

# Surveying-I

## CE-205 (T)

### Plane Table Surveying

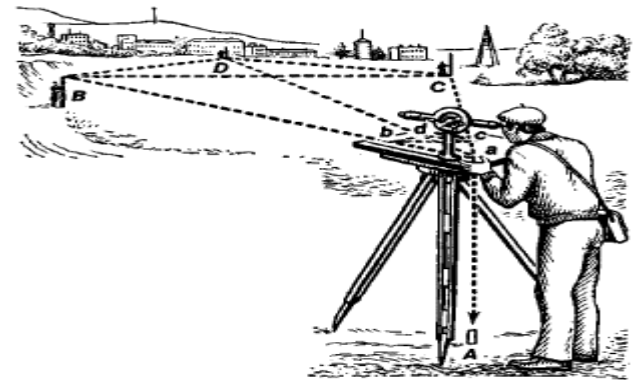
#### Lecture 4

Department of civil engineering  
UET Peshawar

Lecturer  
Engr. Muhammad Rizwan

# Plane Table Surveying

- Plane table is a graphical method of surveying in which the field works and the plotting are done simultaneously.
- It is most suitable for the filling in of the details between stations previously filled by triangulation or theodolite survey.
- It is particularly adopted for small scale or medium scale mapping , in which great accuracy in in details are not required as for topographical survey.



# Instruments In Plane Tabling

## **The Plane Table Essentially consist of :**

- A) A drawing board, mounted on a tripod and
- B) A straight edge called Alidade.

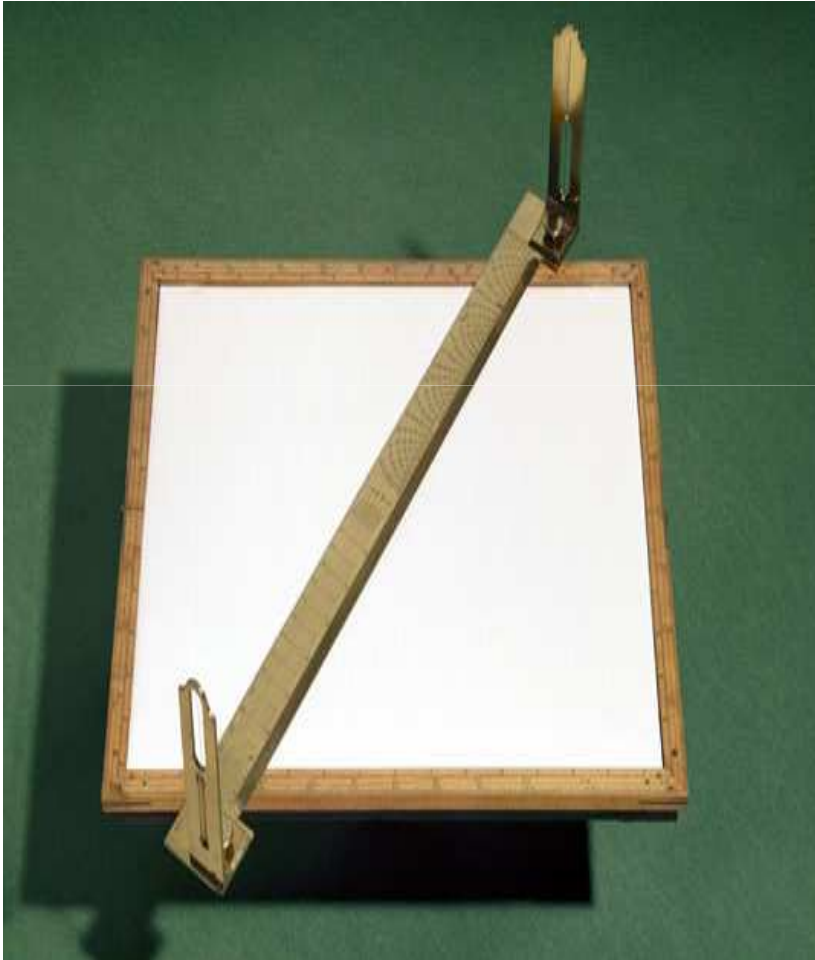
## **The Drawing Board :**

Made of well seasoned wood, 40cm x 30cm to 75cm x 60 cm Or 50 cm to 60 cm square, mounted on a tripod, such that can be leveled and revolved about vertical axis and clamped in any position. Board fitted with a ball and socket arrangement.

## **The Alidade:**

Consist of metal ruler about 50 cm long having straight and smooth ruling edge (working edge) also called Fiducial edge.

