

TACHOMETRIC SURVEY

DEFINITION

Tacheometry is the branch of surveying in which both horizontal and vertical distances between points are determined from instrumental observations, and thus the following advantages:-

- a . Use of chains and tapes is dispensed with and hence the convenience of surveying particularly in broken area, deep ravines, water bodies etc.
- b . Corrections like slope , tension , sag etc avoided.
- c . Rapid work.
- d. Better accuracy in difficult areas.

PURPOSE

Topographic survey for different engineering applications like Town Planning , canals , reservoirs , railways etc.

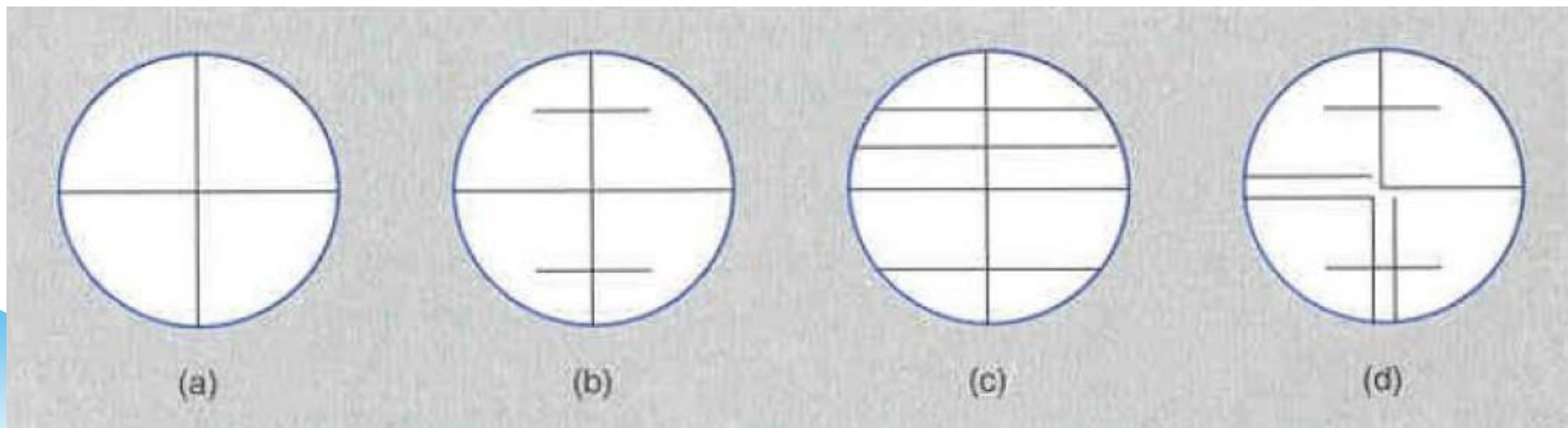
TACHOMETRIC SURVEY

Tachometric Survey:

It is a method of surveying in which horizontal distances and (relative) vertical elevations are determined from subtended intervals and vertical angles observed with an instrument.

Instruments:

Tachometer: A tachometer which essentially nothing more than a theodolite fitted with stadia hairs is generally used for tachometric surveying. Different forms of stadia diaphragms commonly used in tachometers are shown below:



TACHOMETRIC SURVEY

Instruments (Contd...)

Stadia Rods: For short distances (upto 100m), ordinary leveling staff may be used. For greater distances, the stadia rods 3 to 5 metres in length are used. In order to provide good visibility at long distances, stadia rods are typically wider than leveling rods with larger markings.

