Land Survey

Name of Writer

Affiliations

**Four Basic Principles of Land Surveying**

Four basic principles of Land surveying are

1. working from whole to part
2. Giving importance to scientific honesty
3. Check on measurements
4. Accuracy and precision

However, a fifth some sources also claim the fifth point i.e. the economy of accuracy and its influence on the choice of equipment.

**Working from whole to part**

It is a basic principle to start from a whole part and then move on to the details. In this principle, we first fixed the positions of overall boundaries and then move towards adding the details to those fixed and controlled parts. As it is easy to then confine those details within already controlled boundaries (Whyte & Paul, 1997). Even if some errors arise it will be in between those boundaries and any change needed will be confined to it only.

**Giving Importance to Scientific Honesty**

All the notes regarding the dimensions given should be taken with honestly as it has to be assessed later in calculations. All the dimensions should be practically carried out at the field of survey, and should not be cooked or altered in the office later on.

**Check on Measurements**

All the measurements in a survey should be taken with concentration. It has to be taken in such a way that before even the completion of survey the error becomes obvious. A check should be maintained on all the calculations that are being done. Unit conversions and use of the same unit system should be endorsed.

**Accuracy and Precision**

Accuracy and precision should be maintained as a structure built on an inaccurately built or taken measurements will, later on, cause difficulties for the survival of people and the structure itself. A small deviation from the standard mean is though acceptable and is considered accurate. Similarly, the selection of instruments used will have a greater effect on the accuracy and cost of the project. If the accuracy of 1/500 is required then using an instrument with an accuracy of 1/100 will be of no use.

**Surveying Equipment**

Some of the different types of surveying equipment used in the survey are Vernier Theodolite, Prismatic compass and Abney Level, etc.

**Vernier Theodolite**

Theodolite is one of the main instruments used in surveying. It is usually used for the measurement of extending survey lines, horizontal and vertical angles, location of lines on a point and to find the difference in the level of two points. It mainly consists of a level head, an eyepiece, a plate level, a telescope, a vertical axis, etc. most commonly used theodolites are Vernier theodolites but micrometer theodolites are also being used.

**Prismatic Compass**

This is a type of compass which is used when the required accuracy is not very high. It is usually used for surveys of areas where accuracy or time is not a requirement of highest level e.g. surveys of rough roads. It mainly consists of a mirror, graduated disc, reflecting prism, eye vane, etc. Although this is a hand instrument its results can be amplified by using it on a tripod.

**Abney Level**

Abney levels are used to measure angles, grades, and altitudes using trigonometry. It consists of a tube and a movable bubble connected to it through a pointing arm (*Using an Abney Level to measure relative Heights.pdf*, n.d.). Its accuracy is very good and it is also very easy to use. For better accuracy of the Abney level, it is best to use it with another person of the same height.

**Geodetic surveys**

Geodetic surveys are of large scale, surveys that involve land on a nationwide level. These types of surveys can be used for the measurement or mapping of an entire continent. It can also be used for advanced studies like finding a magnetic field of the earth, changes on earth surfaces, etc. It is of very high accuracy, and require complex calculations. These surveys are mostly used for large areas. As these surveys are carried out a large scale, so the curvature of earth surface should be accounted for while calculations. A line joining any two points is hence considered as an arc while the triangle is considered spherical in this form of survey methods. It is good for providing control points, and then small surveys work inside those control points.

**Plane Surveys**

While plane surveys are usually considered for smaller areas, where earth surface is considered plane and curvature are not taken into account. Survey accuracy is comparatively low. Normal surveying instruments like theodolite and prismatic compasses are being used. Two points that join to form a line is considered straight instead of an arc while the triangle is considered plane instead of spherical. This type of surveys is mainly used in engineering projects such as railways, roads, and other constructions.

**Error**

Error is usually defined as a difference of values between data that is observed while and the actual value of that data. In reality, we cannot measure true data because of the error associated with every instrument. When we claim to have found the true value, it is the observed value plus-minus whatever is the limitations of the instrument we are using. These limitations can arise in the form of personal errors, physical properties of a measuring system or some unknown environmental or physical attributes. Unknown or random errors are likely to be lesser in value and can be corrected up to some extent by the method of taking mean and repeated data collection. Due to these limitations, we mostly rely on observed values.

**Residual**

Residual is generally defined as a difference between an observed value through calculations and predicted values. Error is a generic theoretical term which is challenging to perceive but residual can be measured or estimated with the help of a sample. Residuals are the difference between those estimated values and observed values in the model. So what we do is we use residuals to approximate errors.

**Accuracy**

Accuracy is to be on point. It represents how closely the results that we want are in agreement with standard values. It shows the degree of correctness. Accuracy is the quality of your result and how are they confined with the standard values. It is the measures of exactness of achieved result as compared with the standard values. If achieved results are closer with the standard values, the accuracy of the results will be that much higher. For example, if someone is measuring the volume of a one-meter cube box and gets the result like 0.99,0.98 and 1.01 then it will be considered very accurate.

**Precision**

Precision is repeatability and consistency in results. While accuracy represents the degree of correctness, precision signifies the degree of consistency. For a measurement to be more precise the variance between data of similar groups should be minimum. It is the closeness of individual measurement with each other in the same group of data collection. It can also be defined as how often the same result can be reproduced. For example, in data set if we get values like 10.5, 10.4, 10.6 then they are very precise, but if the resulted values are 10.5, 10.3 and 10.9 then we can say that this data set is not precise.

**Leveling**

The objective of leveling is to determine the heights of different objects relative to the surface of the ground, whether it is above or below it. Its purpose is to determine the layout for water supply, sanitation, etc. It is also used to determine the longitudinal or cross-sectional area for construction or the alignment of canals and roads. It deals with measurements in a vertical plane. Heights are measured relative to place or another height. If all the heights are measured in a plane, then the plane will be known as a datum (Bannister, 2006). In topographical measurement, heights are taken relative to sea level. It is done so to make the international comparisons of height with ease. Leveling is a simple process and we set up the instrument at a certain known level within a certain distance. A rod is placed vertically at that point and we use the instrument to measure the height from that rod. This rod is then placed at another unidentified point with unknown height and the measurements are then taken accordingly of that point as well.

The readings measured at every point, where the staff or rod was placed are known as temporary adjustments (Basak, 1994). A level is the surface is a one that is considered parallel to the surface of the earth, if the level is on a large distance then the curvature is accounted for. But a classical example of a level surface is water surface of a still lake. A horizontal surface in leveling is said to be a surface that is tangential to the level surface at any point. Similarly, a vertical surface is one that is perpendicular to a horizontal line. The initial height that is measured with an instrument is known as back sight while the last one is known as foresight. Dumpy level tilting level and automatic level are some types of leveling instruments.

**References**

Whyte, W. S., & Paul, R. E. (1997). *Basic surveying*. Routledge.

Bannister, A. (2006). *Surveying* (Vol. 1). Pearson Education India.

Basak, N. N. (1994). *Surveying & Levelling*. McGraw-Hill Education.