# Instruments In Plane Tabling



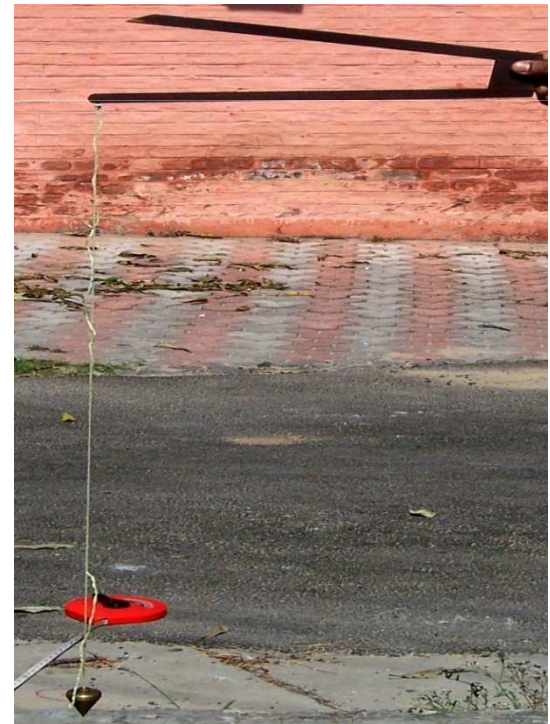
Lecture 4



Plane Table Surveying

# The Accessories to the plane table are:

- 1) Trough compass or circular compass
- 2) a Plumbing fork for or U frame, with a plumb bob for centering the table.
- 3) a Water proof cover to protect the sheet from rain.
- 4) Paper



# Advantages and Disadvantages of Plane Tabling

## Advantages

- It is most suitable for preparing small scale survey.
- Is most rapid.
- The field book is not required.
- The surveyor can compare the plotted work to the actual features.
- There is no chance of omitting the necessary measurements, as the map is prepared in the field.
- It is less costly than the theodolite.

# Advantages and Disadvantages of Plane Tabling

## Disadvantages :

- It is not suitable for work in wet climate.
- It is heavy and is difficult to carry.
- There are many accessories to carry and may be lost.
- It is not intended for accurate work.
- If the map is to be re plotted it is very inconvenient in the absence of field notes.

The Points to be kept in mind while surveying with plane table:

- The small letters a,b,c are used to represent the stations on the paper.
- The table will remain stationary while the alidade is rotated to sight the station.
- While taking the reading the alidade must be centered.
- The board is turned only when the table is to be oriented.



# Setting up the plane table

It includes the following operations:

## 1) The table is fixed at a convenient height

Say about 1m and approximately leaved, legs should spread well apart and firmly fixed.

## 2) Centering

## 3) Leveling

## Home Assignment

# Orientation of Plane Table

- The preparation of keeping the table at each of the successive stations parallel to position which it occupied at the first station is known as **Orientation.**
- When table is properly oriented the lines on the paper are parallel to the lines on the ground, which they represent.
- **There are two methods of Orienting the Table:**
  - 1) By Use of Magnetic Needle
  - 2) By Backsighting

# 1) Orientation by Magnetic Needle

- To orient the table at any subsequent station, the rough compass(or circular compass) is placed along the line representing the magnetic meridian which has been drawn on the paper at first station and the board is then turned until the ends of needle are opposite the zeros of scale.
- The board is then clamped in position.
- This method is sufficiently accurate provided there is no local attraction.
- Suitable for rough small scale.

## 2) Orientation by Backsighting

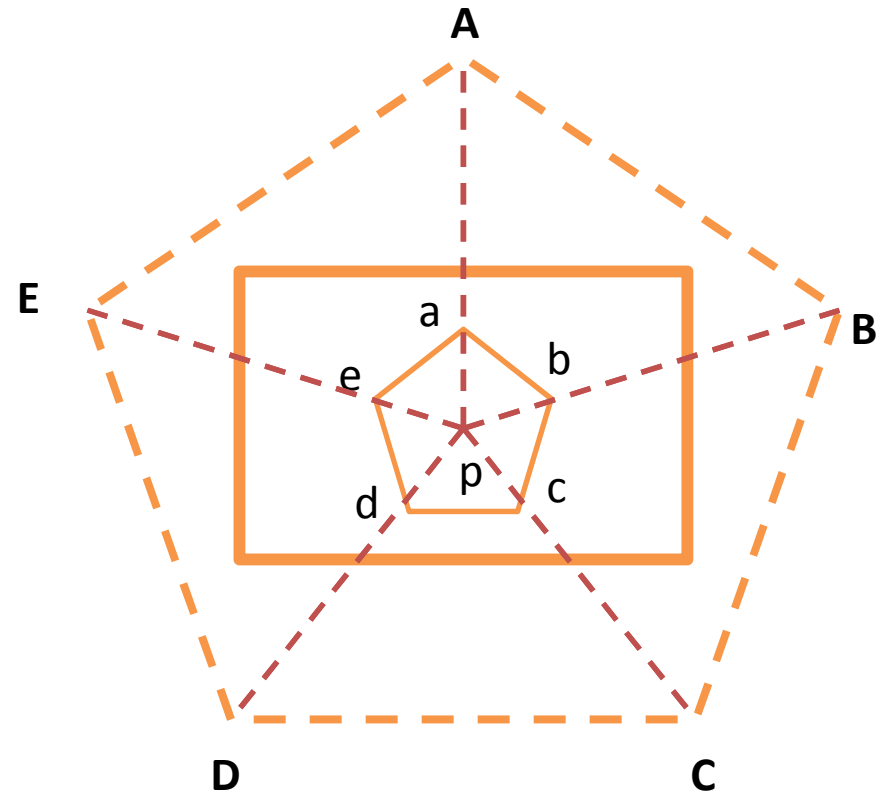
- This is most accurate method and always preferred.
- In this method, the fiducial edge of alidade is laid along a ray drawn from previous station to the present station and the plane table is then rotated till the line of sight of alidade bisects exactly the ranging rod placed at previous station.
- The plane table is then clamped and said to be oriented. In this method, the level of the plane table has to be maintained identical in both the stations.