Systems of Tachometric Measurement:

Depending on the type of instrument and methods/types of observations, tachometric measurement systems can be divided into two basic types:

1. **Stadia systems**
2. **Non-stadia systems/Tangential Systems**

1. Stadia Systems:

In this system staff intercepts, at a pair of stadia hairs present at diaphragm, are considered. The stadia system consists of two methods:

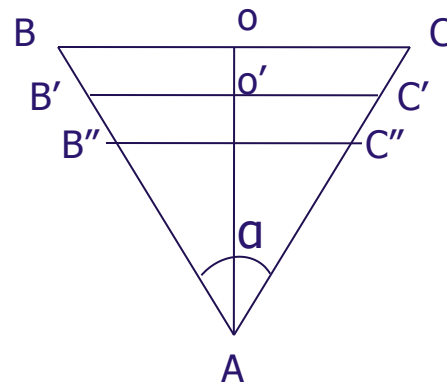
- a. **Fixed-hair method**
- b. **Movable-hair method**

a. Fixed Hair or Stadia Method:

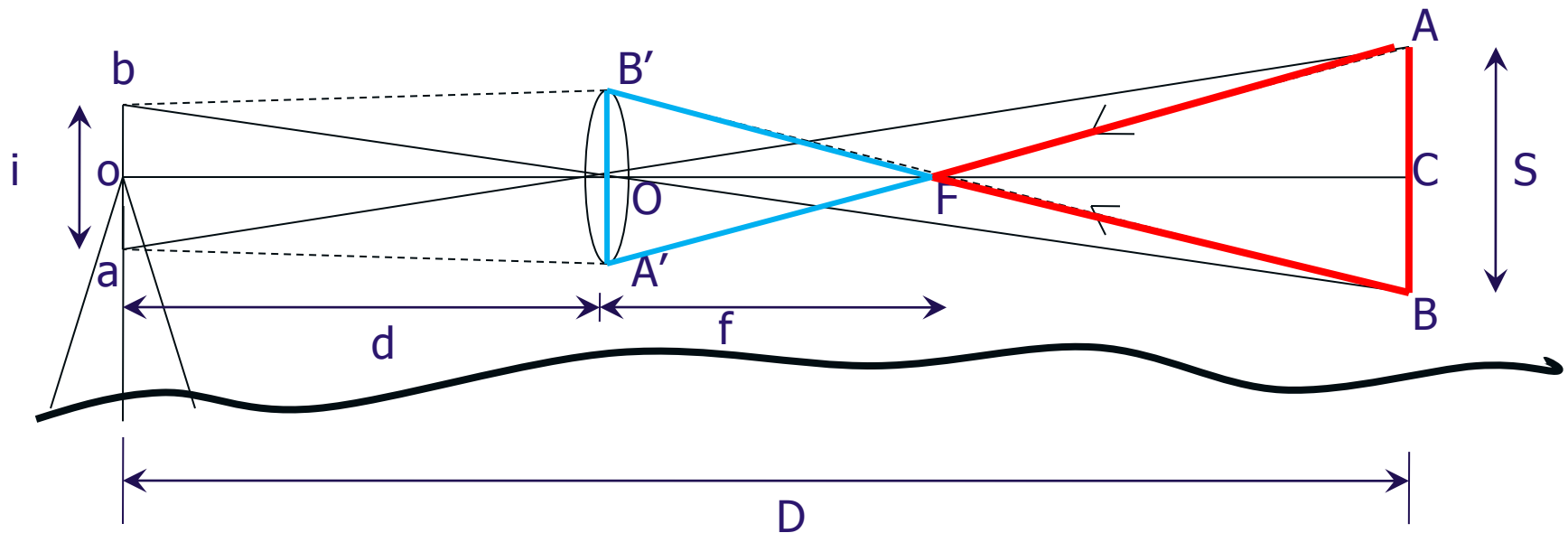
It is the most prevalent method for tachometric surveying. In this method, the telescope of the theodolite is equipped with two additional crosshairs, one above and the other below the main horizontal hair at equal distances. These additional crosshairs are known as stadia hairs.

Stadia Method Principle:

In Isosceles triangles, the ratio of the perpendiculars from the vertex on their bases and their bases is constant.



