

# Plane Table Survey

The plane table surveying is the fast method of surveying. In this type of surveying plotting of the plan and field observations can be done simultaneously. In case of plane table surveying Geometrical conditions of site are manuscript in the map sheet using plane table and alidade after that topographic details are arranged on the map.

The law of plane tabling is parallelism, meaning the rays drawn from stations to items on the paper are parallel to the lines in the stations to the objects on the ground. The relative positions of these objects on the ground are represented with their own plotted positions about the paper and lie on the respective rays. The table is always placed at each of the successive stations parallel into the position it occupied in the starting station. Plane tabling is a graphical way of surveying.

Plane table survey is mainly acceptable for filling insider details when traversing is done with the Theodolite. Sometimes traversing with a plane table might also be done. However, this survey is recommended for the work where great accuracy isn't required. As the fixing and fitting arrangement of this instrument is not perfect, most accurate work cannot be expected. The simplest and the most commonly used plane table is as shown in as per below figure. It is known as a traverse table.



# Equipments used in Plane Table Survey

The equipment needed in plane table surveying is straightforward and almost available everywhere. Following are the plane table survey instruments.

## 1. Drawing Board:

It is made of well-seasoned wood. It varies in size, the common sizes are from 40 cm x 30 cm to 75 cm x 60 cm or 45 cm square, 60 cm square, etc.

The board may be mounted on a tripod with a leveling head or a ball-and-socket arrangement in such a fashion that it can be leveled and revolved about a vertical axis and may be clamped in any position.

The head of the tripod may sometimes be provided with a light metal frame carrying three milled-headed screws to level the table.

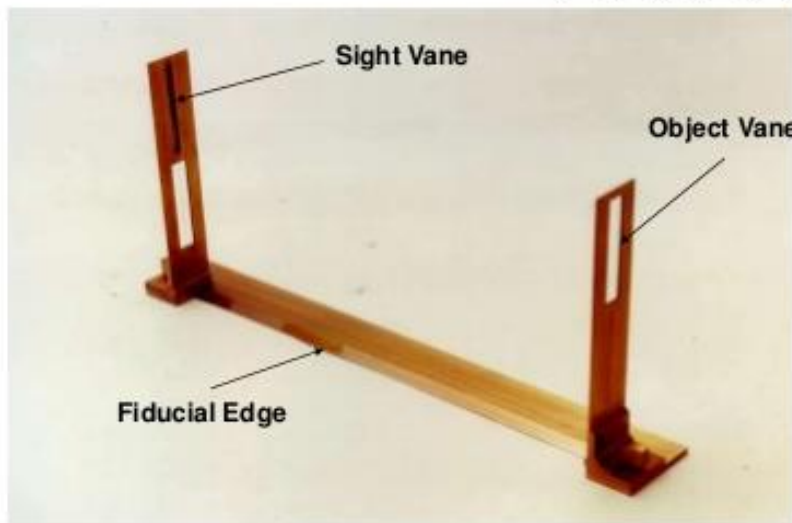


## 2. Alidade:

The alidade is a ruler with a sight line attached and is used on the plane table for bisecting the object, drawing rays, direction lines, etc.

It consists of a metal (brass or gunmetal) or boxwood straightedge or ruler of about 45 cm long. The beveled edge is called the “ruling edge” or the “working edge” or the “fiducial edge.”

