

# Comparison on Measurement of a Building using Total Station, ArcGIS and Google Earth

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**Abstract** - The land surveying is the techniques of determining the three dimensional points, distances and the angle between them, these points are usually on the surface of the earth. Traditionally, this has been done by using tools like tape measurements, rulers and total station which will consume lot of time as well as effort. Hence we are proposing an efficient method in which a person will give various geographical information. Thus this proposed ArcGIS application will be able to perform land surveying in an efficient, user friendly and cost effective manner.

**Key Words:** ArcGIS, Google Earth, and Total-station.

## 1. INTRODUCTION

In surveying, there are many different disciplines that use geodetic instruments to determine the whereabouts of points of interest. Disciplines such as map production, cadastral surveying, measuring and stakeouts on building sites, machine control and flooding risk analysis are examples among others. Nowadays, there are a large of techniques available for measuring a buildings / areas etc., Mapping is a central function of Geographic Information System, which provides a visual interpretation of data. GIS store data in database and then represent it visually in a mapped format. It is not necessary to be a skilled cartographer to create maps. Google Earth, and ArcGIS are the best example for web based GIS measuring solution. The GIS will used for varies field works namely, Imagery, elevations, transportations, addresses, boundaries, water features, and a survey control. A total-station is a combined electronic theodolite and electronic distance measuring device. With the aid of trigonometry, the angles and distances may be used to calculate the co-ordinates of surveyed points in absolute terms. Measuring datas can be saved in internal or external memory of the totalstation instrument.

### 1.1 Esri (Environmental Systems Research-Institute)

It is an international supplier of geographic information system (GIS) software, web GIS and geo-database management applications. The company is headquartered in Redlands, California. In 2014, Esri had approximately a 43 percent share of the GIS software market worldwide, more than any other vendor. Esri uses the name

ArcGIS to refer to its suite of GIS software products, which operate on desktop, server, and mobile platforms. ArcGIS also includes developer products and web services. In a general sense, the term GIS describes any information system that integrates, stores, edits, analyzes, shares and displays geographic information for informing decision making. The term GIS-Centric, however, has been specifically defined as the use of the Esri ArcGIS geo-database as the asset and feature data repository central to computerized maintenance management systems (CMMS) as a part of enterprise asset management and analytical software systems.

### 1.2 Total station

A total station is an electronic/optical instrument used for surveying and building construction. It is an electronic transit theodolite integrated with electronic distance measurement (EDM) to measure both vertical and horizontal angles and the slope distance from the instrument to a particular point, and an on-board computer to collect data and perform triangulation calculations. Robotic or motorized total stations allow the operator to control the instrument from a distance via remote control. This eliminates the need for an assistant staff member as the operator holds the retro-reflector and controls the total station from the observed point. These motorized total stations can also be used in automated setups known as Automated Motorized Total Station (AMTS). The best quality total stations are capable of measuring angles to 0.5 arc-second. Inexpensive "construction grade" total stations can generally measure angles to 5 or 10 arc-seconds.

### 1.3 Google Earth

Google Earth displays satellite images of varying resolution of the Earth's surface, allowing users to see things like cities and houses looking perpendicularly down or at an oblique angle, with perspective. The degree of resolution available is based somewhat on the points of interest and covered in at least 15 meters of resolution. Google Earth allows users to search for addresses for some countries, enter coordinates, or simply use the mouse to browse to a location.

## 2. SURVEYING FIELD

As much known to many people in the engineering field, the surveying process is the base and start point for almost all projects. That is to say, prior, during or even after design, construction or field work, surveying measurements will be taken, whether for fixation of control reference points, setting out of previously determined points onsite or production of maps and quality control. Few examples of such applications include; water pipelines layout, establishment of residential complexes, excavation works, deformation monitoring, etc. This can be done by different instruments and techniques varying in technology, price and application.

### 2.1 Traditional Surveying Methods

Previously, surveying application in urban survey projects included mainly the use of regular tapes distance measurements and optical theodolites for angular measurements. Different kind of tapes varying in length and material were used in measuring the boundaries and details of buildings and complexes. However, this technique – although its simplicity and cheap price of the used tool- has many disadvantages, starting with various errors accompanied with the tape, such as sagging especially in long distances, difference of nominal length and temperature effect....etc. Optical theodolites were quite handy and popular in angular and direction measurements in order to maintain building corners especially non right angle corners, but similar to the use of tapes, at the end large amount of data are required to be taken, displayed and then saved and copied, in addition to all this, the whole field operation being time consuming and executed using extensive manpower.

