orthometric heights are referred to the geoid, which is approximated by the mean sea level (MSL).

The orthometric height is defined as the length of the plumb-line (a line that is always normal to the equipotential surface of the gravity field) between the geoid and the point of the interest and such is intimately related to the gravity field of the earth. As the plumb-line is only slightly curved, the length of the plumb-line is practically the same as the length of the normal to the geoid between the geoid and the point of interest. The geoid is a representation of the surface of the earth that it would assume if the sea covered the earth, also known as surface of equal gravitational attraction and mean sea level. The main function of the geoid in geodesy is to serve as a reference surface for leveling. The elevation measured by leveling is relative to the geoid.

Coordinate determination from GPS measurements uses the known positions of satellites and the measured distance between satellites and the unknown points. In principle, this methodology applies to both point and relative (differential) positioning. The heights directly derived from GPS measurements are geodetic heights referred to the ellipsoid defined by the World Geodetic System1984:WGS84.

Mosul University campus lacks from necessary bench marks of a known geographical coordinates and elevation which are very important for the surveying applications. These points are also necessary for undergraduate dealing with the surveying training in the most scientific colleges inside the campus of the University.

In the present study, A GPS and conventional leveling techniques were used to establish a network of (15) control points distributed inside Mosul University Campus, to be as a bench marks for the surveying applications which are very important and necessary for the civil engineering workshop and for the training courses that have been adopted in the related scientific colleges of the Mosul University. These bench marks are also important in the geological application, for the purpose of data reductions to produce the Bouguer anomaly map.

The leveling measurements of the (15) points were carried out by using leveling instrument from Leica (Type: NAK2) with an accuracy of (cm). The determination of the reduce level of these points were calculated by applied the height of instrument technique. The orthometric heights of the reference point (that have been adopted for the reduction of the 15 points) have been calculated from GPS measured height and the Earth Gravitational Model1996: EGM96.

The coordinate measurements of these points also fixed by using the GPS receiver (GARMIN Etrex Vista color GPS unit). The orthometric heights that have been determined from this study are ranging from (216.61m) to (243.719m) according to the topographical variation of University campus.

ArcGIS 9.1 software was applied in the study for the georeferencing process of the measured spatial data obtained from the GPS receiver (for the all control points) on the study map (IKONOS satellite image in MrSID format).

***Keywords**: GPS, orthometric height, mean sea level, GIS*