# Methods of Plane Tabling

- There are 4 methods of Survey with Plane Table:
  - 1) Radiation
  - 2) Intersection
  - 3) Traversing
  - 4) Resection

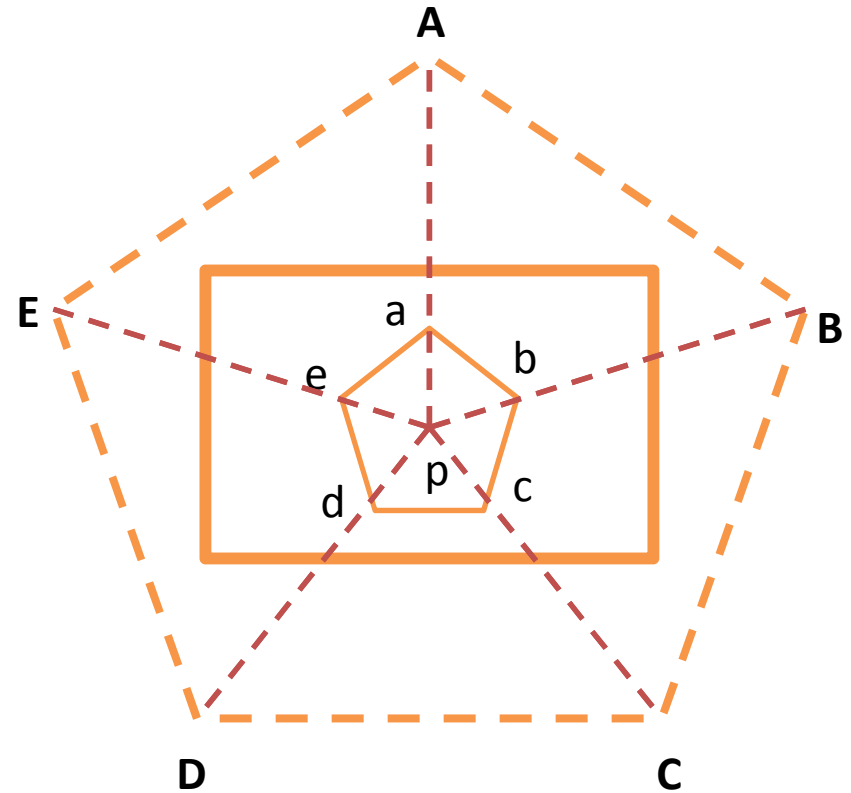
# 1) Radiation

- In this method the point is located on plan by drawing a ray from the plane table station to the point, and plotting to scale along the ray, the distance measured from the station to the point.
- The method suitable for the survey of small areas which can be commanded from a single station.
- Chiefly used for locating details from stations, which have been previously established by other methods such as Triangulation or Traversing.