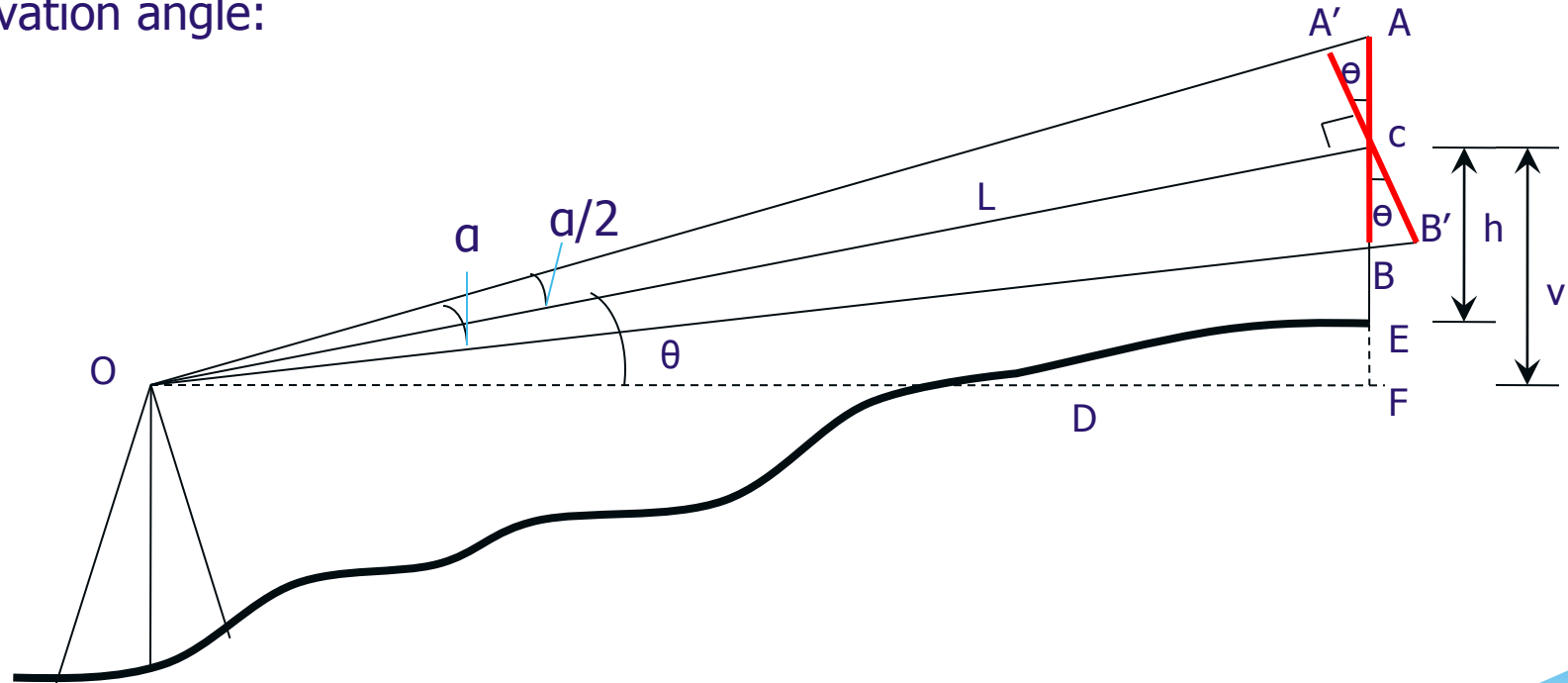
a. Distance and Elevation formula for Horizontal Sights by fixed Hair Method.



b. Distance and Elevation formulae for inclined sights with staff vertical:

It is usual that the line of sight of the tachometer is inclined to the horizontal. Thus, it is frequently required to reduce the inclined observations into horizontal distance and difference in elevation

