India's No.1 Study Channel

Surveying

By Sandeep Jyani Sir

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Que 23. Difference in length of an arc and its subtended chord on earths surface for a distance of 12 km is

a)10 mm

b)15 mm

c)22mm

d)100 mm

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Que 24. Chain surveying is most suitable when

a)The ground is fairly levelled and open with simple details

b)The area is small in extent

c)Plans are required on a large scale

d)All options are correct

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Que 25. Every 20 m chain should be accurate to within

a)± 2 mm

b)± 5 mm

c)± 8 mm

d)None of the above

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Que 26. Method used for chaining on sloping ground is

a)By stepping method

b)By hypotenuse allowance method

c)By clinometer method

d)Both stepping method and hypotenuse

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Que 27. Maximum allowable limit upto that a measurement may very from the true value is known as

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b)Residual error

c)Expected error

d)Sale error

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Que 28. Number of links in a 30 m metric chain is

a)100

b)150

c)180

d)200

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Que 29. Positive error is caused if

a)Length of chain is shorter than the standard

b)Slope and sag correction is not applied

c)Measurements are made along the incorrectly aligned line

d)All options are correct

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Que 30. A well-conditioned triangle has angles not less than _____ and more than _____ respectively

a)10°, 90°

b)20°, 120°

c)90°, 120°

d)None of these

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a)10°, 90°

b)20°, 120°

c)90°, 120°

d)None of these (30° -120°)

Que 31. Compensating errors in chaining are _____.

a)Proportional to the length of line

b)Proportional to the square root of the length of line

c)Inversely proportional to the square root of the length

d)Inversely Proportional to the length of the line

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d)Inversely Proportional to the length of the line

Que 32. If a chain is found very short on testing, it can be adjusted by _____.

a)Straightening the links

b)Inserting additional circular rings

c)Flattening the circular rings

d)Any of the options

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Que 33. Permissible limits of error in chaining for measurement on rough or hilly ground is _____.

a)1 : 2000

b)1 : 1000

c)1 : 500

d)1 : 250

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Que 34. During chaining with a straight line, the leader of the survey party has three arrows and while the follower has five arrows, the distance of the follower from the starting point will be _____.

a)Three Chains

b)Four Chains

c)Five Chains

d)None of these

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d)None of these

Que 35. Invar tape are made of an alloy of _____.

a)Nickle and steel

b)Copper and steel

c)Tin and steel

d)Aluminum and steel

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Que 36. Chainage is the distance measured

a)Along a chain line

b)Perpendicular to a line

c)Perpendicular to a tie line

d)None of these

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Que 37. In chain survey execution, the first step taken is _____.

a)Reference sketches

b)Marking stations

c)Running survey line

d)Reconnaissance

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Que 38. In the surveys, the slope correction applied to the base line is

a)Always cumulative

b)Always compensating

c)Sometimes cumulative, sometimes compensating

d)None of these

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Que 39. The type of surveying in which the curvature of the earth is taken into account is called

a)Geodetic surveying

b)Plane surveying

c)Preliminary surveying

d)Topographical surveying

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Que 40. If his the difference in height between end points of a chain of length *l*, the required slope correction is _____.

$a) \frac{\mathbf{h^2}}{\mathbf{2l}}$

$b) \frac{\mathbf{h}}{\mathbf{2l}}$

$c) \frac{\mathbf{h^2}}{\mathbf{l}}$

$d) \frac{\mathbf{h^2}}{\mathbf{4l}}$

Que 40. If h is the difference in height between end points of a chain of length *l*, the required slope correction is _____.

a) $\frac{h^2}{2l}$

b) $\frac{h}{2l}$

c) $\frac{h^2}{l}$

d) $\frac{h^2}{4l}$

Que 41. Check lines (or proof lines) in Chain Surveying are essentially required _____.

a)To plot the chain lines

b)To plot the offsets

c)To indicate the accuracy of the survey work

d)To increase the out-turn

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Que 42. For which of the following, will the chain surveying be well adopted one?

a)Large areas with difficult details

b)Small surveys in open ground

c)Small surveys with crowded details

d)Large areas with simple details

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Que 44. Which of the following would represent the surface of the water level of a still lake?

a)Level surface

b)Contour surface

c)Horizontal surface

d)None of these

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Que 45. The sag correction in surveys in always _____.

a)Positive

b)negative

c)zero

d)None of these

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b)negative

c)zero

d)None of these

Que 46. What is the true area (in acres), if the area calculated by a 20 m metric chain which is found to be 0.8 link too long is 100 acres

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b) 99.2
c) 98.4
d) 101.6

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Que 47. The correction to be applied to each 30 meter chain length along $\theta°$ slope is _____.

a)$30(\sec\theta - 1)$ m

b)$30(\sin\theta - 1)$ m

c)$30(\cos\theta - 1)$ m

d)$30(\tan\theta - 1)$ m

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c)$30(\cos\theta - 1)$ m

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Que 48. An angle 45° with a chain line may be set our with _____.

a)Optical square

b)Open cross staff

c)French cross staff

d)Prismatic square

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Que 49. The surface of zero elevation around the earth, which is slightly irregular and curved is known as _____.

a)Mean sea level

b)Geoid surface

c)Level surface

d)Horizontal surface

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Plane Table Surveying

- **It is a graphical method of surveying in which field work and plotting are done simultaneously**
- **It is mainly used for small and medium scale mapping (1:10 000 to 1: 25 00 000)**
- **Before starting plane table surveying, at first control stations are established to cover entire area, then a suitable scale is decided**
- **After that surveyor starts collecting details from either of the point and traverses all the stations**
- **Elevation of points of observation are determined with the help of levelling, Indian Clinometer and telescopic alidade**