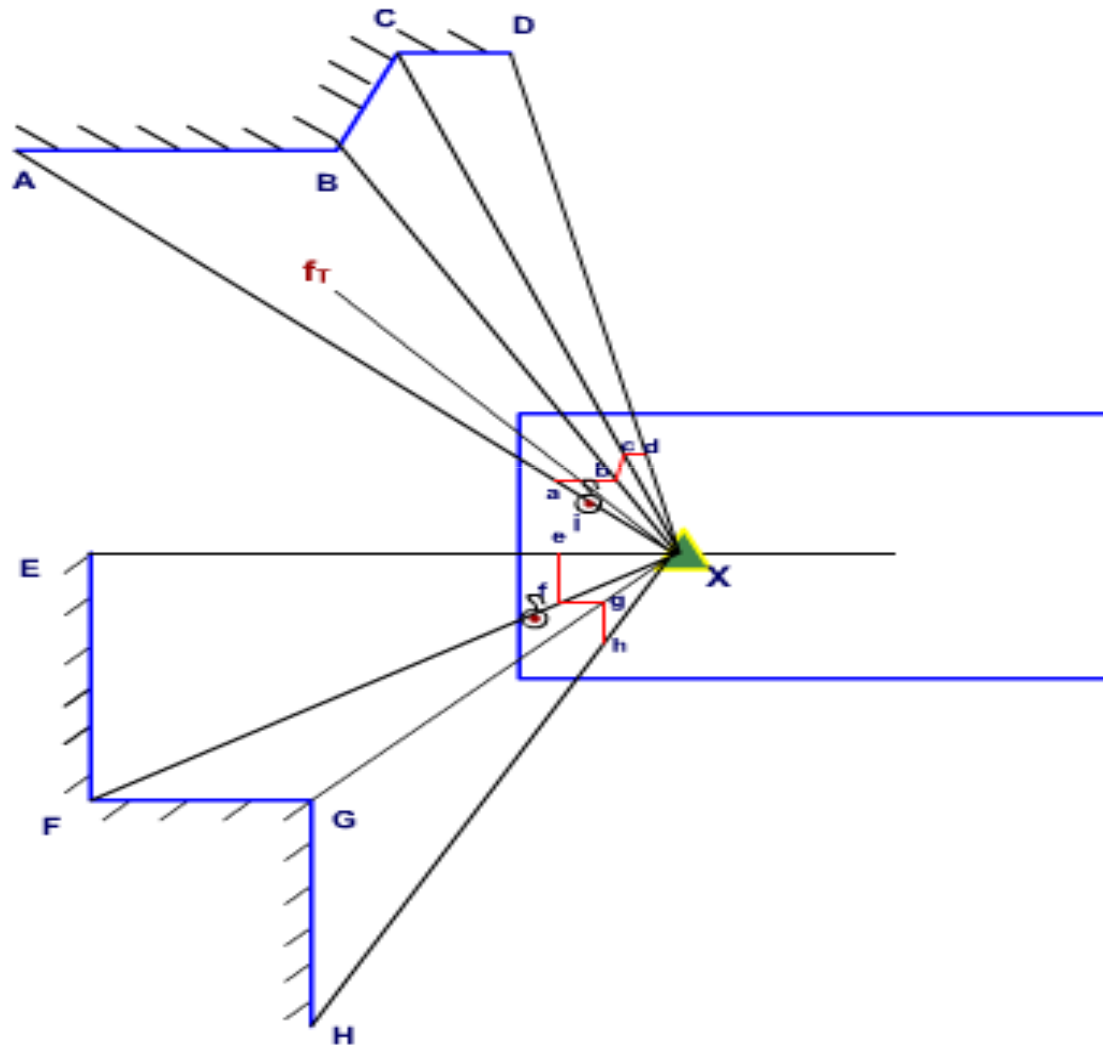


# Radiation Procedure:

- Select Point P on ground such that all the points to be located are visible.
- Set up the table at point P and after leveling it clamp it.
- Select a point on sheet such it exactly above he P, this is done with the help of U-frame.
- Mark the direction of the magnetic meridian with trough compass.
- Centering the alidade at p sight various points all around and draws the rays along the fiducial edge.
- Measured the distance PA, PB, PC and so and plot on the sheet according to scale.



