

BASIC CIVIL ENGINEERING

Unit II

Surveying & Positioning

Topic

PLANE TABLE SURVEYING

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➤ PLANE TABLE SURVEYING

- ▶ **Definition** : Plane table surveying is a Graphical method of surveying in which plotting and the observation is done at a time. In this method of surveying a table top, similar to drawing board fitted on to a tripod is the main instrument. A drawing sheet is fixed on to the table top, the observations are made to the objects, distances are scaled down and the objects are plotted in the field itself. Since the plotting is made in the field itself, there is no chance of omitting any necessary measurement in this surveying. However the accuracy achieved in this type of surveying is less.



➤ **ACCESSORIES USED IN PLANE TABLE:**

- The following accessories are required to carry out plane table survey:
 - 1. Plane table
 - 2. Alidade
 - 3. Plumbing fork with plumb bob.
 - 4. Spirit level
 - 5. Trough compass
 - 6. Drawing sheets and accessories for drawing

1. Plane table:

The most commonly used plane table is shown in Fig. It consists of a well seasoned Wooden table top mounted on a tripod.



The table top can rotate about vertical axis freely. Whenever necessary table can be clamped in the desired orientation. The table can be levelled by adjusting tripod legs.

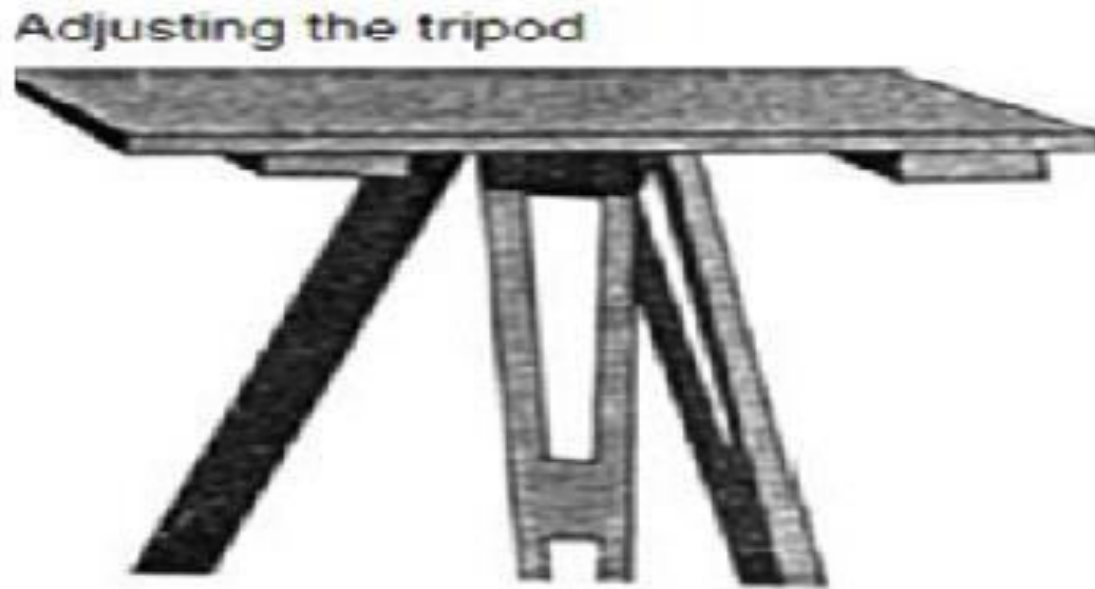


Fig. Plane table with stand



2. Alidade:

It is a straight edge ruler having some form of sighting device. One edge of the ruler is bevelled and is graduated. Always this edge is used for drawing line of sight. Depending on the type of line of sight, there are two types of alidade:

(a) Plain alidade.

(b) Telescopic alidade.

a. Plain Alidade: Figure shows a typical plain alidade. A sight vane is provided at each end of the ruler. The vane with narrow slit serves as eye vane and the other with wide slit and having a thin wire at its centre serves as object vane. The two vanes are



provided with hinges at the ends of ruler so that when not in use they can be folded on the ruler. Plain alidade is not suitable in Surveying hilly areas as the inclination of line of sight in this case is limited.