Advantages of Plane Table Surveying

- **It is suitable for location of details as well as contouring for large scale maps directly in the field.**
- **As surveying and plotting are done simultaneously in the field, chances of getting omission of any detail get less.**
- **The plotting details can immediately get compared with the actual objects present in the field. Thus errors as well as accuracy of the plot can be ascertained as the work progresses in the field.**
- **Contours and specific features can be represented and checked conveniently as the whole area is in view at the time of plotting.**
- **Only relevant details are located because the map is drawn as the survey progresses. Irrelevant details get omitted in the field itself.**
- **The plane table survey is generally more rapid and less costly than most other types of survey.**
- **As the instruments used are simple, not much skill for operation of instruments is required. This method of survey requires no field book.**

Disadvantages of Plane Table Surveying

- **The plane table survey is not possible in unfavorable climates such as rain, fog etc.**
- **This method of survey is not very accurate and thus unsuitable for large scale or precise work.**
- **As no field book is maintained, plotting at different scale require full exercise.**
- **The method requires large amount of time to be spent in the field.**
- **Quality of the final map depends largely on the drafting capability of the surveyor.**
- **This method is effective in relatively open country where stations can be sighted easily .**

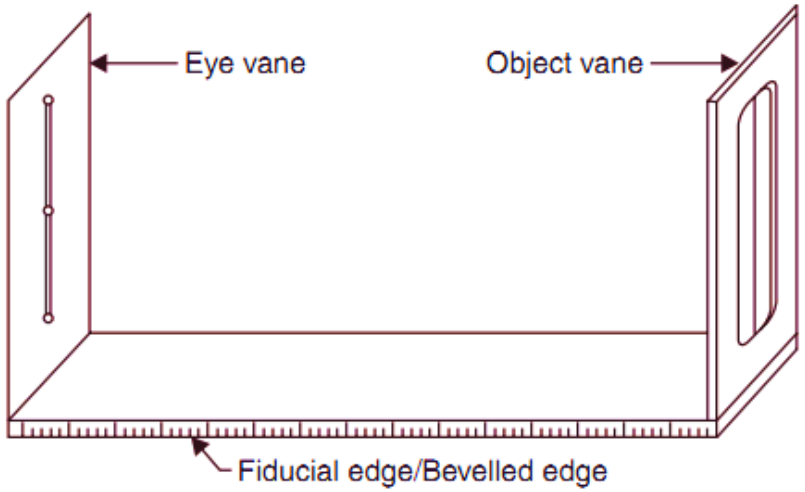
Instruments

- **A plane table mounted on a tripod stand and a number of accessories are used during plane table survey. The accessories consist of alidade, spirit level, trough compass, plumbing fork, plumb bob, drawing sheet**

1. **The plane table consists of a drawing board with arrangement for fixing on a tripod stand.**

A plane table

2. A**n alidade is a straight edge ruler used for sighting the object and drawing lines with object vane and sight vane,** with one of the edges is beveled and graduated known as fiducial edge
   - **The line passing through the slit of the eye vane joining the thin wire of the object vane and passing beyond is known as the line of sight of a plane alidade**

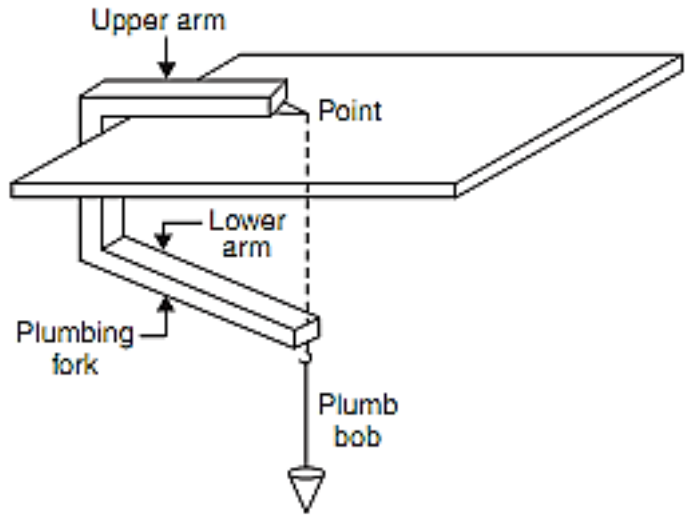


Alidade

Instruments

3. Plumbing Fork

- A plumbing fork is a U-shaped piece of metal or wooded frame
- The end of one of its arm is pointed and the other arm is having an arrangement for hanging a plumb bob
- The frame is constructed in such away that the tip of the pointed arm and the plumb line lie in the same vertical line. At the time of use, the pointed arm is placed on the table and the other arm, with a plumb bob attached, is kept below the table. Plumbing fork with a plumb bob is used in large scale surveying for Centering of the plane table and for Transferring of ground point.



Instruments

4. Spirit Level

- It consists of flat based tube with a small bubble either circular or tubular in shape .
- It is used to check the level of plane table by placing it on the board in two positions at right angles to each other.
- When the bubble tube remains in the centre at any point on the table is considered to be properly leveled.