# Radiation

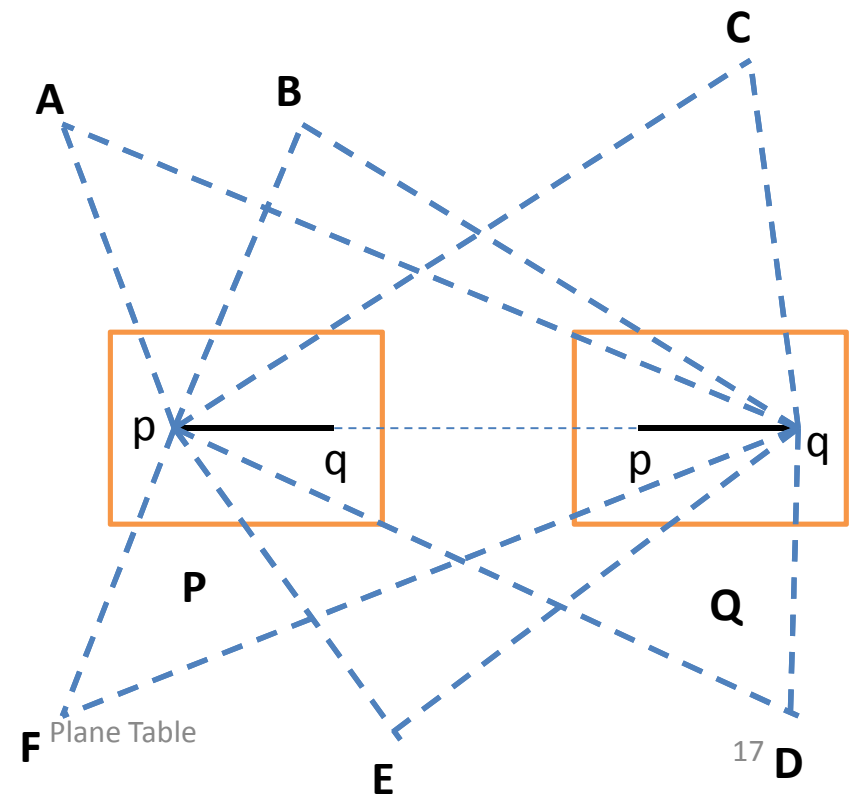




# 2) Intersection

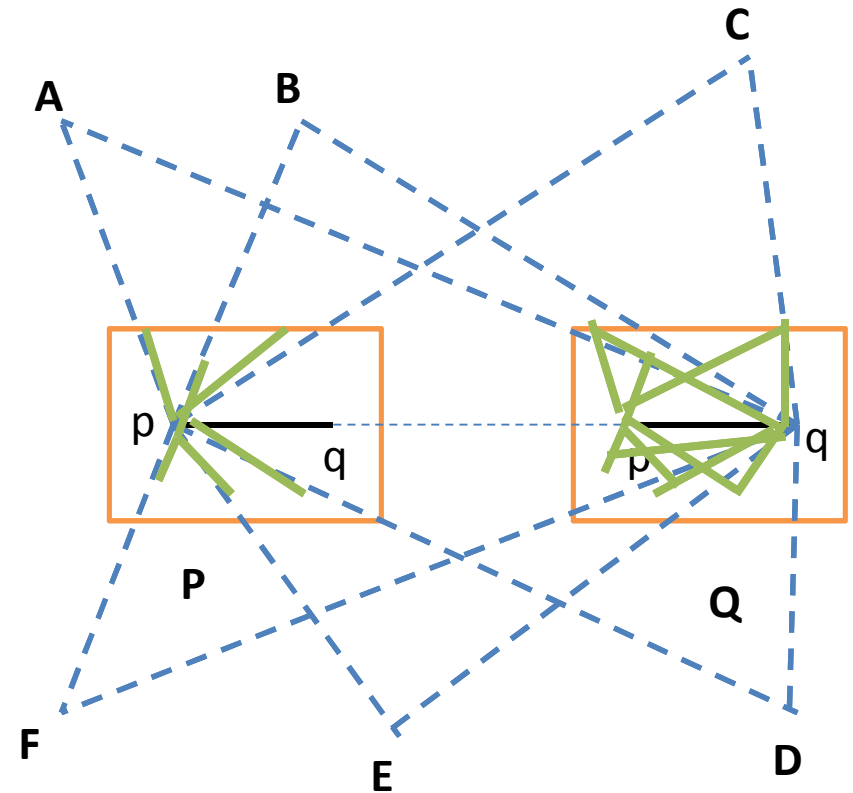
- In this method the point is fixed on plan by Intersection of rays drawn from Two Instrument Station.
- The line joining these stations is called Base Line.
- The method requires only the linear measurement of this line.

- The method commonly used for locating:
  - a) Details
  - b) distant and inaccessible points
  - c) broken boundaries
  - d) Rivers
  - e) Checking distant objects



# Intersection Procedure:

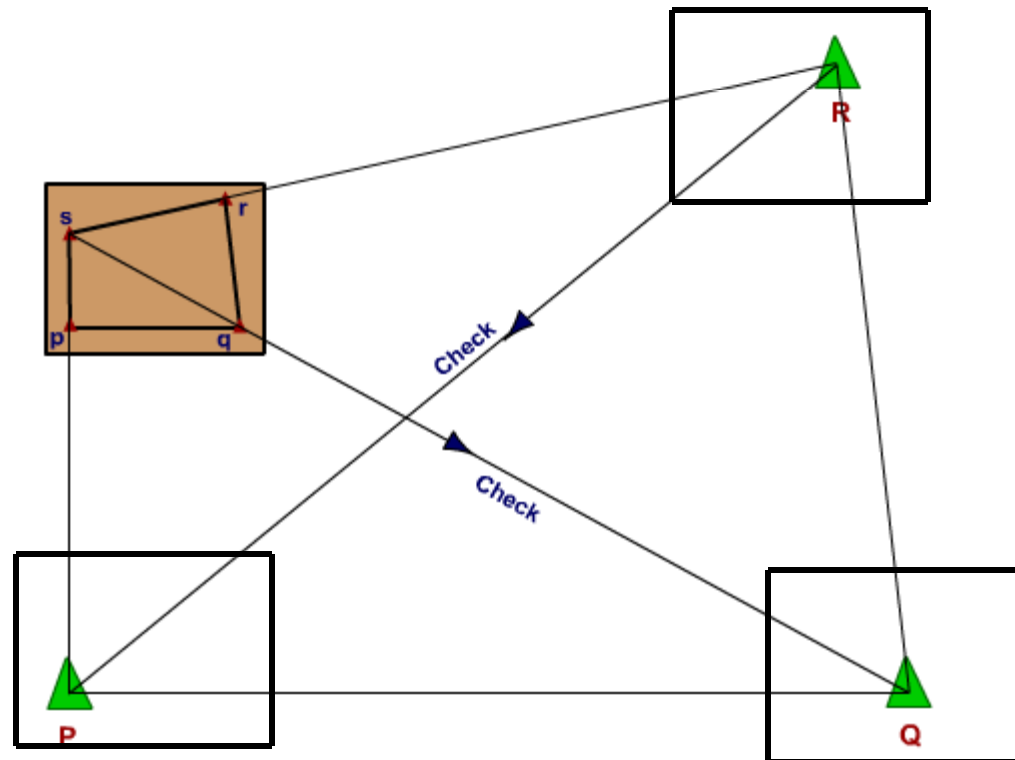
- Select two points P and Q in commanding position, line joining P and Q is called Base line.
- Select a point p on sheet above station P, center and level it and also mark the magnetic north.
- With the alidade centered with p draw rays to Q and other points say A,B,C etc.
- Measure distance between P and Q accurately and mark the location of q on sheet.
- Shift the table and fix it at Q such that q is exactly above the station Q.
- Place alidade along qp and orient the table by backsighting and clamp it.
- With the alidade placed along q draw rays to the objects again.
- The point of intersection will give the location of all these points.