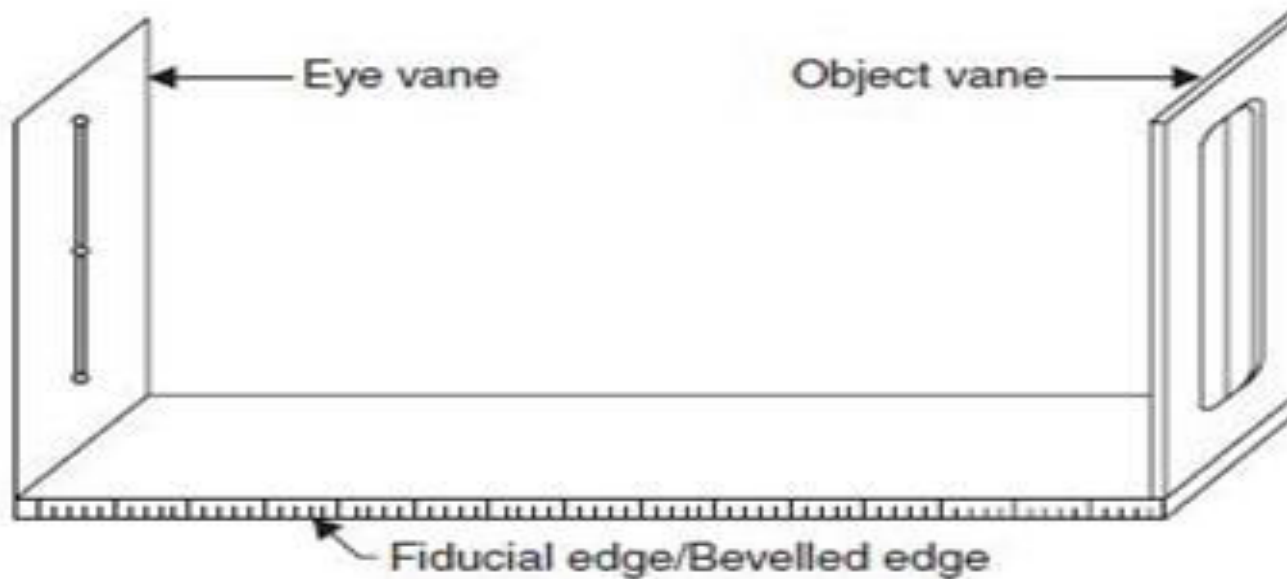


Fig. Plane alidade



4. Plumbing Fork and Plumb Bob:

Figure shows a typical plumbing fork with a plumb bob. Plumbing fork is a U-shaped metal frame with a upper horizontal arm and a lower inclined arm. The upper arm is provided with a pointer at the end while the lower arm is provided with a hook to suspend plumb bob. When the plumbing fork is kept on the plane table the vertical line (line of plumb bob) passes through the pointed edge of the upper arm. The plumb bob helps in transferring ground point to the drawing sheet and vice versa also.



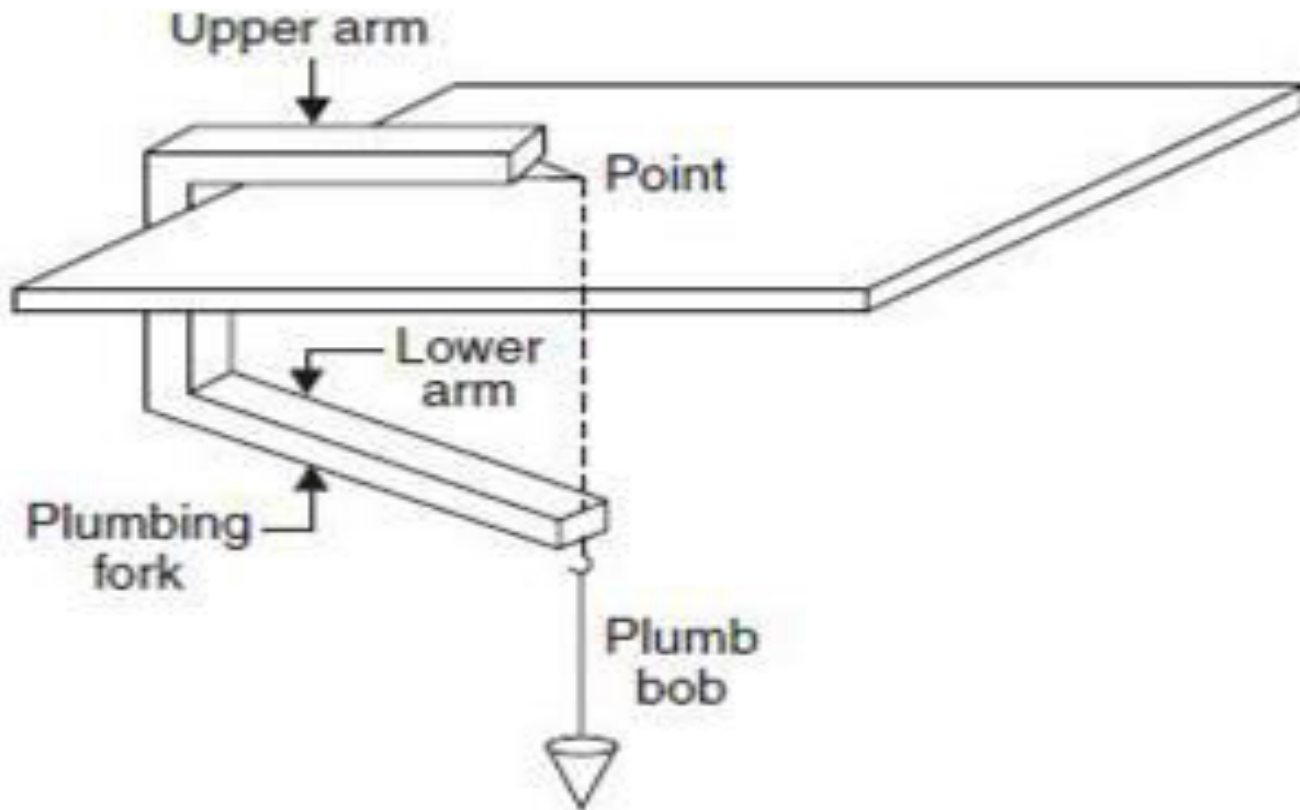


Fig. Plumbing fork and plumb bob.

5. Spirit Level:

A flat based spirit level is used to level the plane table during surveying. To get perfect level, spirit level should show central position for bubble tube when checked with its positions in any two mutually Perpendicular direction.