Instruments

5. Compass

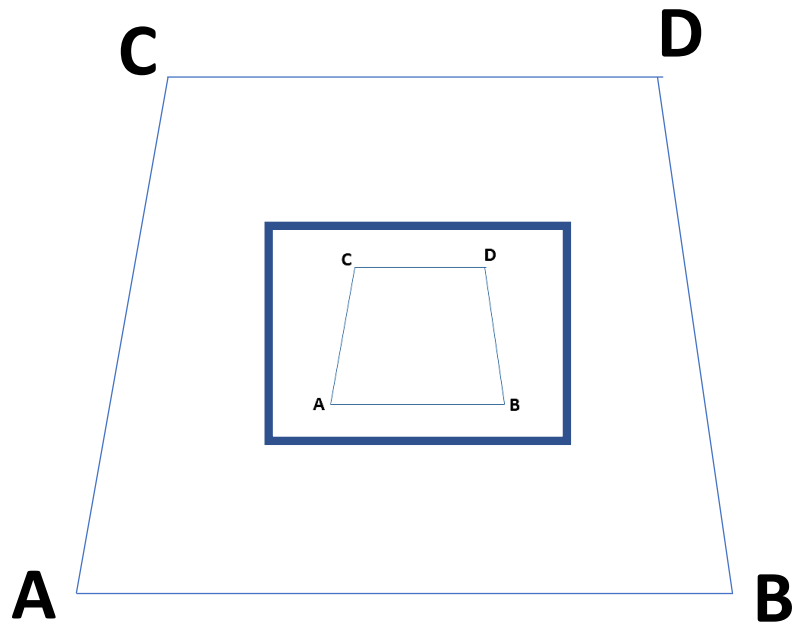
- **Type of compass used is trough compass**
- **It is used for orienting the plane table to magnetic north**
- **The side of trough compass should be parallel and plane such that they can be used as ruler or for placing the compass such that it coincides with the line already drawn in north south direction**

6. Drawing Paper

- **A drawing paper of good quality and well-seasoned is to be used for plotting.**
- **It should be able to withstand the rubbing of the alidade.**
- **The effect of changes in humidity and temperature of the atmosphere should be minimum thus reduction in the expansion or contraction of the paper, and minimum alteration in the scale of the map and distortion in the plan.**

Basic Principle of Plane Table Surveying

- Plane table surveying is based on the principle that lines drawn during plotting always lie parallel to the corresponding lines actually present on the ground.
- For example, let us consider four ground stations A, B, C and D which on joining provides a polygon ABCD. This has been plotted on a sheet of paper at a scale by plane table surveying. Here, the sides AB, BC, CD and DA are plotted in such a way that they are parallel to the sides actually available on the ground.



Setting of Instruments

- At each station, the plane table is required to get set up before carrying out any plotting work.
- It basically consists of the four operations:
  1. **Fixing**
     - In this operation, first the top of the tripod stand is fixed in level by eye estimation at convenient height with its legs uniformly spread and shoes fixed firmly into the ground. The board is fixed to the tripod head by tightening the clamping screw.
  2. **Centering**
     - The table should be so placed over the station on the ground that the point plotted on the sheet corresponding to the station occupied should be exactly over the station on the ground
  3. **Leveling**
     - The top of the table is leveled by moving the legs of the tripod. The level of plane table is first judged by eye estimation. Further, it is checked by keeping spirit level at different positions on the table and if required, legs are further adjusted.
  4. **Orientation**
     - It is a process of putting the plane table into same fixed direction so that the line representing a certain direction on the plan is parallel to the direction on the ground
  5. **Sighting the points**

Methods of Orientation:

a) By Trough compass

- A trough compass is placed on the top right side corner of the drawing sheet an draw line on north south direction
- To orient the plane table, on the top right hand side corner of the drawing sheet and rotate the table till magnetic needle coincides with the line drawn in north south direction

b) By back sighting

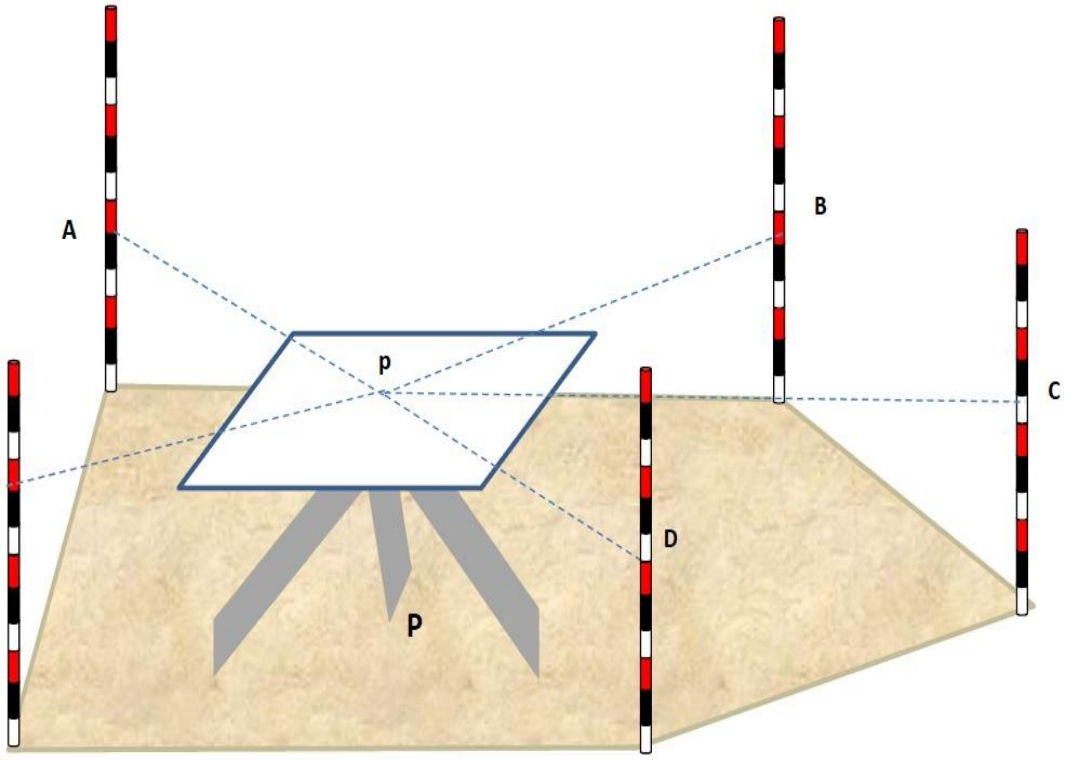
- In this method, plane table is oriented by Backsighting on previous station