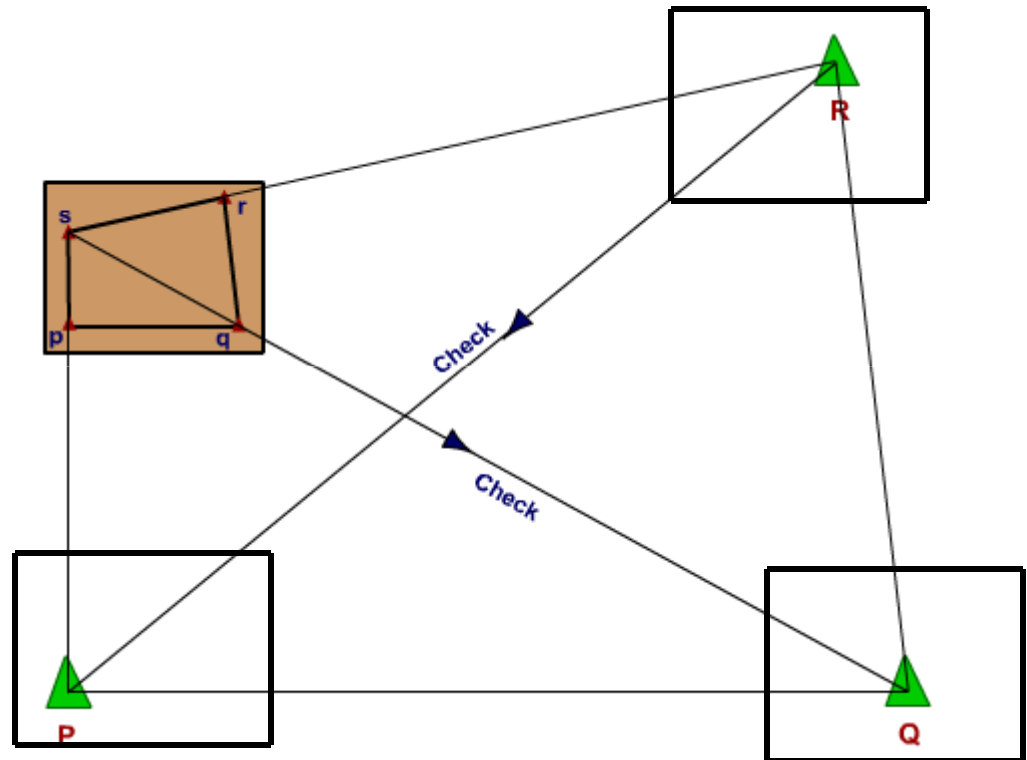
# 3) Traversing

- This method is similar to the compass traversing.
- It is used for running survey lines between stations which have been previously fixed by other methods of surveying to locate the topographical details.
- It is also suitable for survey of Rivers or Roads etc.



# Traversing

- Procedure  
Home Assignment

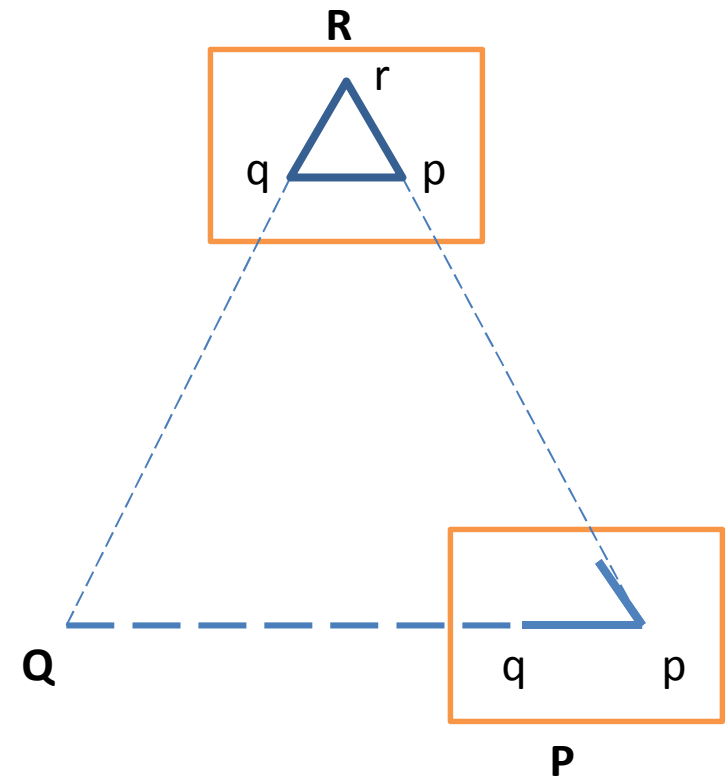


# 4) Resection

- This method is used for establishing the instrument stations only.
- After fixing the stations. Details are located by either radiation or intersection.
- The characteristic feature of Resection is that, the point plotted on the plan is the station occupied by the Plane Table.

- Select a base line **PQ** on ground, measure it accurately with steel tape.
- Setup table at **P**, Center it,
- Placing alidade at line **pq** . Orient table by running ray until **Q** sighted, clamped it.
- With alidade touching **p**, sight **R** , which is to be located by intersection.
- Shift the instrument and setup at **R**, orient the table by taking back sight on **P**, clamp it.
- With alidade centered at **q**, sight the station **Q** and draw a ray.
- The point of intersection of this ray and that previously drawn from **p** gives the required point **r**.