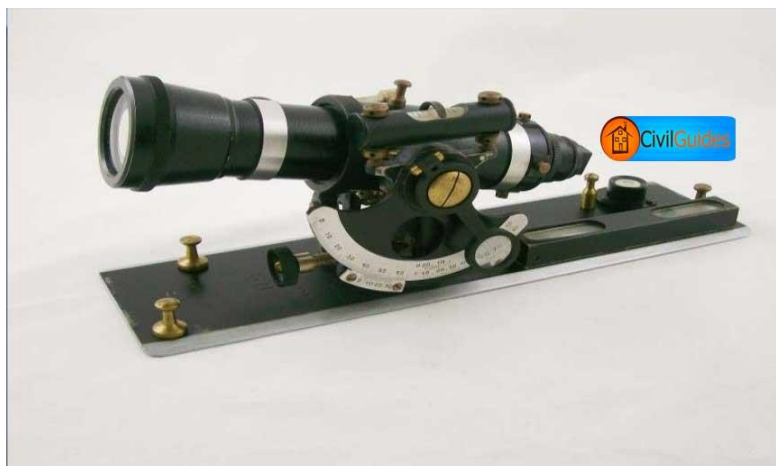
# PLANE ALIDADE



The alidade may be plain fitted with sight vanes at both the ends, or it may be equipped with a telescope.

One of the sight vanes is provided with a narrow rectangular slit. While other is provided with a central vertical hair or wire.

If the alidade is telescopic, the telescope is provided with a vertical circle, and a level tube is fitted with cross-hairs.



**Telescopic Alidade**

### 3. Spirit Level:

If the spirit level which may be very sensitive is not fitted to the alidade, the table can be levelled by placing the spirit level in two positions at right angles to each other and setting the plane table such that the bubble is central in both positions.



#### 4. Trough Compass:

Trough Compass with two bubble tubes at right angles to each other mounted on a square brass plate is used for indicating the direction of the magnetic meridian on the paper.

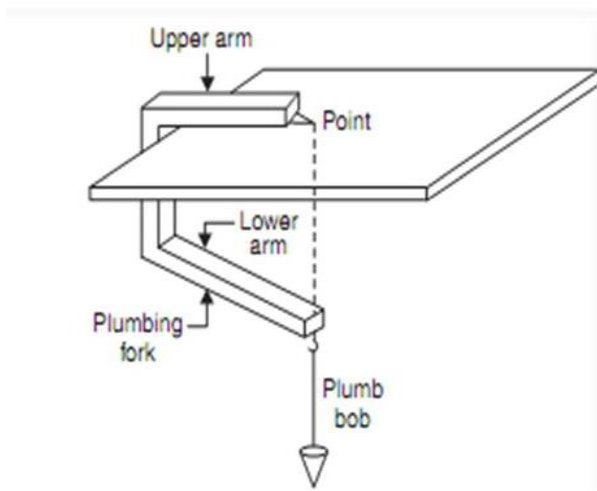


#### 5. U-Frame or Plumbing Fork:

A plumbing fork with a plumb bob attached to one end is used for centering the table at a particular station.

This is used in large-scale work for setting the table such that the point on the paper (representing the instrument station being occupied) may be brought vertically over the station marked on the ground.

### U-FORK WITH PLUMB BOB



## 6. Paper or Drawing Sheet:

The paper used for plotting the survey on the plane table should be of excellent quality because it is very sensitive and liable to changes due to the variation of humidity of the atmosphere. The paper expands and contracts in different directions with different amounts which consequently alters the scale and distorts the map.

The paper may be fixed on the drawing board by using drawing pins or by pasting the edges. Besides these, the other drawing instruments like a pencil, rubber, scales, etc., are also required for plane table survey.



## 7. Tripod:

Tripod is also required for plain table survey. It is in one of the important plane table survey instruments without it is impossible to do plain table survey.

Tripod is used to fix the drawing board. It consists of a screw at the bottom which is used to set and level the drawing board on it comfortably.



# Methods for Plane Table Survey

The setting up of the table includes three operations,

- (1) Levelling the table;
- (2) Orienting the table; and
- (3) Centering the table, i.e., (the point on the paper representing the station being occupied should be vertically above the point on the ground).

## (1) Levelling:

The plane table should be set up at a convenient height (nearly a meter) by spreading the legs to keep the table approximately levelled above the particular station.

The levelling is then completed by using of levelling screws (if provided) or by tilting the board by hand if the instrument has a ball and socket arrangement.