METHODS OF PLANE TABLE SURVEY

- Different operations are involved during the location of details through plane table surveying.
- To carry out the operations under different field conditions, different methods of plane table surveying have been evolved –
  1. **Method of Radiation**
  2. **Method of Intersection**
  3. **Method of Traversing**
  4. **Method of Resection.**
- The method of radiation and the method of intersection are employed to locate objects and features present in the area of survey.
- The method of traversing is used to plot the network of stations and the method of resection is employed to determine and to plot the location of the plane table as well as to orient the table simultaneously.

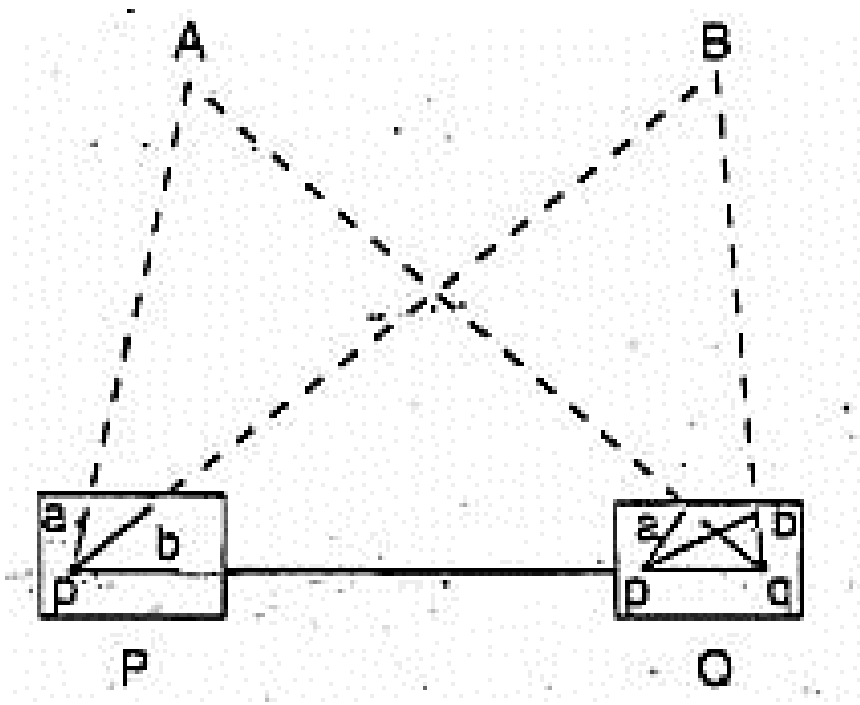
1. METHOD OF RADIATION

- In this method, instrument is set up at a station and rays are drawn to various stations which are to be plotted.
- Then distances are cut on a suitable scale after actual measurement.
- It is suitable for small area where all the points are visible and accessible from the station.
- The method is convenient if telescopic or digital alidade is used. Otherwise, it is effective when associated with tacheometer or EDM for measurement of horizontal distance.



2. METHOD OF INTERSECTION

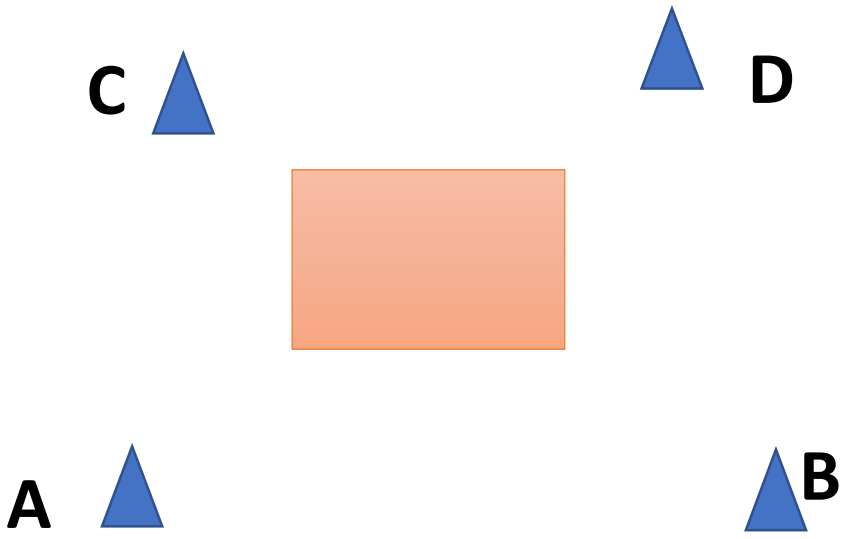
- In this method, locating of a point on the drawing sheet is done by intersecting two rays drawn from two different stations.
- Also called as GRAPHICAL TRIANGULATION.
- It is preferred when distance between stations is very large and stations are inaccessible and ground is undulating.