**This method is called Back Ray method.**



## **The others cases of Resection are:**

- 1) Two Point Problem
- 2) Three Point Problem

### **1) Two Point Problem:**

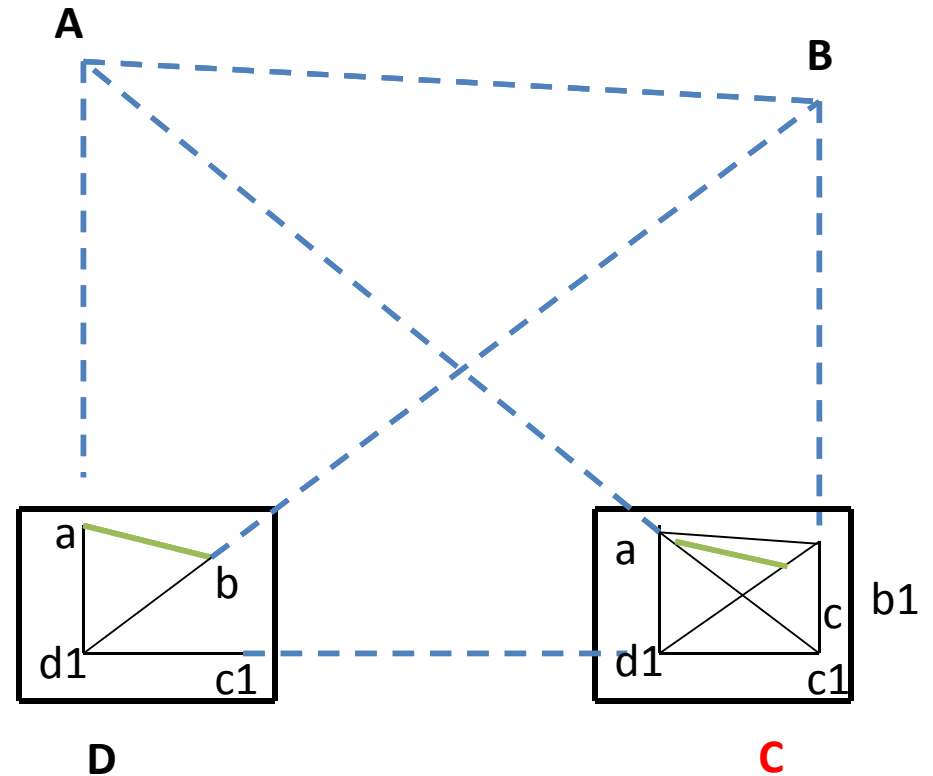
Two point problem consist in locating the position on the plan of the station occupied by the plane table, by means of observation to Two well defined points, which are visible from the instrument station and whose position have been already plotted on the plan.

**A B** are the two points on ground, **a b** their plotted position on sheet, **C** the station over which the table is to be setup and **c** is its position on sheet/plan.

The solution obtain as :

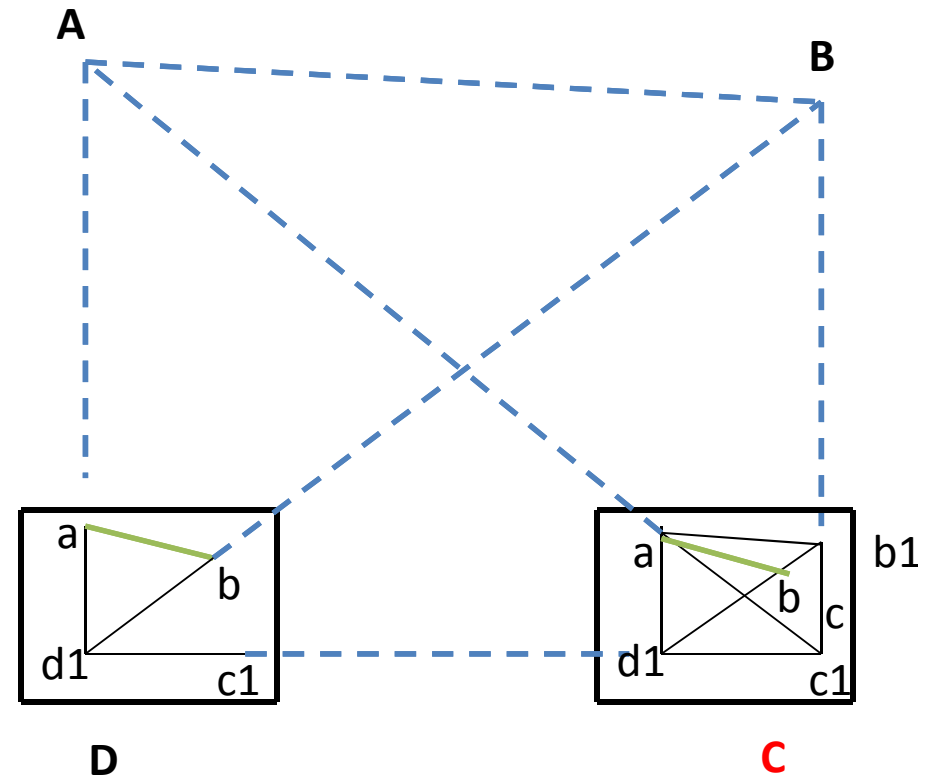
**Solution:**

- Choose suitable station **D**.
- Setup the table at **D**, orient the table by compass or judging **ab** line parallel to **AB** and clamp it.
- With alidade touching **a**, sight **A** and draw ray. similarly with alidade touching **b** sight **B** and draw line. Intersection **d1** (station **D**).
- With alidade centered on **d1**,sight **C**, and draw ray **d1c1**.