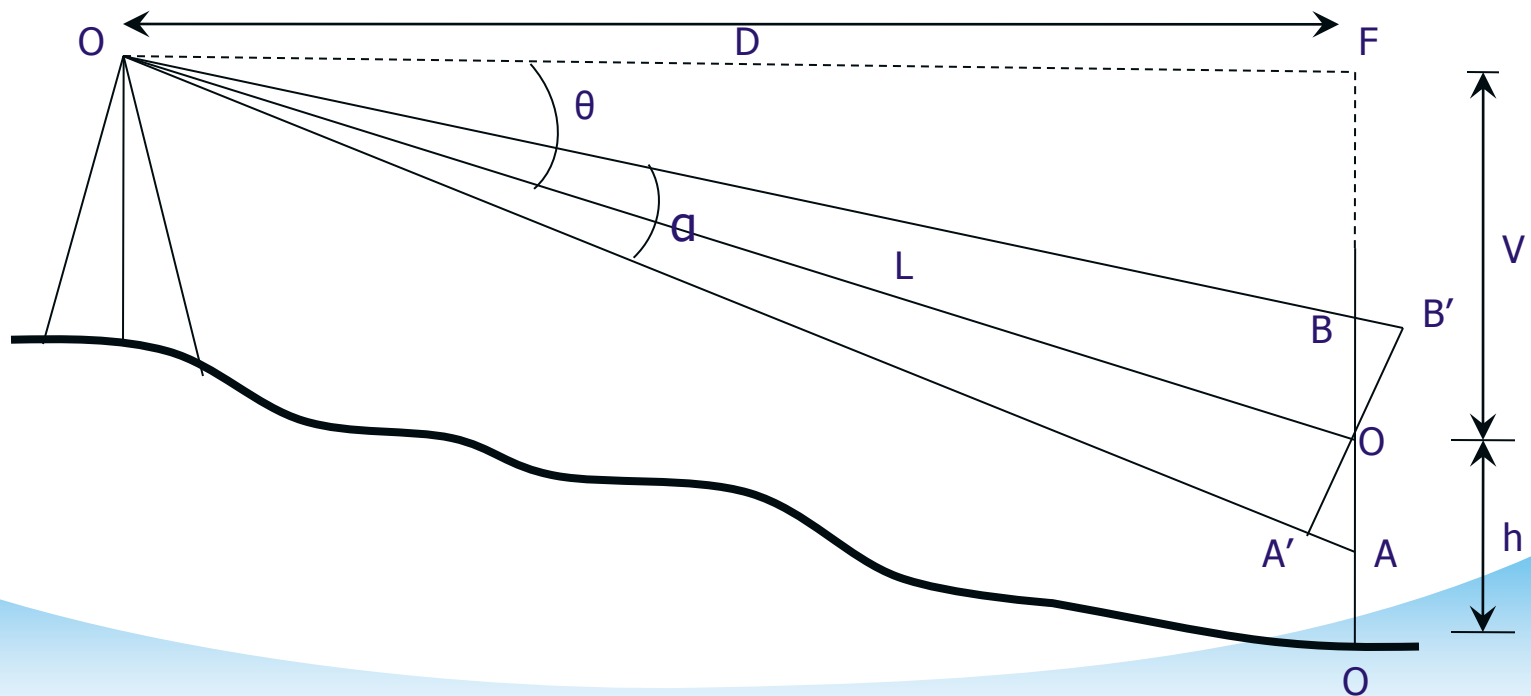
Elevation angle:



b. Distance and Elevation formulae for inclined sights with staff vertical:

It is usual that the line of sight of the tachometer is inclined to the horizontal. Thus, it is frequently required to reduce the inclined observations into horizontal distance and difference in elevation

Depression angle:



Uses of Stadia Method:

1. The stadia method of surveying is particularly useful for following cases:
2. In differential leveling, the back sight and foresight distances are balanced conveniently if the level is equipped with stadia hairs.
3. In profile leveling and cross sectioning, stadia is a convenient means of finding distances from level to points on which rod readings are taken.
4. In rough trigonometric, or indirect, leveling with the transit, the stadia method is more rapid than any other method.
5. For traverse surveying of low relative accuracy, where only horizontal angles and distances are required, the stadia method is a useful rapid method.

