

5th nov,
SATURDAY

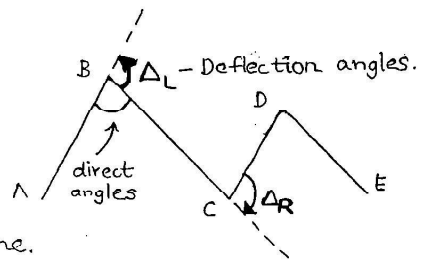
04. THEODOLITE SURVEY

→ Theodolite.

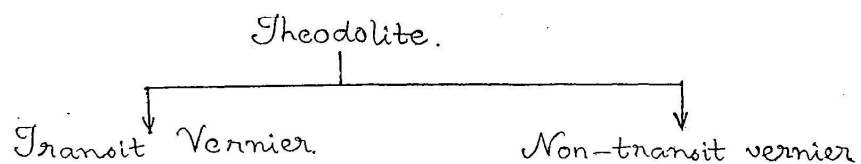
- It is used for measurement of horizontal and vertical angles directly.
- Indirectly, it can also be used for calculating distances, and elevation of objects.

→ Miscellaneous Operations with Theodolite.

- magnetic bearing of a line.
- direct angles
- deflection angles.
- prolongation of a straight line.



- locating the intersection point between any two straight lines.
- to lay off a horizontal angle



* Transitting / Plunging / Reversing:-

It is the process of rotating the telescope in a vertical plane about horizontal axis.

* face left observations:

When vertical circle is to the left side of an observer, observations made are called 'Face Left Observations'.

It is called as 'Telescope in normal condition and bubble is up.'

* face right observations:

When the vertical circle is to the right side of an observer, observations made are called as face right observations.

By transitting, face left can be made to face right and vice versa.

* Swinging of Telescope:

Rotation of telescope in the horizontal plane. If telescope is rotated in clockwise direction, it is a 'Right Swing' and if telescope rotated in anti-cw direction, it is a 'Left Swing'.

✓	FL	RS
	FR	RS

FL	LS
FR	LS

X

FL-RS is the best combination.

* Double sighting or Double Centering

It is the process of measuring the angles twice, once the telescope in normal condition and once the telescope in the inverted condition.

→ Main Parts of a Theodolite.

1. Telescope

2. Levelling head.

3. Lower plate. } Vernier

4. Upper plate } plates.

5. Plate Levels

6. Altitude bubble.

7. Vertical Circle.

8. A - Strands

9. T - frames

10. Tripod.

(3.9)

→ Working Operations :

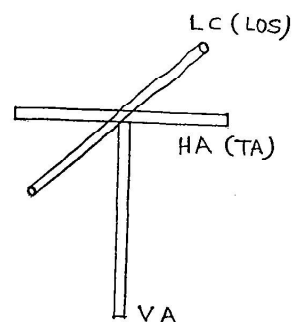
- (i) Both clamp screws are tightened; no movement of telescope
- (ii) Releasing lower clamp screw, tightening upper clamp screw, object can be bisected without change in the vernier readings.
- (iii) Releasing upper clamp screw, tightening lower clamp screw, object can be bisected with changed vernier readings.

NOTE:

① Size of theodolite is the diameter of the main horizontal graduated circle. Generally it is 80 mm to 120 mm.

→ Fundamental Lines & their Relations.

1. Horizontal Axis or Trunion Axis
2. Vertical Axis
3. Line of collimation or LOS
4. Axis of Plate levels.
5. Axis of Altitude bubble.



* Fundamental relations

- (i) Axis of plate level $\perp^n$ Vertical axis.
- (ii) Horizontal axis $\perp^n$ Vertical axis.
- (iii) Line of collimation (LOS) $\perp^n$ horizontal axis.
- (iv) Axis of altitude bubble $\parallel$ LOS (when horizontal & vertical circle reads 0).

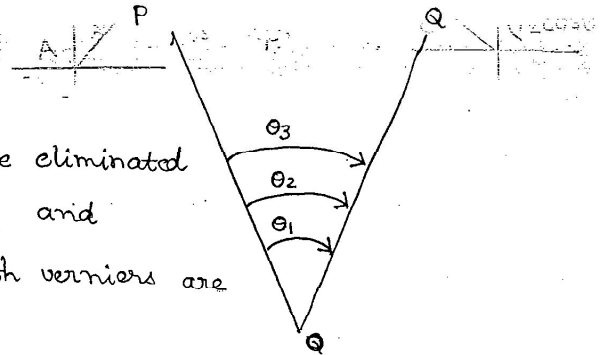
→ Temporary Adjustments.

1. Setting
2. Centering
3. Levelling
4. Elimination of parallax.

→ Measurement of Horizontal Angle by Repetition method.

It is an accurate method because the degree of precision attained to a much finer degree than the least count of the vernier.

$$\angle POQ = \frac{\theta_3}{3}$$

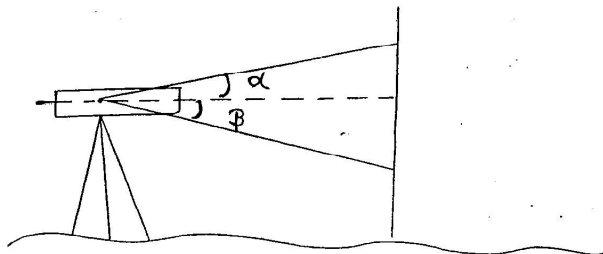


- * The following errors will be eliminated
- due to eccentricity of verniers and centres are eliminated as both verniers are used.
- errors due to line of sight and trunion axis being out of adjustment are eliminated because the readings on both faces are taken.
- error due to inaccurate graduations are eliminated.

→ Measurement of Horizontal Angle by Reiteration method.

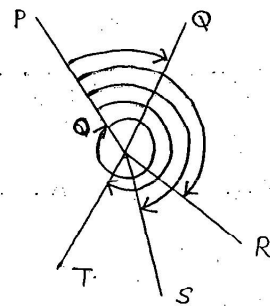
Reiteration method (or) Direction method (or) Method of Series. → Horizontal angles of a group having a common vertex point can be measured.

→ Measurement of Vertical Angles



α → angle of elevation

β → angle of depression.



→ Permanent Adjustments

1. Plate Level Test.

To make the plate bubble central to their run when the vertical axis of theodolite is truly vertical.

2. Cross Hair Ring Test.

To make the vertical cross hair lie in a plane perpendicular to the horizontal axis.

3. Azimuth test.

To make LOS $\perp$ to horizontal axis.

4. Spire test

To make horizontal axis $\perp$ to vertical axis.

5. Vertical Arc test.

To make the vertical circle indicate zero when the LOS is $\perp$ to vertical axis.

Q A theodolite is placed at A and a 3m long vertical staff is held at B. The depression angle made at reading of 2.5 m marking on staff is $6^{\circ}10'$. The horizontal distance b/w A & B is 2200 m. HI of at A is 1.2 m. and RL of point A is 880.88 m. Using combined correction, determine RL of point B in metres.

Correct staff reading on B

$$= 2.5 - 0.06735 \times (2.2)^2$$

$$= 2.174 \text{ m.}$$

$$\text{RL of B} = (880.88 + 1.2) - 2200 \tan 6^{\circ}10'$$

$$- 2.174$$

$$= \underline{\underline{642.204 \text{ m.}}}$$