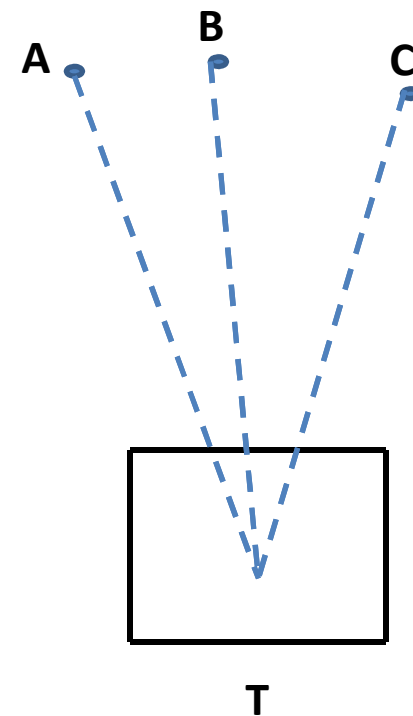
- Remove table and setup at **C**, orient table by backsighting on **D**.
- With alidade against **a**, sight **A** and draw ray intersecting the line **d1c1** in **c1**.
- With alidade centered at **c1** sight **B**, proved to pass through **b**, if properly Oriented., if not then **c1B**, and **d1B**.
- **b1** represent station **B**.
- **ab** is true representation of line **AB**, so error in orientation equal to angle **b1ab**.
- To eliminate the error the table must be rotated by this angle.
- To do this: place alidade along **ab1** and fix a ranging rod **P** at a great distance from the table and bisect.
- Place alidade along **ab** and bisect again **P**. now **ab** is parallel to **AB**.
- To find true position of **C** , center alidade on **a** and bisect **A**, draw ray. Similarly center at **b** and , bisect **B** and draw ray. The interaction of these two lines will give point **c**(Station **C**)
- 



## 2) Three Point Problem

The three point problem consist in locating on the plan the position of the instrument station on the ground by means of observation to **Three well defined points**, whose positions have been already plotted on the plan.

- Suppose **A,B,C** are three points, which have been plotted as **a,b,c** and the table is setup at **T** from which **A,B,C** are visible.
- It is required to plot on the plan the position **t** of the instrument station **T**.



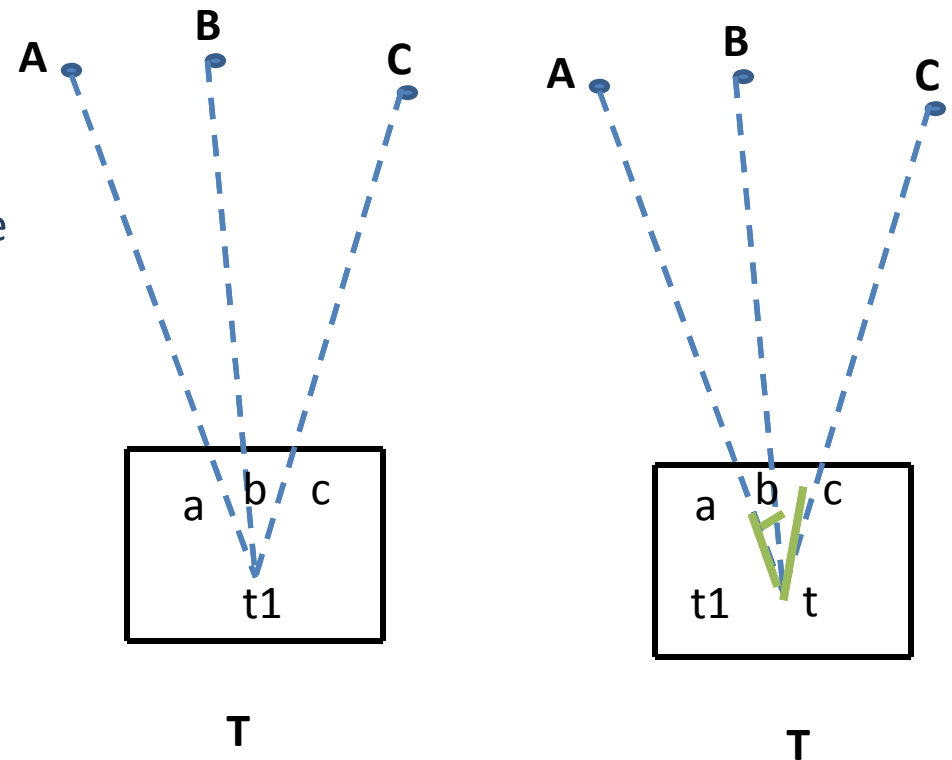
The problem may be solved:

- 1) Mechanically
- 2) Graphically
- 3) by Trial

# 1) Mechanical method:

Also called Tracing –cloth or Paper method.

- The table is setup at **T**. a sheet of Tracing cloth is stretched over the plane table sheet and point **t1** is chosen to represent approximately the station(**T**).
- When alidade center at **t1**, sight **A,B,C** and draw rays.
- The tracing cloth is unfastened and moved around the plane table until three rays pass through plotted points **a,b,c** on the sheet. i.e **t1** and **t** corresponding to station **T**.
- Alidade then centered at **ta** line and the table is oriented by turning the board until **A** bisected.



**2) Graphical method**

**3) Trial method**

**Home Assignment**

# References

- Surveying & Leveling (part 1) by T P Kanetkar & S V Kulkarni  
(Part 1)