A level tube or circular level is placed on the table first parallel to two screws and then over the third screw.

If the levelling or the ball-and-socket arrangement is not provided, the levelling may be completed by simply adjusting the legs.

## (2) Orientation:

Orientation may be defined as the operation keeping the table at each of the successive stations parallel to the position occupied by the table at the first station.

Thus, all the lines on the paper will be parallel to the corresponding lines on the ground if the table is oriented. This operation becomes necessary in case of more than one instrument stations.

If orientation is not done, the board would not be parallel to itself at various instrument stations and the plan would be obtained by using a different meridian at each station, and the relative plotted positions of various points in the area will be quite different from the actual ones.

There are two methods of the orientation of the table,

- (a) By back sighting and
- (b) by magnetic needle.

### (3) Centering:

Centering is an essential step in plain table survey. The centering means to set the table vertically on the ground point.

To perform this operation, place the pointed end of the upper leg of the fork coinciding with the point on the paper and suspend a plumb-bob from the lower leg and shift the table body until the plumb-bob of the fork hangs precisely over the centre of the station peg.

## General Instructions during Plane Table Surveying

**The following points should be kept in view while surveying with a plane table:**

- (i) The points A, B, C etc. on the ground should be denoted by the corresponding small letters a, b, c, etc. when plotted on the sheet.
- (ii) The table should be turned only when it is to be oriented. After performing the orientation, it must be kept clamped in position.
- (iii) The table should be kept clamped in position while the objects are sighted. Only the alidade should be moved on the table to bisect the objects.
- (iv) While the sights are being taken, the fiducially edge of the alidade must be set touching the plotted station-point on the sheet and not the other edge.
- (v) The lines should be drawn as fine as possible and with a good quality hard pencil.
- (vi) The lines should be drawn close to the edge of the alidade.
- (vii) Unnecessary complication of rays should be avoided. The rays and reference marks as soon as they can be dispensed with should be rubbed off.
- (viii) The drawing should be kept as clean as possible.

## Errors in Plane Tabling Surveying

**The common sources of error may be classified as:**

1. Instrumental errors.
2. Errors of manipulation and sighting.
3. Errors of Plotting.

### **1. Instrumental Errors:**

- (i) The surface of the board not being a perfect plane.
- (ii) The fiducially edge of the alidade not being a straight line.
- (iii) The sights of the alidade not being perpendicular to its base.
- (iv) The fittings of table and tripod being loose.
- (v) The defective trough compass.

All the above errors are adjustable and the effect of the residual errors of adjustment is quite negligible.

### **2. Errors of Manipulation and Sighting:**

- (i) The board not being horizontal.
- (ii) The table not being accurately centered.
- (iii) The table not being correctly oriented.
- (iv) The table not being properly clamped.
- (v) The objects not being correctly sighted.
- (vi) The alidade not being correctly centered on the station-pointing the paper.
- (vii) The rays not being accurately drawn through the station point.

### **3. Errors of Plotting:**

Errors of plotting are a common source of inaccuracy and can only be minimised;

- (i) By using a good quality paper and stretching it properly on the board.
- (ii) By constant care in drawing and in the use of scales.