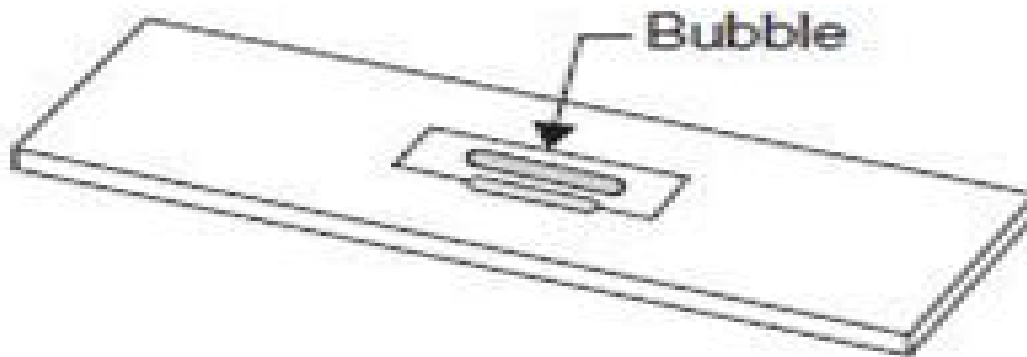


Fig. Spirit level



6. Trough Compass:

It consists of a 80 to 150 mm long and 30 mm wide box carrying a freely suspended needle at its centre. At the ends of the needle graduations are marked on the box to indicate zero to five degrees on either side of the centre. The box is provided with glass top to prevent oscillation of the needle by wind. When needle is centred (reading 0-0), the line of needle is parallel to the edge of the box. Hence marking on the edges in this state indicates Magnetic north-south direction.



Trough Compass:

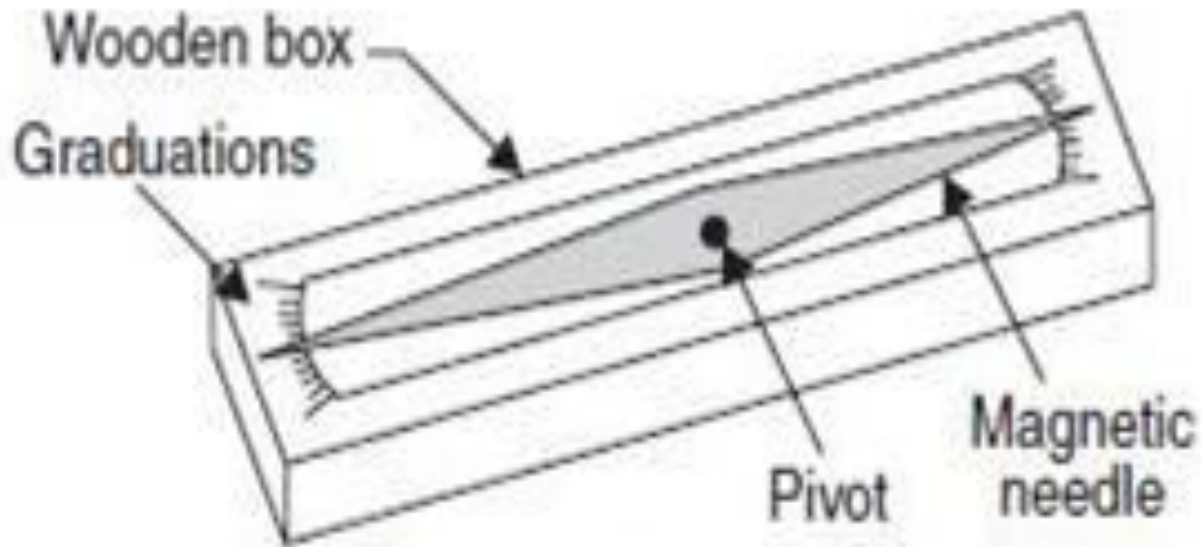


Fig. Trough compass

7. Drawing Sheet and Accessories for Drawing

A good quality, seasoned drawing sheet should be used for plane table surveying. The drawing sheet may be rolled when not in use, but should never be folded. For important works fibre glass sheets or paper backed with thin aluminium sheets are used. Clips clamps, adhesive tapes may be used for fixing drawing sheet to the plane table. Sharp hard pencil, good quality eraser, pencil cutter and sand paper to keep pencil point sharp are other accessories required for the drawing work. If necessary, plastic sheet should be carried to cover the drawing sheet from rain and dust.



- **Temporary adjustments of plane table:**
 - Setting & levelling of plane table.
 - Centring of plane table.
 - Orientation of plane table.
 - Sighting the points.

The following four methods are available for carrying out plane table survey:

- ▶ 1. Radiation
- ▶ 2. Intersection
- ▶ 3. Traversing
- ▶ 4. Resection.

