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# Tacheometric Surveying

- Tacheometric surveying is further classified into two methods:

1. Stadia Method of Tacheometry
2. Tangential Method of Tacheometric Surveying

# Tacheometric Surveying

- Tacheometric surveying is defined as a method of angular surveying in which a tachometer is used to determine the horizontal and vertical distance between two points. Thus, eliminating the tedious process of chain surveying to measure horizontal distance.

# Tacheometric Surveying

- Tacheometric surveying is preferred over chain or tape surveying. It is faster and more convenient, especially in hard terrains such as broken grounds, deep ravines, swampy areas, stretches of water bodies, etc. The accuracy of this surveying technique ranges from 1/1000 to 1/10000.

# Principle of Tacheometric Surveying

- The principle of tacheometric surveying is based on the property of an isosceles triangle i.e. the ratio of the distance of the base from the apex and the length of the base is always constant.
- The formula for the horizontal distance is determined using:
- $H = K * s * \cos^2 \theta$
- Note: The additive constant is 0.00, and the multiplying constant is 100.00.

# Principle of Tacheometric Surveying

- The formula for the vertical distance for the same tacheometer is:
- $V = (K*s*\sin 2\theta)/2 = H\tan\theta$
- Where,
- s= staff intercept = Top Reading – Bottom Reading
- K= Multiplying Constant (generally taken as 100)
- $\theta$ = Vertical angle on the theodolite

# Principle of Tacheometric Surveying

- Thus, after computing the vertical distance value, the reduced level of the instrument station (R.L.), the height of the instrument (H.I.), central wire reading (R), and the R.L. of any point under observation can be calculated as:
- R.L of Point = R.L of Instrument Station + H.I ± V-R

# Procedure for Tacheometric Surveying

- Set up the instrument above the specified station and precisely level it with reference to the altitude level.
- Set the vertical circle's vernier to zero. Then, with the altitude level in the middle of its run, use a measuring tape to precisely measure the instrument's height (the vertical distance from the top of the peg to the center of the objective).
- Alternatively, the height may be found by keeping the stadia rod first before the telescope and reading through the object-glass.

# Procedure for Tacheometric Surveying

- 4- Orient the instrument by following the steps listed below:
- The magnetic meridian or the real meridian can be used as the reference meridian.
- When the reference meridian is a magnetic meridian, set one of the verniers to zero and rotate the telescope around the vertical axis, relaxing the bottom clamp until the compass needle points north.
- The correct bearing of a reference point or another station of the traverse with reference to the first station must be known in order to orient the instrument with reference to the real meridian.
- Set up the vernier to read this bearing, and then rotate the telescope about the outer axis until the station or reference object is bisected.

# Procedure for Tacheometric Surveying

- Take the bearing, the vertical angle, and the top, bottom, and axial hair readings while holding the staff on the benchmark (the line of sight may be horizontal or inclined).
- 6. If there is no local benchmark, fly level from the nearest accessible Benchmark (B.M.), and a temporary B.M. may be constructed near the region.
- 7. The bearings, vertical angles, and staff readings are used to find all representative locations under the instrument station's command (to the top, bottom, and the axial hairs). "Side shots" are the phrase for these observations.
- 8. Take a glance at the second station when all the representative spots have been identified from the first station. Record the vertical angle and the staff readings relating to the top, bottom, and axial hairs.

# Procedure for Tacheometric Surveying

- Change the station of the instrument to the second. As before, set up, center, and level the instrument and measure its height.
- 10. Take a back sight to the first station. Also, pay attention to the bearings, the vertical angle, and the staff reading the top, bottom, and axial hairs.
- 11. Since each station is sighted twice, two values for the station's distances and altitudes are produced, which must be within the legal limits; otherwise, the operation must be redone.