3. METHOD OF TRAVERSING

- This method of plane table surveying is used to plot a traverse in cases stations have not been previously plotted by some other methods.
- In this method, traverse stations are first selected. The stations are plotted by method of radiation by taking back sight on the preceding station and a fore sight to the following station.
- Here distances are generally measured by tachometric method and surveying work has to be performed with great care.

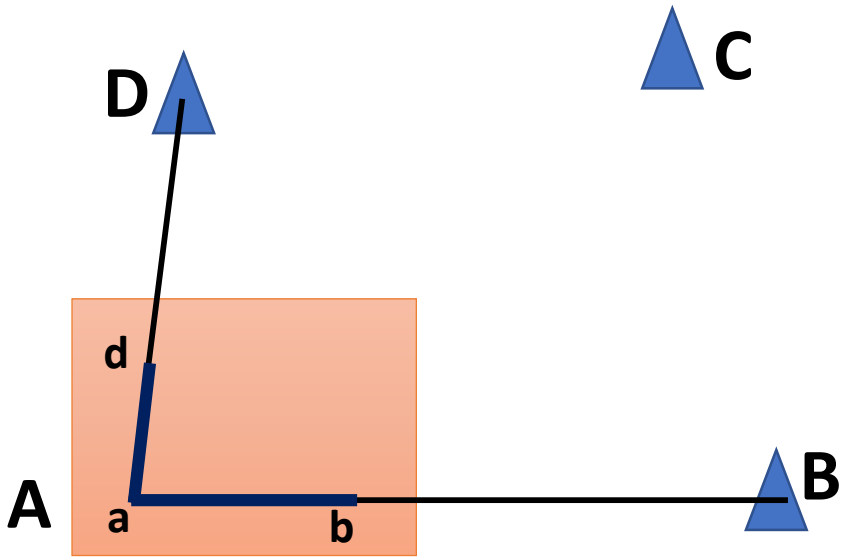
3. METHOD OF TRAVERSING



Let us consider the stations A, B, C and D

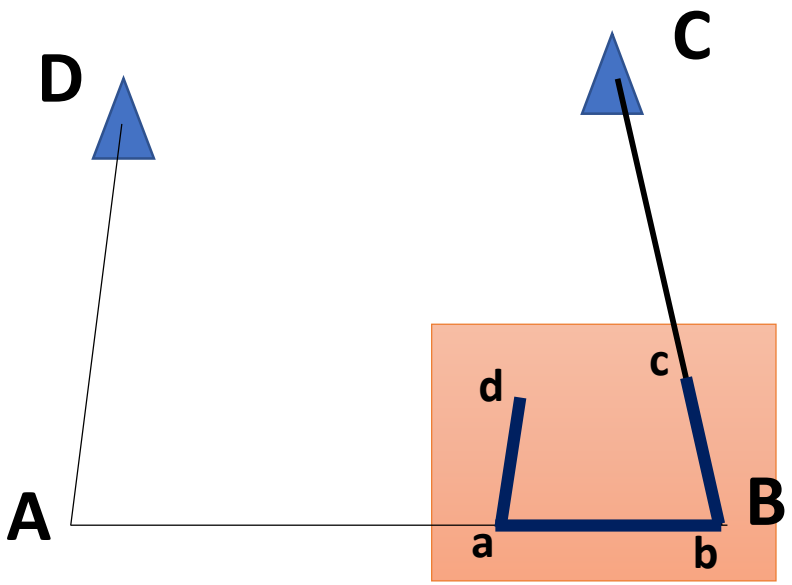
Stations are to be chosen in such a way that adjoining stations are visible

3. METHOD OF TRAVERSING



With the alidade pivoted at a, draw the rays to B and D. Distances AB and AD are measured and plotted on the respective rays, ab and ad respectively.

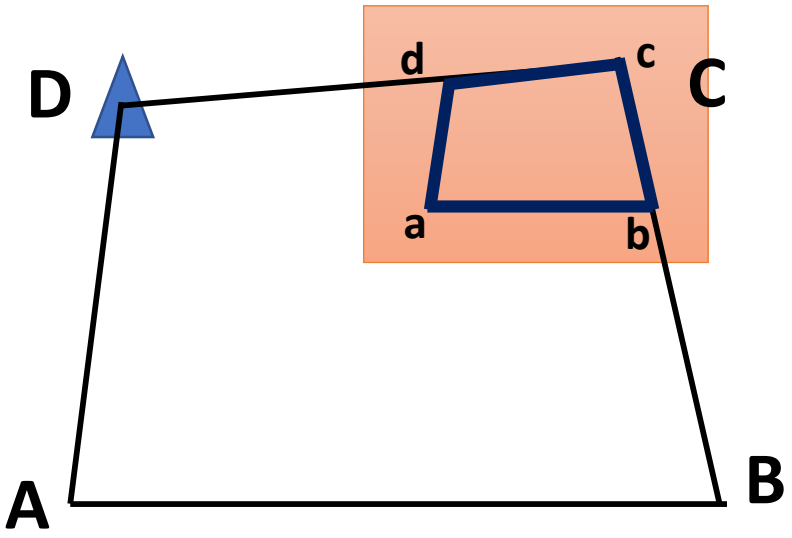
3. METHOD OF TRAVERSING



The plane table is then shifted to station B, get it set and then oriented by back sighting to station A.