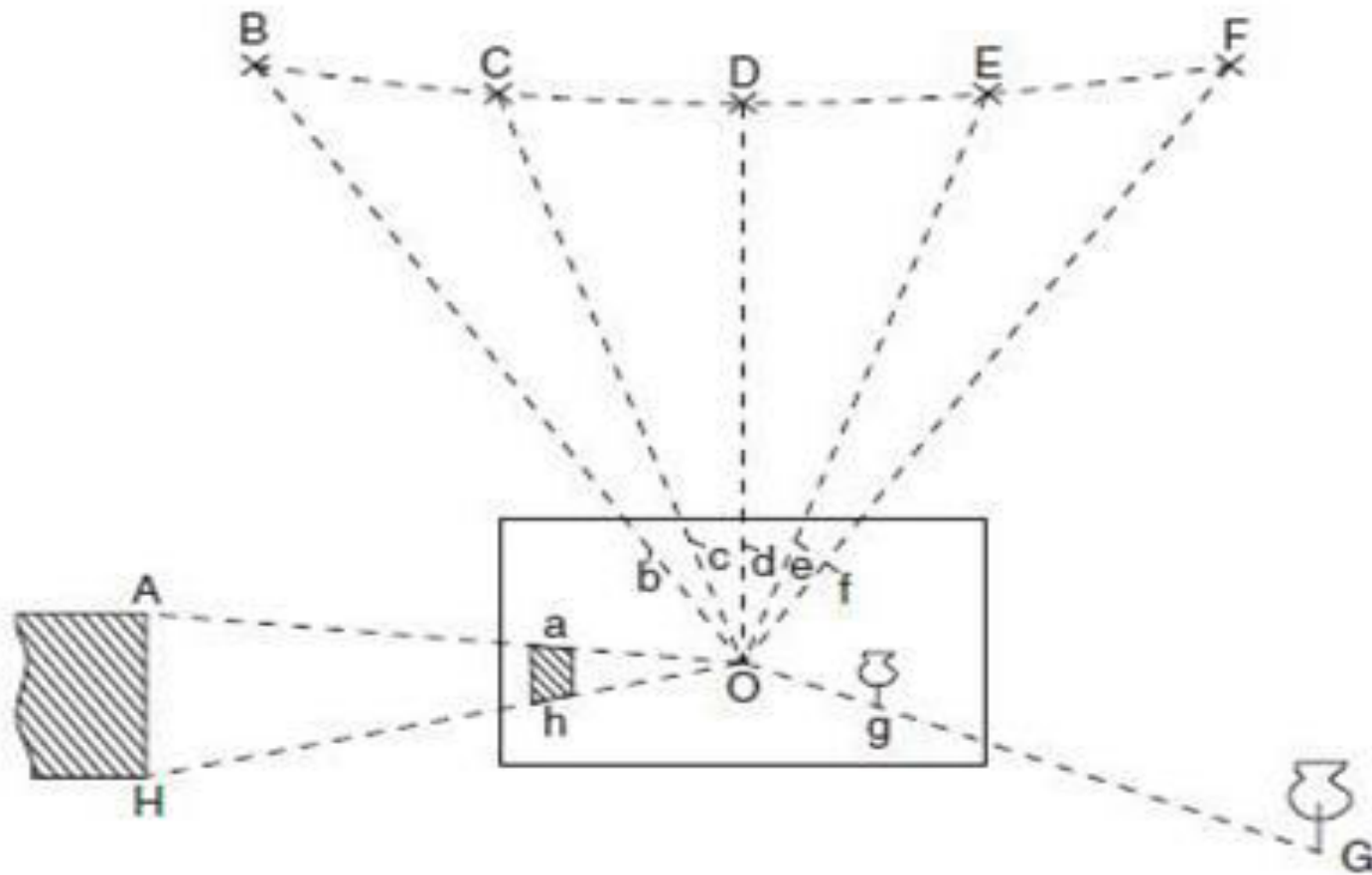
The first two methods are used for locating details while the other two methods are used for locating position of plane table station on drawing sheet.



➤ Radiation method:

After setting the plane table on a station, say O, is required to find the plotted position of various the objects A, B, C, D To get these positions, rays OA, OB, OC are drawn with soft pencil Then the distances OA, OB, OC, are measured scaled down and the positions of A, B, C, are found on the drawing sheets. This method is suitable for surveying small areas and is convenient if the distances to be measured are small. For larger areas this method has wider.





Radiation method of plane tabling

➤ Intersection method:

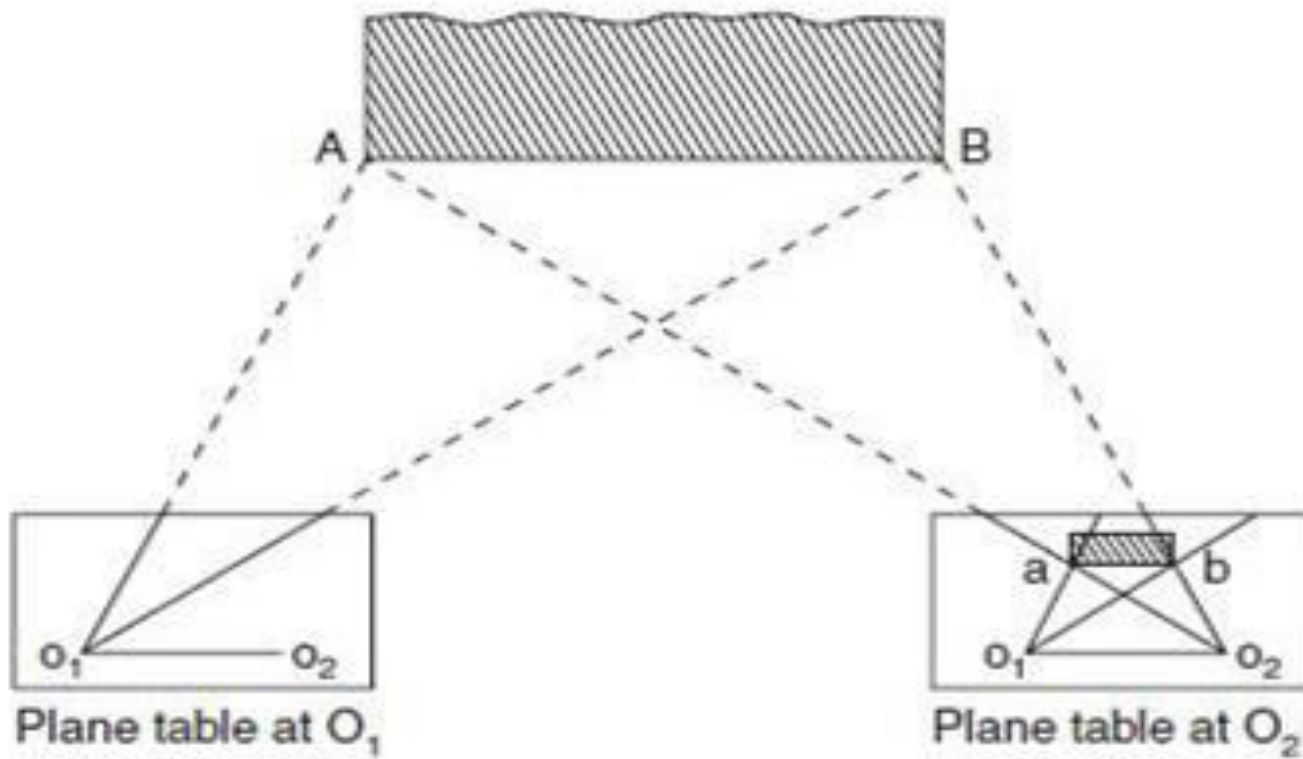
In this method the plotted position of an object is obtained by plotting rays to the object from two stations. The intersection gives the plotted position. Thus it needs the linear measurements only between the station points and do not need the measurements to the objects. the method for locating objects A and B from plane table positions O1 and O2

This method is commonly used for locating:

(a) details

(b) the distant and inaccessible points



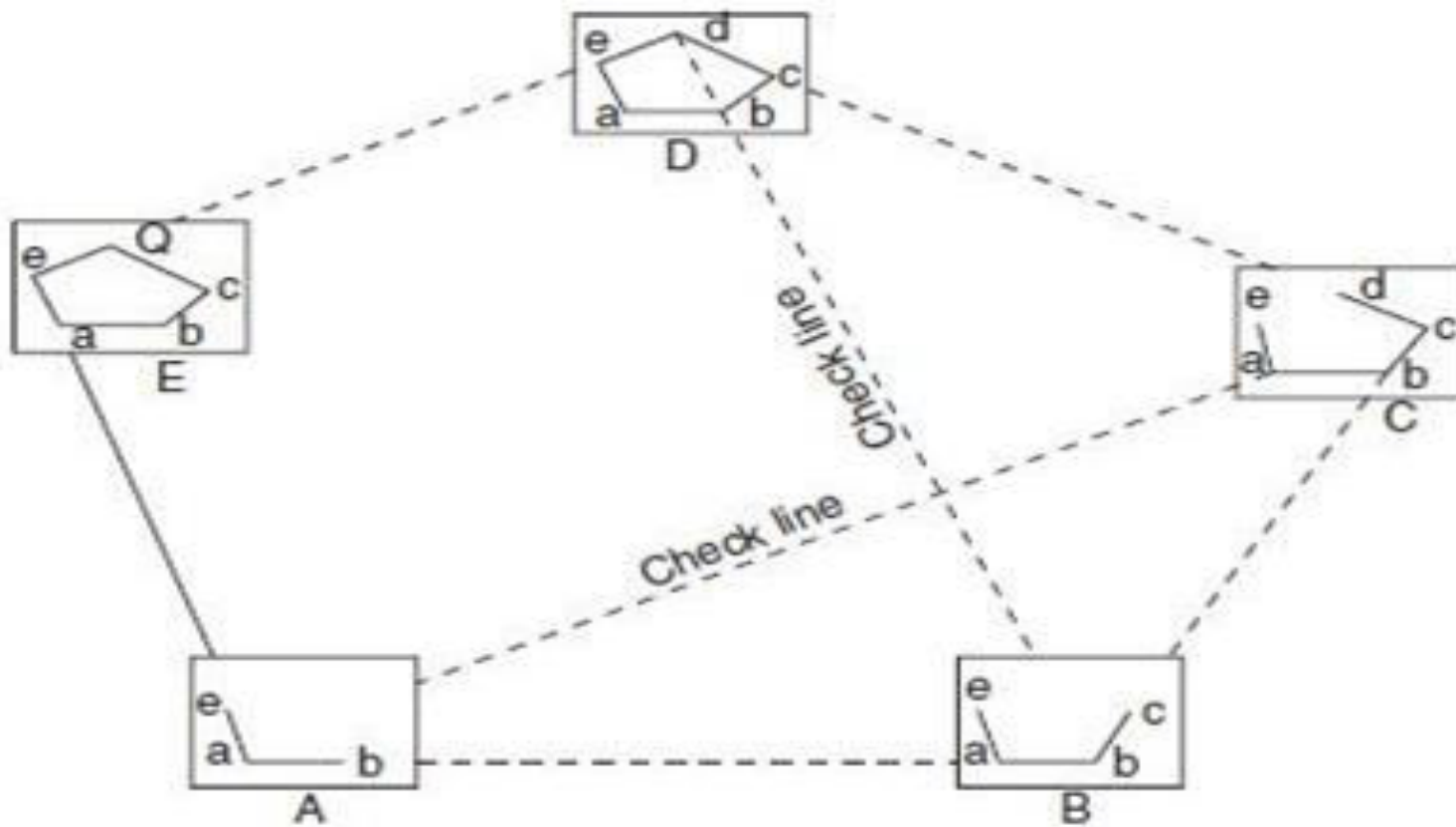


Intersection method of plane tabling

➤ **Traversing method:**

This is the method used for locating plane table survey stations. In this method, ray is drawn to next station before shifting the table and distance between the stations measured. The distance is scaled down and next station is located. After setting the plane table at new station orientation is achieved by back sighting. To ensure additional checks, rays are taken to other stations also, whenever it is table possible. Figure shows a scheme of plane survey of closed area. This method can be used for open traverses also.





Plane table traversing



➤ Resection method:

This method is just opposite to the method of intersection. In the method of intersection, the plotted position of stations are known and the plotted position of objects are obtained by of intersection. In this method the plotted position objects are known and the plotted position of station is obtained. If a, b and c are the plotted positions of objects A, B and C respectively, to locate instrument station P on the paper, the b, orientation of table is achieved with the help of a, c and then resectors Aa, Bb, Cc are drawn to get the p, the plotted position of P. Hence in the



resection method major work is to ensure suitable orientation by any one of the methods. The following methods are used in the method of resection.

(a) by compass

(b) by back sighting

(c) by solving two point problem

(d) by solving three point problem.

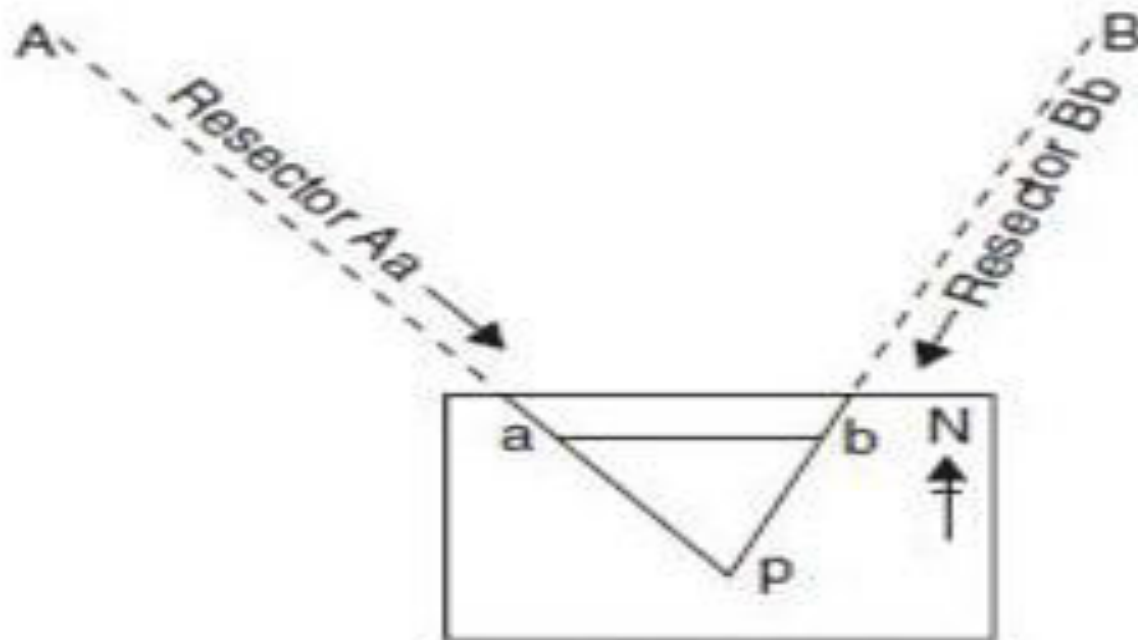
(a) Resection after Orientation by Compass:

Let a and b be the plotted positions of A and B of two well defined points in the field. Keeping the trough compass along north direction marked on the drawing sheet table is oriented on station P , the position of which is to be found on paper.

The resectors Aa and Bb are drawn to locate p the



plotted position of station point P. This method gives satisfactory results, if the area is not influenced by local attractions. It is used for small scale mapping only.