## **Types of Plane Table Surveying**

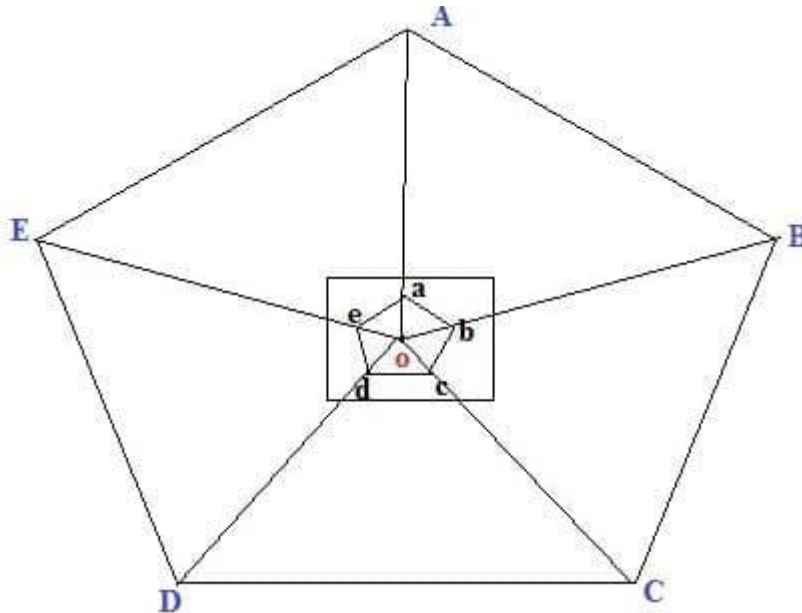
Generally there are four methods are available to perform plane table surveying. They are

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



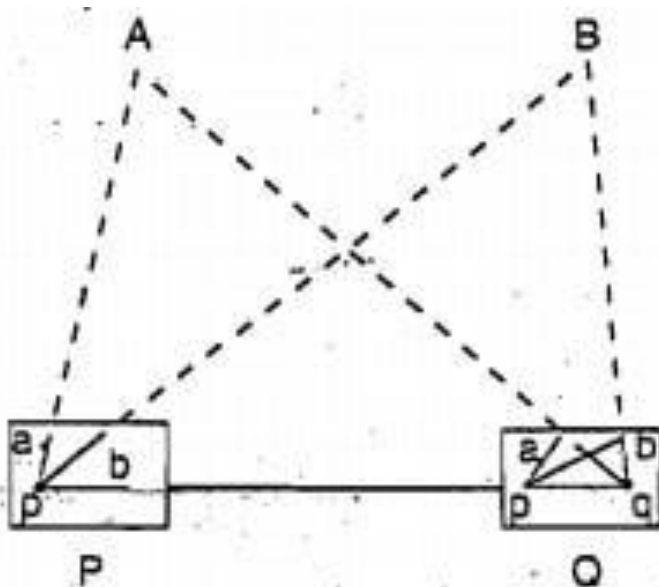
## 1. Radiation

In this method, plane table is located at one point “o” as shown in fig. and perform the whole from that point. From point O, sight the points A,B,C,D and E using alidade, locate and plot the points as a,b,c,d and e in the drawing sheet.