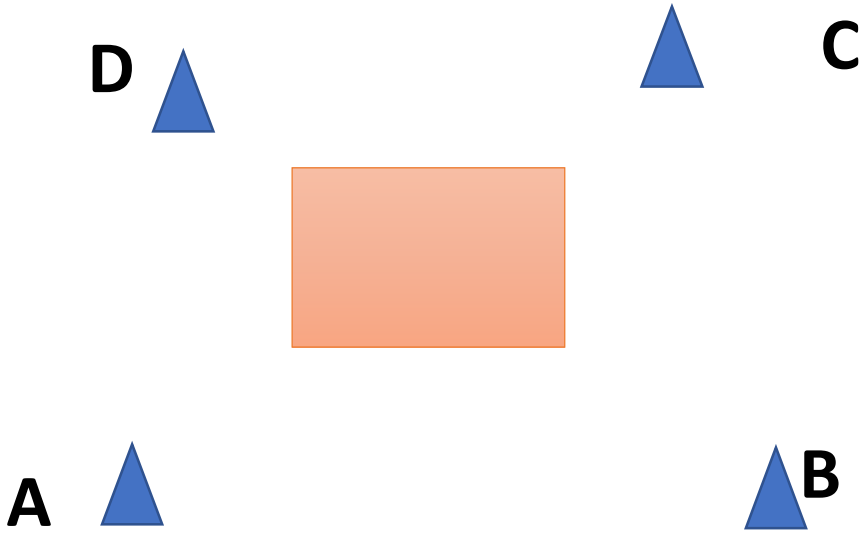
With the alidade pivoted at b, draw a ray to C. Distance BC is measured and plotted on the ray as bc.