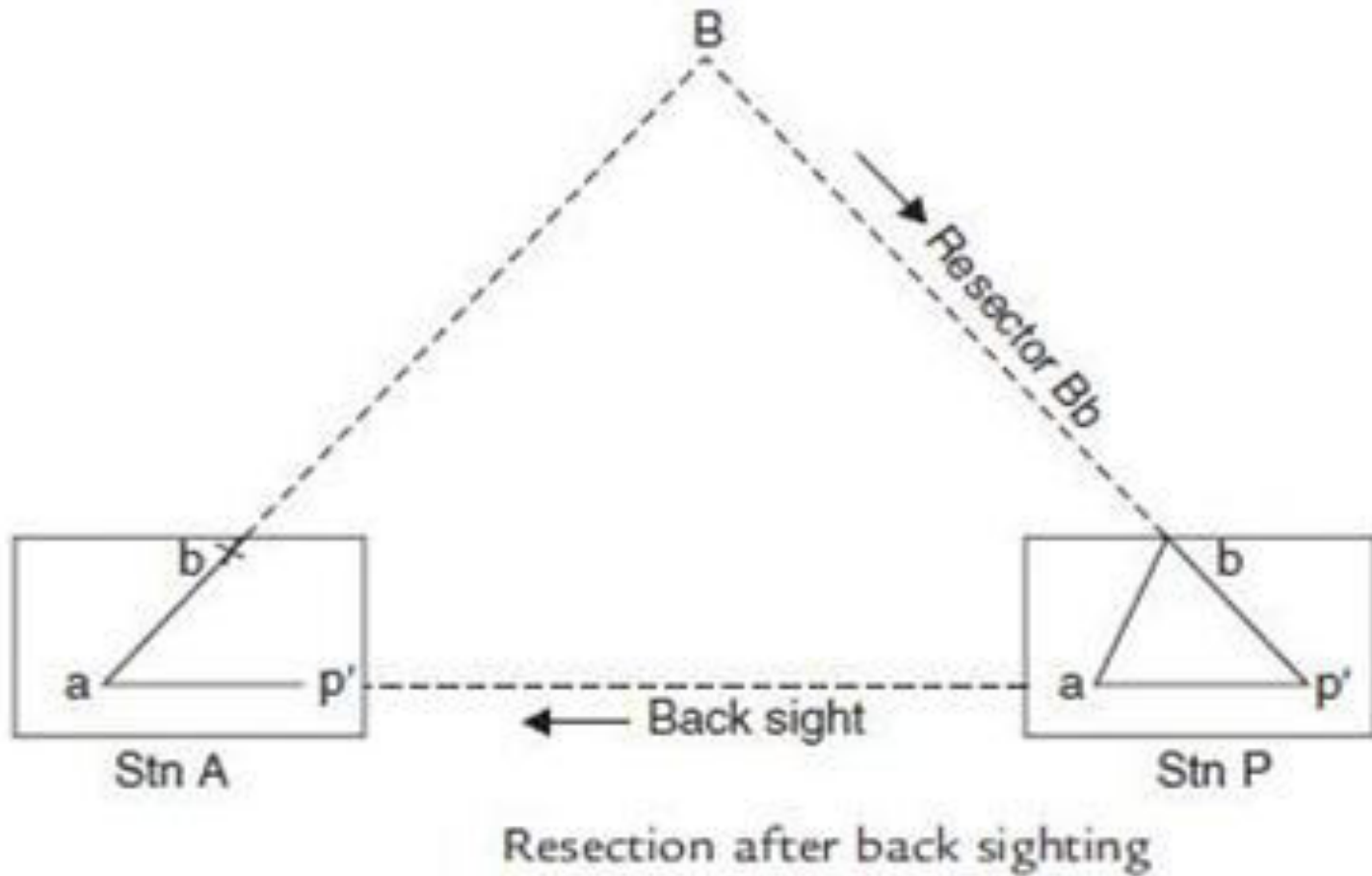
Station P

Resection after orientation with compass



(b) Resection after Orientation by Back Sighting: shows in Figure the scheme of resection after orientation by back sighting. From station A, the position of B is plotted as 'b' and ray has been taken to station P as ap. Then plane table is set at P and oriented by back sighting A, line AP is not measured But the position of P is obtained on the paper by taking resection Bb.