# Methods of Tacheometric Surveying

- he horizontal distance between an instrument Station "A" and a staff Station "B" is determined by the angle subtended at point "A" by a known distance at point "B" and the vertical angle from point "B" to point "A" correspondingly.
- Tacheometric surveying is further classified into two methods:

# Methods of Tacheometric Surveying

1. Stadia Method of Tacheometry

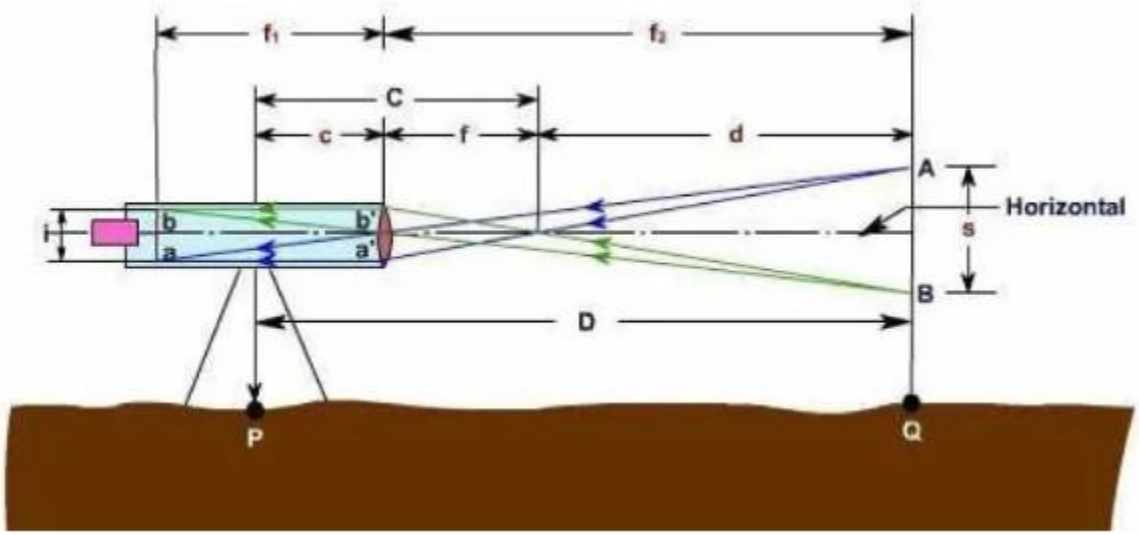
- The stadia technique of tacheometry is a popular method adopted for calculating horizontal distance and vertical elevation.
- The horizontal distance between the staff station and the instrument station and the elevation of the staff station along the instrument's line of sight is computed using this approach with only one observation from the instrument station.

# Methods of Tacheometric Surveying

- This method of surveying can be further classified into the following two types:
- A. Fixed Hair Method
- The device used for taking observations in this form of surveying is a telescope with two extra cross-hairs, one above and one below the center hair.
- Thus, stadia hairs are ones that are equally spaced from the center hair.
- When observed via the instrument's telescope, the stadia hairs are seen to intercept a specific length of the staff.

# Methods of Tacheometric Surveying

- This is the most often used tacheometric surveying approach.

