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Methods of Techometric survey:-

The telescope used in stadia surveying are of three kinds:

- (1) The simple external-focusing telescope
- (2) the external-focusing anallactic telescope (Possor's telescope)
- (3) the internal-focusing telescope.

A tacheometer must essentially incorporate the following features

- (i) The multiplying constant should have a nominal value of 100 and additive 0
- (i) The axial horizontal line should be exactly midway between the other two
- (ii) The telescope should be truly anallactic. contained in this value should not exceed 1 in 1000.lines.
- (iv) The telescope should be powerful having a magnification of 20 to 30diameters.

The aperture of the objective should be 35 to 45 mm in diameter to have a sufficiently bright image.

For small distances (say upto 100 meters), ordinary levelling staff may be used. For greater distances a stadia rod may be used.

A stadia rod is usually of one piece, having 3-5 meters length.

A stadia rod graduated in 5 mm (i.e. 0.005 m) for smaller distances and while for longer distances, the rod may be graduated in 1 cm (i.e. 0.01 m).

Different systems of Tacheometr Measurement:

The various systems of tacheometric survey may be classified as follows:

The stadia System

- (a) Fixed Hair method of Stadia method
- (b) Movable hair method, or Subtense method

- (c)The tangential system
- (d) Measurements by means of special instruments

(a) Fixed hair methodIn this method,

- The angle at the instrument at A subtended by a known short distance along a staff kept at B is made with the help of a stadia diaphragm having stadia wires at fixed or constant distance apart.
- The readings are on the staff corresponding to all the three wires taken.

- The staff intercept, i.e., the difference of the readings corresponding to top and bottom stadia wires will therefore depend on the distance of the staff from the instrument.
- When the staff intercept is more than the length of the staff, only half intercept is read.
- For inclined sight, readings may be taken by keeping the staff either vertical or normal to the line of sight.
- This is the most common method is tacheometry and the same 'stadia method' generally bears reference to this method.

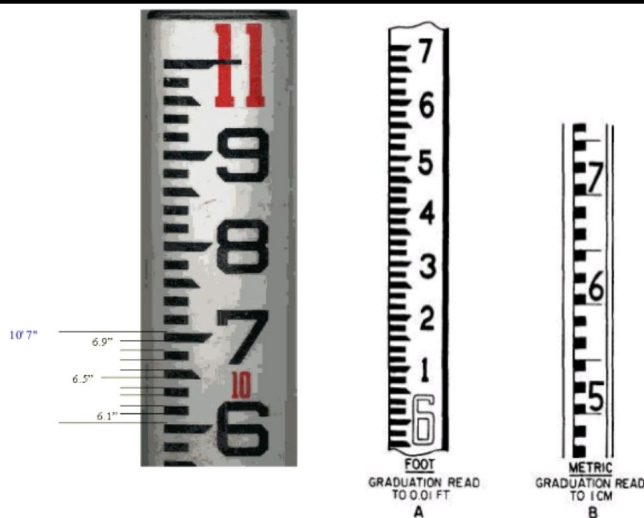
Subtense Method

- This method is similar to the fixed hair method except that the stadia interval is variable.
- Suitable arrangement is made to vary the distance between the stadia hair as to set them against the two targets on the staff kept at the point under observation. (it means there is already fixed target on staff at known distance)
- Thus, in this case, the staff intercept, i.e., the distance between the two targets is kept fixed while the stadia interval, i.e., the distance between the stadia hair is variable.
- As in the case of fixed hair method, inclined sights may also be taken.

Tangential Method

- In this method, the stadia hairs are not used, the readings being taken against the horizontal cross-hair.
- To measure the staff intercept, two pointings of the instruments are, therefore, necessary.
- This necessitates measurement of vertical angles twice for one single observation.

Types of staff used in Techometric survey



Note: For subtense method two targets are fixed on staff and reading were taken on that.

Distance and Elevation formulae for Staff Vertical: Inclined Sight

Let P Instrument station

M position of instruments axis.

A, C, B = Points corresponding to the readings of the three hairs.

S = AB = Staff intercept.

Q = Staff station.

O = Optical centre of the objective .

i = Stadia interval .

Angle = Inclination of the line of sight from the horizontal.

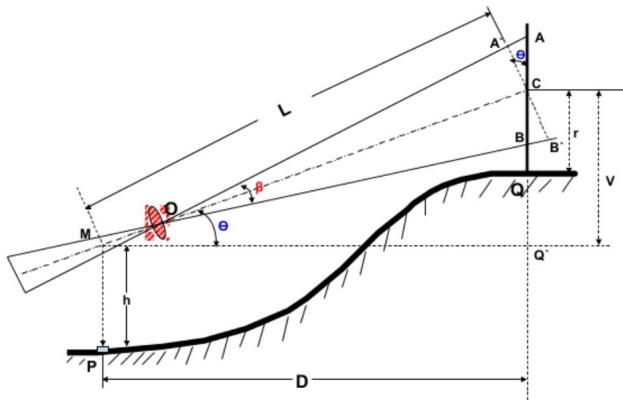
L = Length MC measured along the line of sight.

D = MQ' = Horizontal distance between the instrument and the staff.

V = Vertical intercept at Q, between the line of sight and the horizontal line.

h = height of the instrument.

B = angle between the two extreme rays corresponding to stadia hairs. r central hair reading .



Now ,

Draw a line A'CB' normal to the line of sight OC.

Angle AA'C = 90° + B/2, being the exterior angle of the triangle COA'.

Similarly, from triangle COB', angle OB'C = angle BB'C = 90° - B/2.

Since $\beta/2$ is very small (its value being equal to $17' 11''$ for $k = 100$), angle AA'C and angle BB'C may be approximately taken equal to 90°.

$$\angle AA'C = \angle BB'C = 90^\circ$$

$$\text{From } \triangle ACA', A'C = AC \cos \theta \quad \text{or} \quad A'B' = AB \cos \theta = s \cos \theta \quad \dots\dots\dots(a)$$

Since the line A'B' is perpendicular to the line of sight OC, equation $D = k s + C$ is directly applicable. Hence, we have

$$MC = L = k \cdot A'B' + C = k s \cos \theta + C \quad \dots\dots\dots(b)$$

The horizontal distance

$$D = L \cos \theta = (k s \cos \theta + C) \cos \theta$$

$$D = k s \cos^2 \theta + C \cos \theta \quad \dots\dots\dots(1)$$

Similarly, $V = L \sin \theta = (k s \cos \theta + C) \sin \theta = k s \cos \theta \cdot \sin \theta + C \sin \theta$

$$V = k s \frac{\sin 2\theta}{2} + C \sin \theta \quad \dots\dots\dots(2)$$

Thus equations (1) and (2) are the distance and elevation formulae for inclined line of sight.

(a) Elevation of the staff station for angle of elevation

If the line of sight has an angle of elevation α , as shown in the figure, we have

(1) Elevation of staff station = Elevation of instrument station + $h + V - r$.

(2) Elevation of the staff station for the angle of depression:

Elevation of Q = Elevation of P + $h - V - r$.