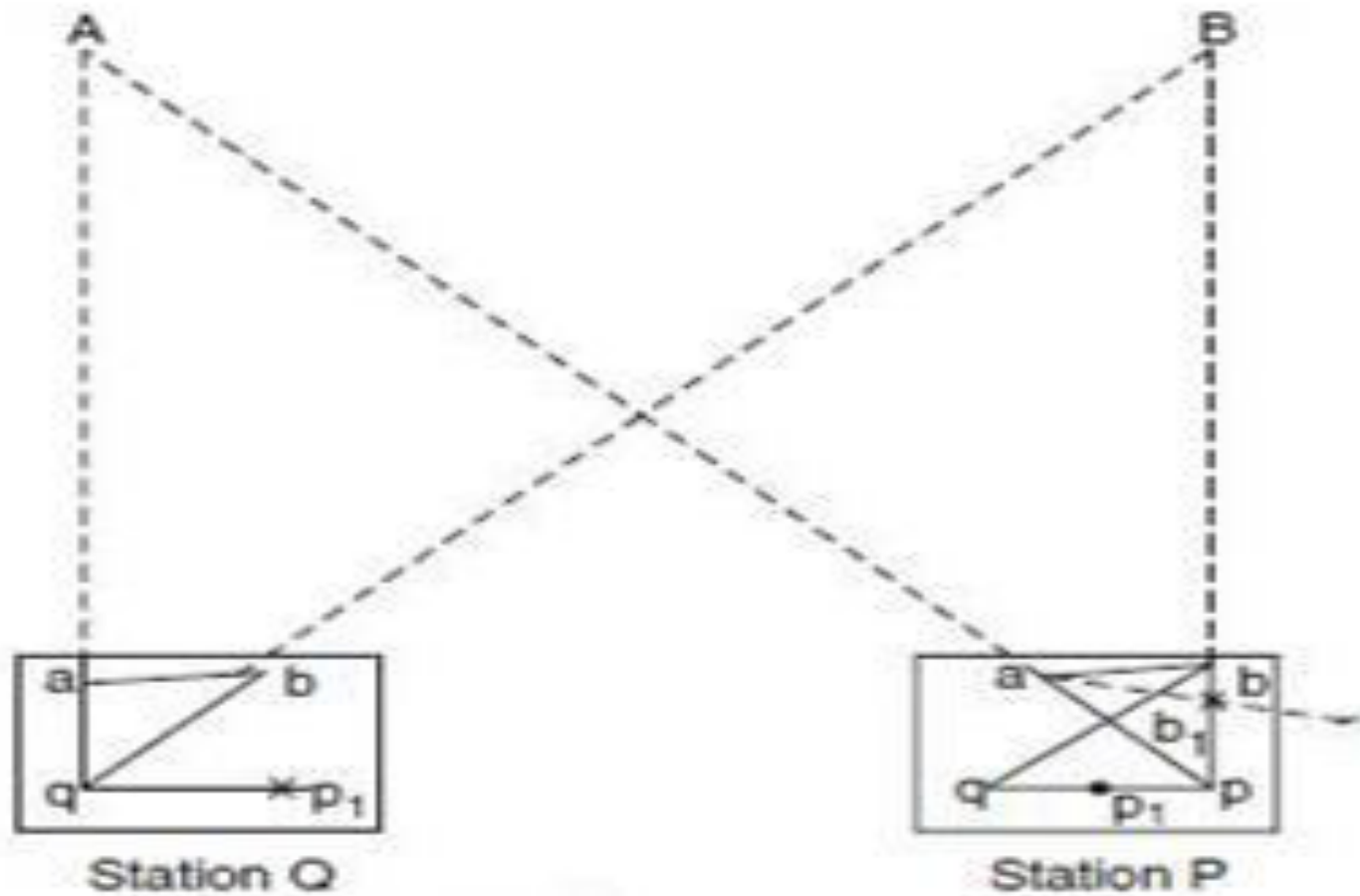


(c) Resection after Solving Two Point Problem:

The problem of finding plotted position of the station point occupied by the plane table with the help of plotted positions of two well defined points known as solving two point problem. shows in Figure the scheme of solving.

Procedure: Let A and B be two well defined points like lightning conductor or spire, the plotted positions a and b already known. Now the problem is to orient the table at P so that by resection its plotted position p can be obtained. The following steps may be followed to solve this problems:





Two-point problem



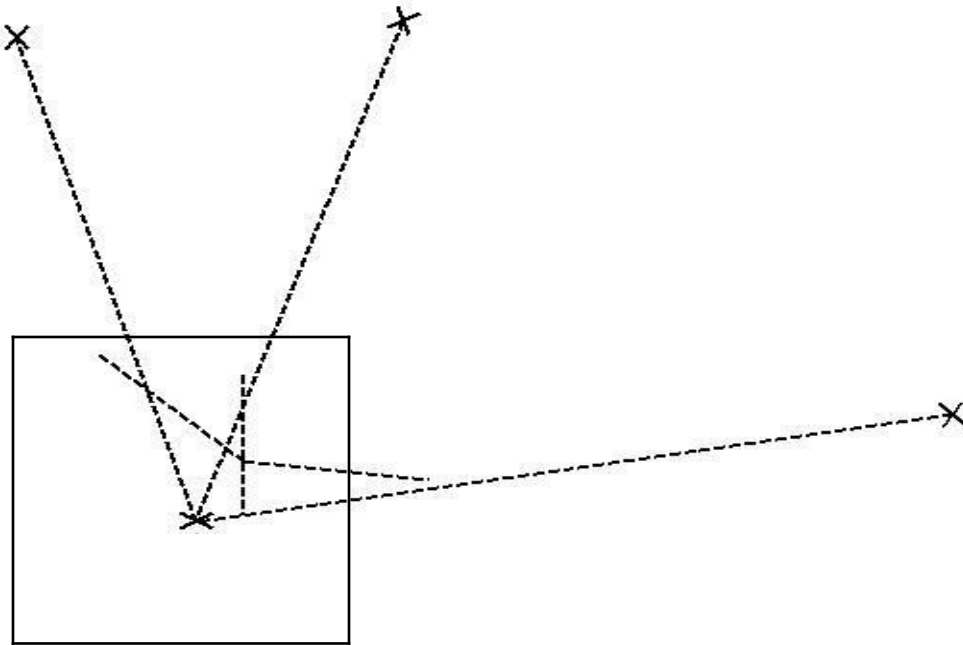
- (i) Select a suitable point Q near P such that the angles PAQ and PBQ are not acute.
- (ii) (i) Roughly orient the table at Q and draw the resectors Aa and Bb to get the point 'q'. (ii) Draw the ray qp and locate p_1 with estimated distance QP.
- (iii) Shift the plane table to P and orient the table by back sighting to Q. (iv) Draw the resector Aa to get 'p'.
- (v) Draw the ray pB. Let it intersect line bq at b_1 .
- (vi) The points b and b_1 are not coinciding due to the angular error in the orientation of table. The angle bab_1 , is the angular error in orientation. To correct it,

Fix a ranging rod at R along ab , Unclamp the table and rotate it till line ab sights ranging rod at R. Then clamp the table. This gives the correct orientation of the table which was used in plotting the points A and B.

(viii) The resectors Aa and Bb are drawn to get the correct plotted position ' p ' of the station P.

(d) *Resection after Solving Three Point Problem:*
Locating the plotted position of a station point using observations to three well defined points whose plotted positions are known, is called solving three point problem.

Let A, B, C be three well defined objects on the field whose plotted positions a, b and c are known. Now the problem is to locate plotted position of the station point P .



THANK
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