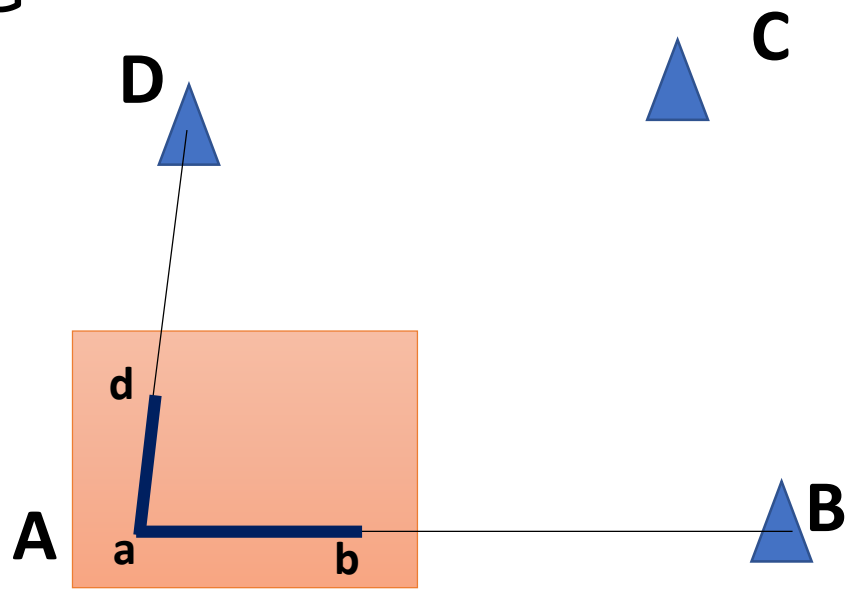
3. METHOD OF TRAVERSING

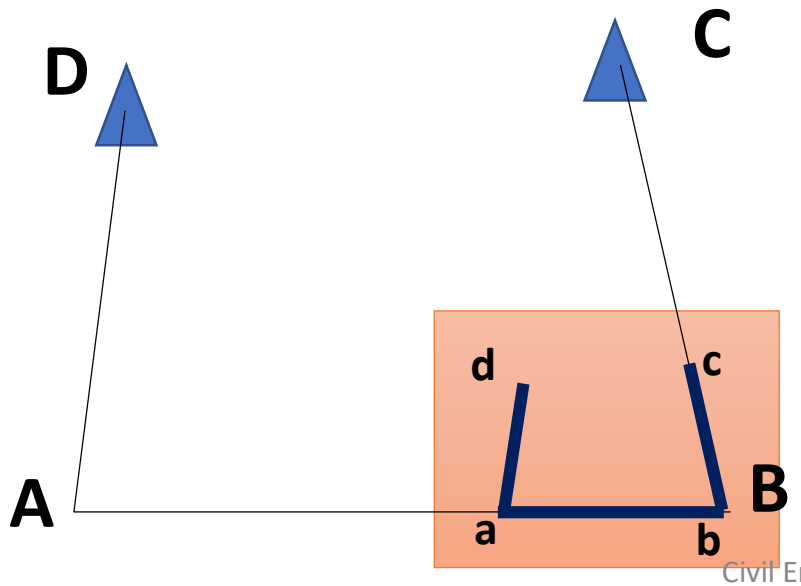


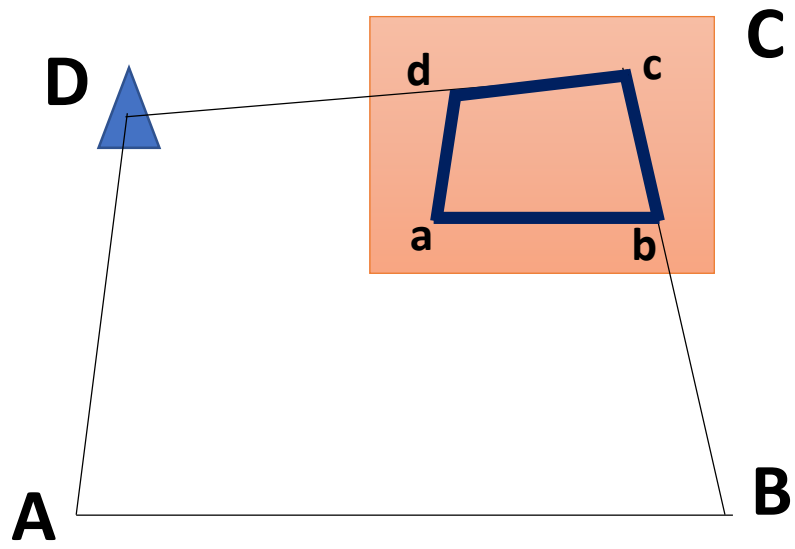
In this way, plane table is shifted to stations C and D and corresponding rays are drawn to obtain the plotting of the traverse abcd.

3. METHOD OF TRAVERSING





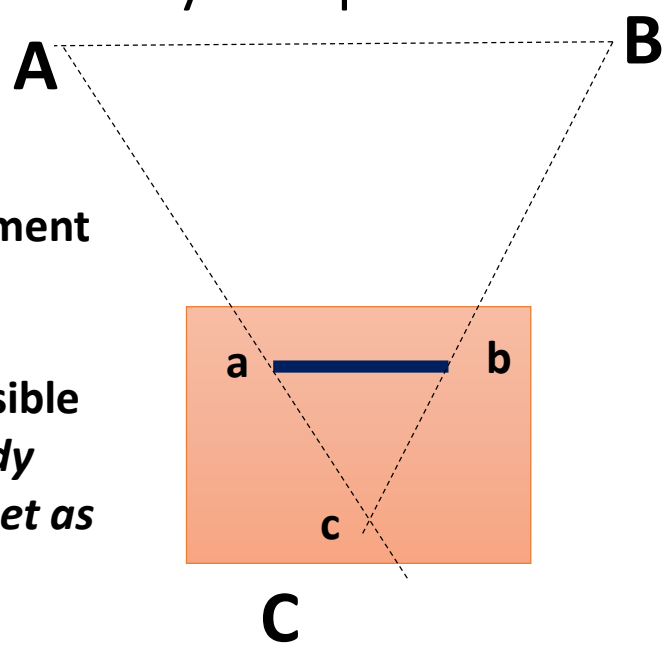




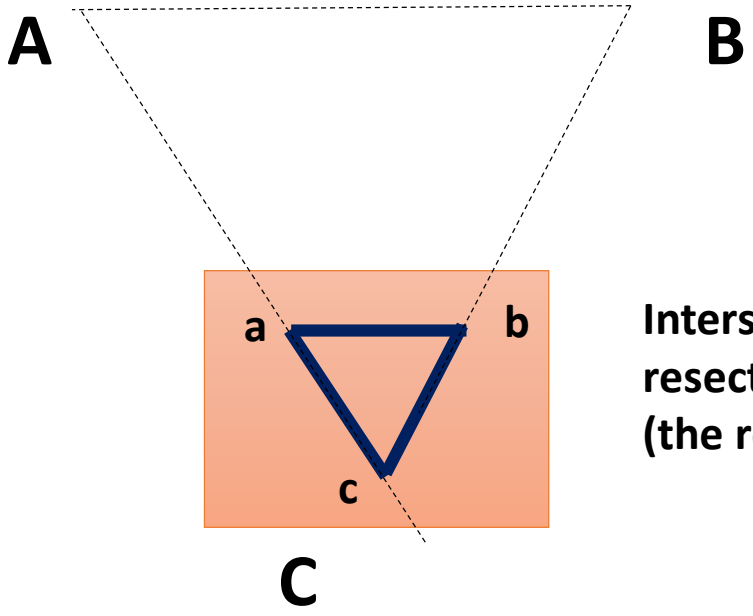
4. Method of Resection

- It is the process of determining location of station occupied by the plane table with reference to stations which are already plotted on the drawing sheet

a) Resection by Compass



C is the instrument station to be located
A and B are visible stations *already plotted on sheet as a and b*

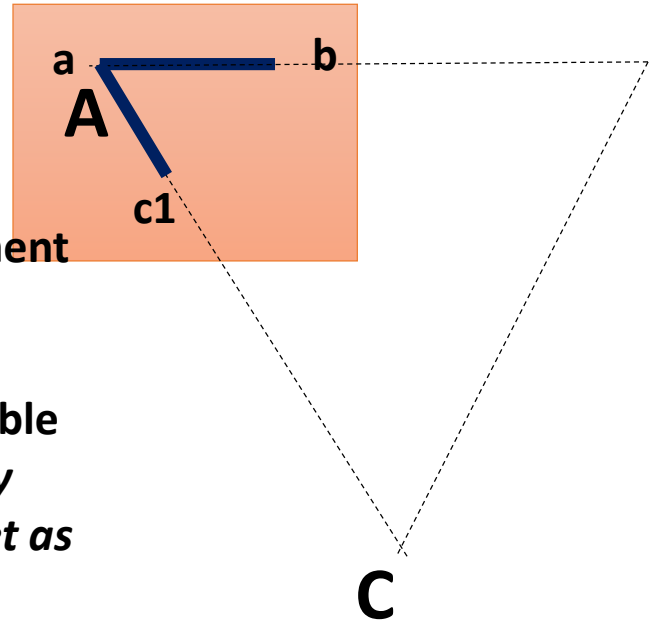


Intersection of the resectors will give c (the required point)