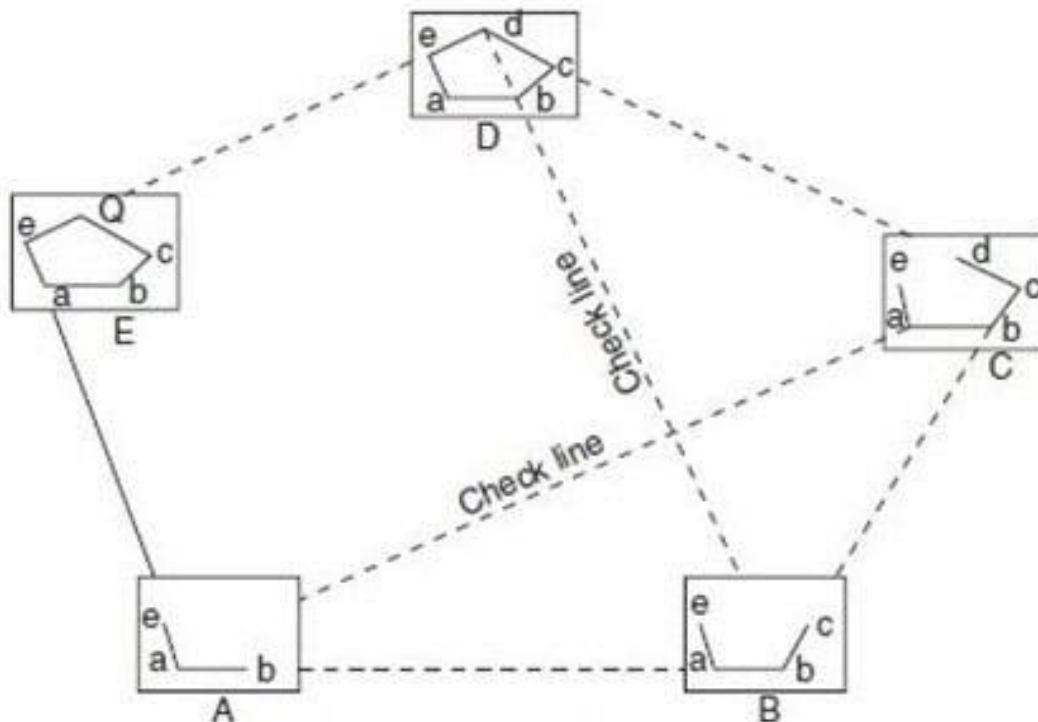
## 2. Intersection

In this method we can locate the point by plotting two rays from two known stations. As shown in figure, P and Q are the known station. First the equipment is placed on P and plot the lines by sighting the stations A, B and Q. then shift the equipment to station Q and plot the lines by sighting stations A, B and P. Finally, the intersection of A and B rays is the required location of point of intersection.



### 3. Traversing

Traversing is the connection of series of straight lines. In case of traversing, plane table is located at one point for suppose A as shown below. From that point sight towards B and measure the distance AB. Then shift the plane table to point B and sight towards A and measure BA. Average distance of AB and Ba are plotted to scale in drawing sheet. Then Sight the point C from B and measure BC and repeat the same procedure until last point. Conduct some checks at some points. Finally traverse lines are plotted on the drawing sheet.



### 4. Resection

Resection is a method of plane table surveying in which location of plane table is unknown and it is determined by sighting it to known points or plotted points. It is also called method of orientation.

## **Merits of Plane Table Survey**

- (1) Map of the area is plotted in the field, i.e., both the field work and the plotting are done simultaneously.
- (2) Field notes of the measurements are not required, and thus the errors in booking are eliminated.
- (3) The correctness of plotted work can be checked by check observations in the field.
- (4) Office work is only finishing up of the drawing.
- (5) Direct measurements of lines and angles are avoided as they are obtained graphically.
- (6) Errors due to extended angular observations with angular instruments and incorrect plotting with bad protractors are avoided.
- (7) This is suitable in a magnetic area where you can't rely on the compass survey.
- (8) More work will be done in less time and labour.
- (9) It is less costly than a Theodolite survey.
- (10) It is most suitable for preparing small-scale maps.
- (11) Contours and irregular objects may be represented accurately.
- (12) The reduced levels of points other than the station points of known elevations may be found out with the help of a tangent Clinometer.
- (13) The survey can be completed very rapidly.
- (14) Much skill is not required to prepare a map.
- (15) The danger of omitting the necessary measurement is eliminated as the survey is plotted in the field.

## **Demerits of Plane Table Survey**

- (1) Plane tabling is not suitable for work in wet climates, in places where high winds predominate, and in wooded country.
- (2) If the area to be surveyed is large, frequent changes in the size of drawing sheets are required.
- (3) Due to changes in temperature, the table is liable to warp.
- (4) If the sun is bright, plotting may be difficult due to the strain on the eyes.

- (5) It is not very accurate for large-scale surveys as compared to compass and Theodolite surveys.
- (5) The instruments and its accessories are heavy and cumbersome, and they are likely to be lost.
- (7) Since the field notes are not maintained, it is inconvenient to calculate the quantities or re-plot the survey to a different scale if required.
- (8) Although the plane table is advantageous in open country, it is inferior to the compass in the thickly wooded lands.
- (9) The plane tabling is not intended for accurate work.