Uses of Stadia Method:

6. On surveys of low relative accuracy -particularly topographic surveys-where both the relative location of points in a horizontal plane and the elevation of these points are desired, stadia is useful. The horizontal angles, vertical angles, and the stadia interval are observed, as each point is sighted; these three observations define the location of the point sighted.

Errors in Stadia Measurement:

Most of the errors associated with stadia measurement are those occur during observations for horizontal angles and differences in elevation. Specific sources of errors in horizontal and vertical distances computed from observed stadia intervals are as follows:

1. Error in Stadia Interval factor

This produces a systematic error in distances proportional to the amount of error in the stadia interval factor.

Errors in Stadia Measurement (Contd.....

2. Error in staff graduations

If the spaces on the rod are uniformly too long or too short, a systematic error proportional to the stadia interval is produced in each distance.

3. Incorrect stadia Interval

The stadia interval varies randomly owing to the inability of the instrument operator to observe the stadia interval exactly. In a series of connected observations (as a traverse) the error may be expected to vary as the square root of the number of sights. This is the principal error affecting the precision of distances. It can be kept to a minimum by proper focusing to eliminate parallax, by taking observations at favorable times, and by care in observing.

4. Error in verticality of staff

This condition produces a perceptible error in measurement of large vertical angles than for small angles. It also produces an appreciable error in the observed stadia interval and hence in computed distances. It can be eliminated by using a staff level.

Errors in Stadia Measurement (Contd.....

5. Error due to refraction

This causes random error in staff reading.

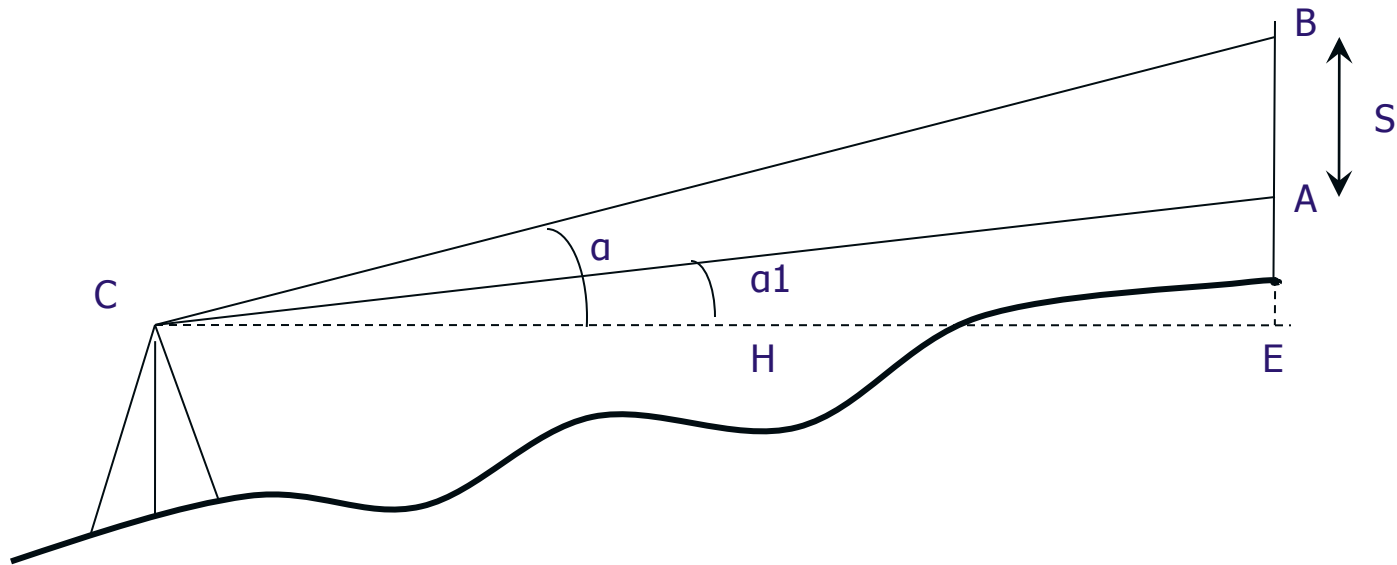
6. Error in vertical angle

Error in vertical angle is relatively unimportant in their effect upon horizontal distance if the angle is small but it is perceptible if the vertical angle is large.