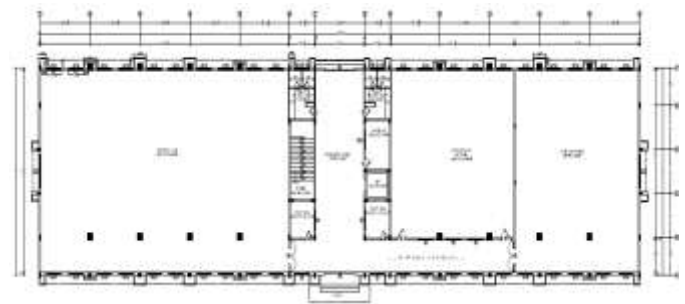
### 2.2 Modern Surveying Methods

Recently, many modern surveying instruments are used in various projects and applications, mainly total stations and GPS equipment. Total stations combine both distance measuring device (EDM) along with angular measuring equipment (Theodolite) together with processor and memory, in order to observe, calculate and save direct boundaries corners and features in their local or global coordinate (Easting, Northing, Height) format. GPS receivers wither geodetic precise ones or less accurate navigators, observe continuously rotating satellite signals from sky, and again determine the global coordinates of surveyed points relative to the Global datum. The wide use of the aforementioned instruments comes from their efficiency, or in other words easiness of data sampling, storage and display. This will of course lead to reduction in manpower needed as well as required field and even office work time. However, these advantages will surely be accompanied with slight disadvantages, which should be compared versus their benefit of usage. Now speaking about disadvantages, price of used instruments here in is one good example, as total

stations are minimum three time expensive than regular digital theodolites, while geodetic GPS receivers being at least 7 times more. However, regular navigators are cheap in price; quarter the price of digital theodolites, but they sure will propose degraded accuracy. Concerning GPS receivers, various errors will affect GPS positioning, either from satellites, atmosphere or receivers. However, most of these errors can be modeled and thus reduced by adopting several techniques such as differencing between two receivers, i.e. relative positioning, some errors will still evolve in the solution, especially the inevitable multipath error, caused by receiving signals from more than one path.

## 3. PRACTICAL ON THE FIELD

After presentation of the different techniques to be adopted in the current research, the theoretical applied part in this research will be introduced, regarding the case study area, and surveying of the building complex using both traditional and modern instruments.



**Fig -1:** Totalstation Field work Out-pup



**Fig -2:** GOOGLE MAP Practical Out-pup by using a software



Fig -3: ArcGIS Practical Out-put by using a software

#### 4. Comparison on the Totalstation, Google map and a ArcGIS

| Parameter               | Totalstation  | Google Map   | ArcGIS Software  |
|-------------------------|---|--|--|
| Type of usage           | Instrument (authorist person only can handle)         | Software (unauthorist persons can handle the software) | Software (unauthorist persons can handle the software) |
| Measuring period        | It will take some time to measure the building / land | It will take just a 10 min to measure a 50cent.        | It will take just a 10 min to measure a 50cent.        |
| Accuracy of measurement | It will give accurate measurement                     | It will not gives an accurate measurement              | It will give a accurate measurement of the building    |

#### 5. Conclusion

This research paper will help to Survey the land/ Buildings,etc., by easy way to the construction sectors. Dr.N.G.P Institute Of Technology, at Coimbatore was monitored using ArcGIS, Google map and by using Total Station to determine its structural integrity and to compare the accuracy of the horizontal methods so as to determine which of them is better in terms of accuracy which in turn will enable users (Surveyors, Geodesist, Engineers, etc.) to decide on the method to employ as regards the purpose of measurement, the magnitudes and direction of the expected displacements of any engineering structure to be monitored.

The results of this research has shown that the building was stable during the period of observation. For this reason, the building is still fit for usage. The research has also shown that the ArcGIS method is better than the total station method and a Google Earth in terms of accuracy for deformation monitoring of engineering structures. This will

assist users to decide on the method to apply as the selection of method depends upon the accuracy requirements which in turn are determined by the purpose of measurements and by the magnitude and direction of the expected deformation or movements.

This ArcGIS software helps in land surveying which will have advantages like, reduction in time consumptions, Elimination of workers compensation charges, and also helps in a land trading.

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