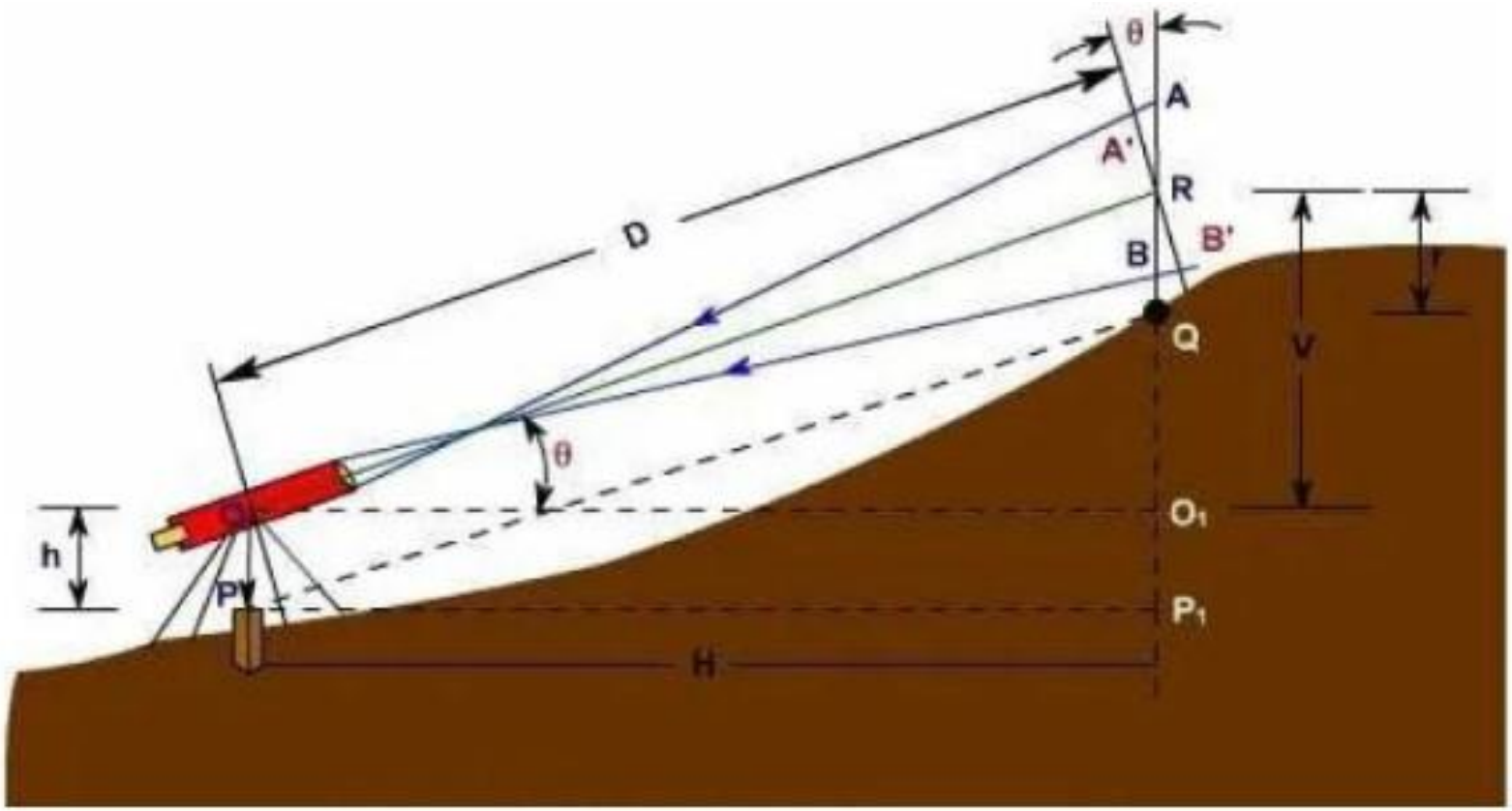



Fixed Hair Method

# Methods of Tacheometric Surveying

- B. Movable Hair Method
- In contrast to the stadia hair technique, the telescope connected to the instrument in the movable hair method comprises moveable cross-hairs.
- The center hair can also be used to fix the moveable cross-hairs.
- The stadia interval is customizable in this manner for different staff positions. The horizontal distance is then calculated. The gadget is used with two fixed-distance targets.

# Methods of Tacheometric Surveying




Movable Hair Method

# Methods of Tacheometric Surveying

- 2. Tangential Method of Tacheometric Surveying
- Tangential tacheometric surveying necessitates two observations between the staff station and the instrument station. The horizontal distance and elevation difference between the collimation line and the staff station is calculated in this manner.
- The most significant advantage of this procedure is that it may be performed with a standard transit theodolite. Due to the sheer sluggish rate of work, this approach is used less in comparison to the stadia system.

# Methods of Tacheometric Surveying

- Tangential Method
- In this method diaphragm of the tacheometer is
- not provided with the stadia hair.
- • Reading are taken by the central horizontal hair.
- • Staff with two targets at a fixed distance (S) is
- used for taking reading.
- • The vertical angles Θ1 and Θ2 are measured.

# Difference

| Stadia hair method | Tangential method |
| --- | --- |
| • Diaphragm of the tacheometer is provided with three stadia hair. | • Diaphragm of the tacheometer is not provided with stadia hair. |
| • Looking through the telescope the three stadia hair readings taken. | • The readings are taken by the single horizontal hair adjust upper and lower target respectively. |
| • One vertical angle is observed. | • Two vertical angle is observed. |
| • This method is most commonly used in practice. | • This method is not commonly used in practice |