The Tangential Method:

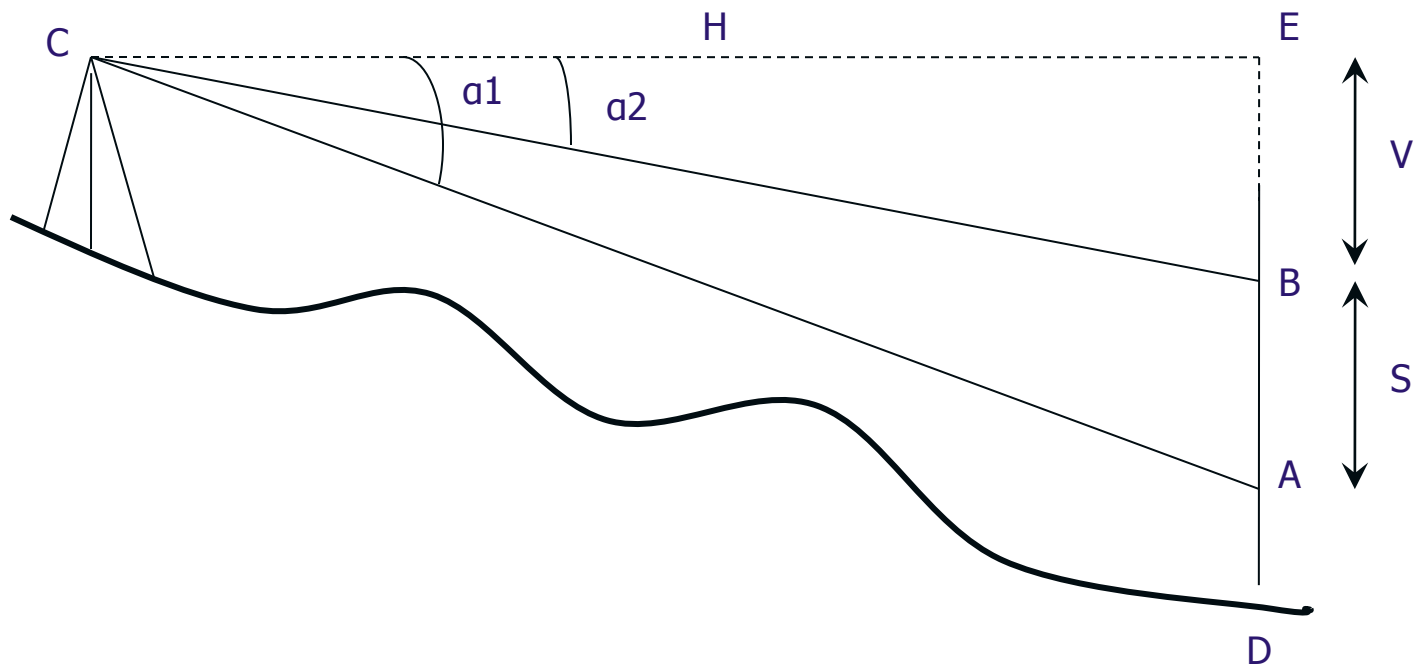
In tangential method horizontal and vertical distances are computed from observed vertical angles to two targets fixed at distance (S) on staff.

a. Both Elevation angles:



The Tangential Method:

b. Both Depression angles:



The Tangential Method:

c. One angle Elevation and other Depression:

