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SURVEY1 DIPLOMA IN CIVIL ENG AND BUILDING TECH

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SURVEY ONE INTRODUCTION

- Surveying is defined as taking a general view of, by observation and measurement determining the boundaries, size, position, quantity, condition, value etc. of land, estates, building, farms mines etc. and finally presenting the survey data in a suitable form. This covers the work of the valuation surveyor, the quantity surveyor, the building surveyor, the mining surveyor and so forth, as well as the land surveyor.

Another school of thought define surveying as the act of making measurement of the relative position of natural and manmade features on earths surface and the presentation of this information either graphically or numerically.

The process of surveying is therefore in three stages namely:

- **Taking a general view**

- This part of the definition is important as it indicates the need to obtain an overall picture of what is required before any type of survey work is undertaken. In land surveying, this is achieved during the reconnaissance study.

- **Observation and Measurement**

- This part of the definition denotes the next stage of any survey, which in land surveying constitutes the measurement to determine the relative position and sizes of natural and artificial features on the land.

- **Presentation of Data:**

- The data collected in any survey must be presented in a form which allows the information to be clearly interpreted and understood by others. This presentation may take the form of written report, bills of quantities, datasheets, drawings and in land surveying maps and plan showing the features on the land.

PURPOSE OF SURVEY

The purposes of surveying are summarized as follow,

1. To prepare map of earth above or below sea level.
2. To establish property boundaries of private and public lands.
3. To measure area and volume of lands.
4. To establish permanent control points from which engineering projects surveys may be referred.
5. To produce up-to date plans of the areas in which engineering projects are to be built.
6. To ensure that the construction is built in its correct relative and absolute position on the ground (setting out) i.e. roads sewers & buildings etc.
7. To select suitable site or route for any building, road, sewer lines, irrigation channels and other engineering projects.

Types of Surveying

- On the basis of whether the curvature of the earth is taken into account or not, surveying can be divided into two main categories:

Plane surveying

- is the type of surveying where the mean surface of the earth is considered as a plane. All angles are considered to be plane angles. For small areas less than 250 km2 plane surveying can safely be used. For most engineering projects such as canal, railway, highway, building, pipeline, etc constructions, this type of surveying is used. It is worth noting that the difference between an arc distance of 18.5 km and the subtended chord lying in the earths surface is 7mm. Also the sum of the angles of a plane triangle and the sum of the angles in a spherical triangle differ by 1 second for a triangle on the earths surface having an area of 196 km2.

Geodetic surveying:

- is that branch of surveying, which takes into account the true shape of the earth (spheroid).
  - In geodetic survey, large areas of the earth surface are involved usually on national basis where survey stations are precisely located large distances apart. Account is taken of the curvature of the earth, hence it involves advanced mathematical theory and precise measurements are required to be made.
  - Geodetic survey stations can be used to map out entire continent, measure the size and shape of the earth or in carrying out scientific studies such as determination of the Earth□s magnetic field and direction of continental drifts.

Classification of surveying

- For easy understanding of surveying and the various components of the subject, we need a deep understanding of the various ways of classifying it.

Objective

- To enable the students have understanding of the various ways of classifying surveying Classification Of Surveying
- Surveying is classified based on various criteria including the instruments used, purpose, the area surveyed and the method used.

Classification on the Basis of Instruments Used.

- Chain tape surveys
- Compass surveys
- Plane table surveys
- Theodolite surveys

i. Tape and offset survey.
ii. Compass survey.
iii. Plane table survey
iv. Theodolite survey
v. Total Station Survey
vi. Aerial Survey
vii. Remote sensing
viii. GPS survey
ix. GIS

Classification based on the surface and the area surveyed

1) Land survey

- Topographic survey: This is for depicting the (hills, valleys, mountains, rivers, etc) and manmade features (roads, houses, settlements) on the surface of the earth.
- Cadastral survey is used to determining property boundaries including those of fields, houses, plots of land, etc.

- City surveys: The surveys involving the construction and development of towns including roads, drainage, water supply, sewage street network, etc, are generally referred to as city survey.
- Engineering survey is used to acquire the required data for the planning, design and Execution of engineering projects like roads, bridges, canals, dams, railways, buildings, etc.

Marine or Hydrographic Survey:

- Those are surveys of large water bodies for navigation, tidal monitoring, the construction of harbours etc.

Astronomical Survey:

- Astronomical survey uses the observations of the heavenly bodies (sun, moon, stars etc) to fix the absolute locations of places on the surface of the earth.

CLASSIFICATION ON THE BASIS OF PURPOSE

- Engineering survey
- Control Survey:

  Control survey uses geodetic methods to establish widely spaced vertical and horizontal control points.
- Geological Survey

  Geological survey is used to determine the structure and arrangement of rock strata. Generally, it enables to know the composition of the earth.
- Military or Defence Survey is carried out to map places of military and strategic importance
- Archeological survey is carried out to discover and map ancient/relies of antiquity

Classification Based On Instrument Used

- Chain/Tape Survey: This is the simple method of taking the linear measurement using a chain or tape with no angular measurements made.
- Compass Survey: Here horizontal angular measurements are made using magnetic compass with the linear measurements made using the chain or tape.
- Plane table survey: This is a quick survey carried out in the field with the measurements and drawings made at the same time using a plane table.
- Leveling

This is the measurement and mapping of the relative heights of points on the earths surface showing them in maps, plane and charts as vertical sections or with conventional symbols.

- Theodolite Survey:

Theodolite survey takes vertical and horizontal angles in order to establish controls

CLASSIFICATION BASED ON THE METHOD USED

- Triangulation Survey

In order to make the survey, manageable, the area to be surveyed is first covered with series of triangles. Lines are first run round the perimeter of the plot, then the details fixed in relation to the established lines. This process is called triangulation. The triangle is preferred as it is the only shape that can completely over an irregularly shaped area with minimum space left.

- Traverse survey:
- If the bearing and distance of a place of a known point is known: it is possible to establish the position of that point on the ground. From this point, the bearing and distances of other surrounding points may be established. In the process, positions of points linked with lines linking them emerge. The traversing is the process of establishing these lines, is called traversing, while the connecting lines joining two points on the ground. Joining two while bearing and distance is known as traverse. A traverse station is each of the points of the traverse, while the traverse leg is the straight line between consecutive stations. Traverses may either be open or closed.

BRANCHES OF SURVEYING

- **Aerial Surveying**

  - Aerial surveys are undertaken by using photographs taken with special cameras mounted in an aircraft viewed in pairs. The photographs produce three- dimensional images of ground features from which maps or numerical data can be produced usually with the aid of stereo plotting machines and computers.

Hydrographic Surveying (Hydro-Survey)

- Hydro survey is undertaken to gather information in the marine environment such as mapping out the coast lines and sea bed in order to produce navigational charts.

Geodetic Survey:

- In geodetic survey, large areas of the earth surface are involved usually on national basis where survey stations are precisely located large distances apart. Account is taken of the curvature of the earth, hence it involves advanced mathematical theory and precise measurements are required to be made.

- Geodetic survey stations can be used to map out entire continent, measure the size and shape of the earth or in carrying out scientific studies such as determination of the Earths magnetic field and direction of continental drifts.

Plane Surveying

- In plane surveying relatively small areas are involved and the area under consideration is taken to be a horizontal plane. It is divided into three branches.
  - Cadastral surveying
  - Topographical surveying
  - Engineering surveying

Cadastral surveying

- These are surveys undertaken to define and record the boundary of properties, legislative area and even countries.
- It may be almost entirely topographical where features define boundaries with the topographical details appearing on ordinance survey maps.
- In the other hand, markers define boundaries, corner or line points and little account may be taken of the topographical features.

Topographical Survey

- These are surveys where the physical features on the earth are measured and maps/plans prepared to show their relative positions both horizontally and vertically
- The relative positions and shape of natural and man –made features over an area are established usually for the purpose of producing a map of the area of for establishing geographical information system.

Engineering Survey

- These are surveys undertaken to provide special information for construction of Civil Engineering and building projects.

- The survey supply details for a particular engineering schemes and could include setting out of the work on the ground and dimensional control on such schemes.

BASIC PRINCIPLES IN SURVEYING

- **PRINCIPLE OF WORKING FROM WHOLE TO PART**

  It is a fundamental rule to always work from the whole to the part. This implies a precise control surveying as the first consideration followed by subsidiary detail surveying.

This surveying principle involves laying down an overall system of stations whose positions are fixed to a fairly high degree of accuracy as control, and then the survey of details between the control points may be added on the frame by less elaborate methods

- Once the overall size has been determined, the smaller areas can be surveyed in the knowledge that they must (and will if care is taken) put into the confines of the main overall frame.

- Errors which may inevitably arise are then contained within the framework of the control points and can be adjusted to it.

- Surveying is based on simple fundamental principles which should be taken into consideration to enable one get good results.

- Working from the whole to the part is achieved by covering the area to be surveyed with a number of spaced out control point called primary control points called primary control points whose pointing have been determined with a high level of precision using sophisticated equipment. Based on these points as theoretic, a number of large triangles are drawn. Secondary control points are then established to fill the gaps with lesser precision than the primary control points. At a more detailed and less precise level, tertiary control points at closer intervals are finally established to fill in the smaller gaps.

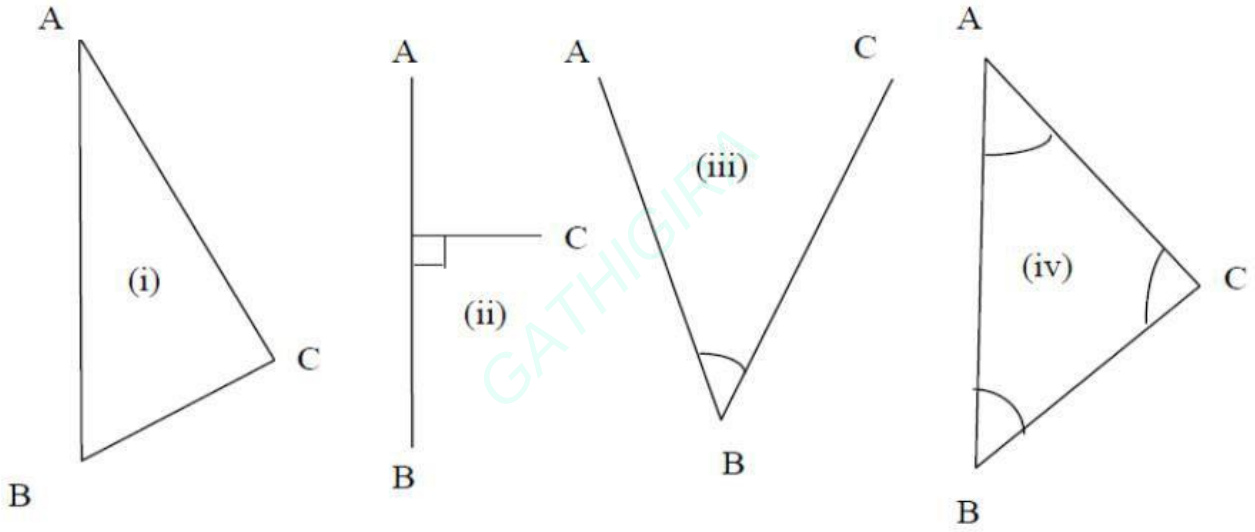
- The main purpose of surveying from the whole to the part is to localize the errors as working the other way round would magnify the errors and introduce distortions in the survey. In partial terms, this principle involve covering the area to be surveyed with large triangles. These are further divided into smaller triangles and the process continues until the area has been sufficiently covered with small triangles to a level that allows detailed surveys to be made in a local level. Error is in the whole operation as the vertices of the large triangles are fixed using higher precision instruments

- **Using measurements from two control parts to fix other points**.
- Given two points whose length and bearings have been accurately determined, a line can be drawn to join them hence surveying has control reference points. The locations of various other points and the lines joining them can be fixed by measurements made from these two points and the lines joining them. For an example, if A and B are the control points, the following operations can be performed to fix other points.

- Using points A and B as the centers, ascribe arcs and fix (where they intersect).
- Draw a perpendicular from D along AB to a point C.

To locate C, measure distance AB and use your protractor to equally measure angle ABC.

- To locate C the interior angles of triangle ABC can be measured. The lengths of the sides AC and BC can be calculated by solving the triangle.


A
(i)
C
B
A
C
(ii)
B
A
C
(iii)
B
A
(iv)
C
B

a) By Angular Measurement only;

To locate the position of C the angle α and β are measured from control point A and B respectively of survey line AB (fig. 1.5 a) It is used in triangulation survey.

b) By Linear measurements only;

The length AC and BC are measured from control points A and B respectively and plotted. The position of C is located provided that AC + BC > AB (fig. 1.5b). It is called trilateration. Due to introduction of electronically distance measurement (EDM) instruments, it is mostly used in precise survey work.

c) By Linear and Angular measurements

i) **By polar coordinate system**. Measure angle α at point A on known the line AB and measure distance AC (fig. 1.5c). This method is used in traverse survey.

REF

- FUNDAMENTAL OF SURVEYING
- SURVEY HANDBOOK
- SURVEY MADE EASY NOTES
- SURVEYING BANNISTER
- MY NOTES

END

THANKS

BY

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