Set the table at C, orient it with compass and clamp
Draw a resector towards A from a
Similarly sight B from b and draw a resector

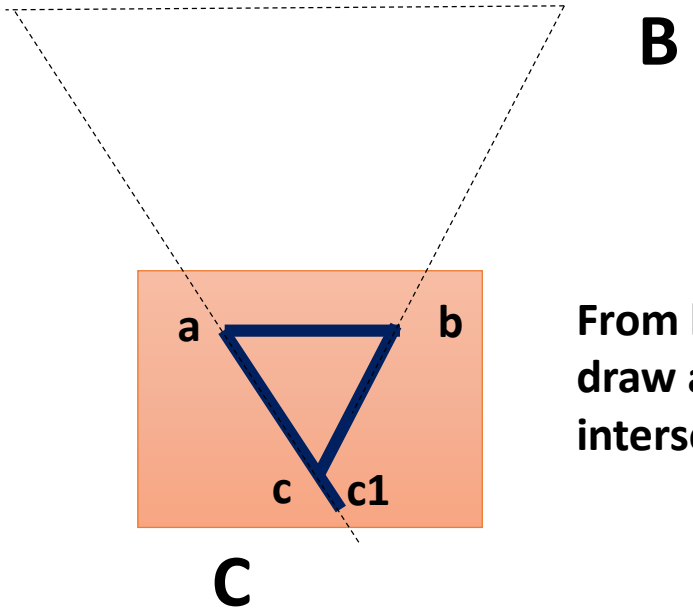
4. Method of Resection

b) Resection by Backsighting



C is the instrument station to be located
A and B are visible stations *already plotted on sheet as a and b*

Set the table at A, orient it by backsighting B along AB
From a, sight C and draw a ray and estimate point C roughly as c_1



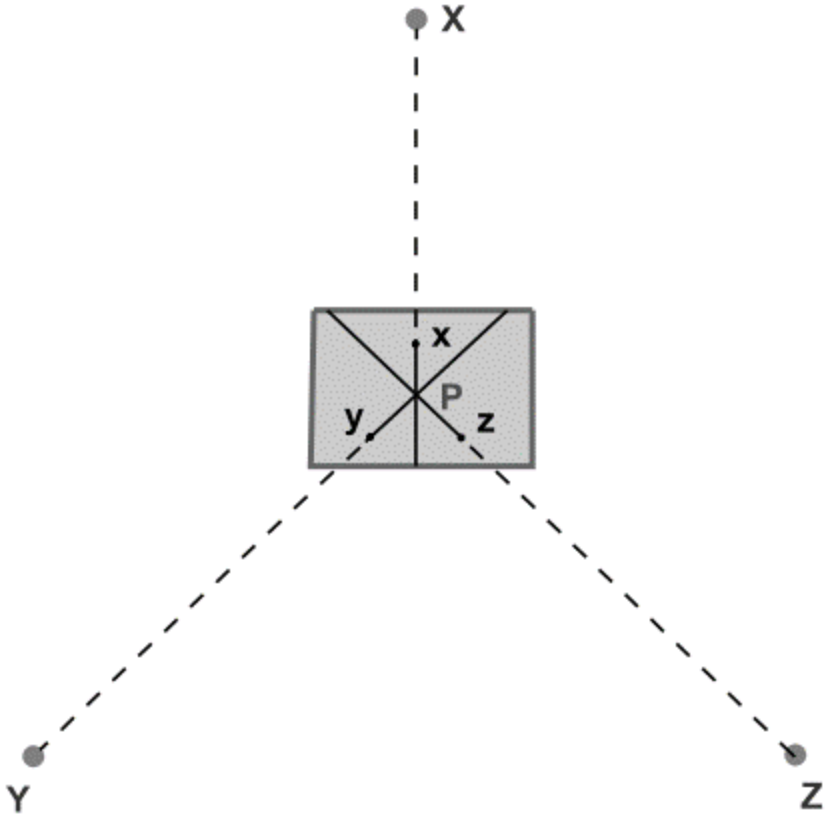
From b, sight B and draw a ray bB to intersect c_1a on c

Shift the table to C and centre it with respect to c_1
From c_1a , orient the table and backsight to A

4. Method of Resection

c) Resection by 3 point problem

- In this method, three well defined points, having locations already being plotted on the drawing are involved. These are used to find and subsequently plot the location of the plane table station.
- if X, Y and Z are well defined objects present in the field whose plotted positions are x, y and z. Now, if the plane table is oriented correctly, the three resectors X_x, Y_y and Z_z get intersected at p which represents the location of the plane table station, P on the drawing sheet.



4. Method of Resection

c) Resection by 3 point problem

- **in three point problem, if the orientation of the plane table is not proper, the intersection of the resectors through the three points will not meet at a point but will form a triangle, known as triangle of error**
- **The size of the triangle of error depends upon the amount of angular error in the orientation.**
- **In three point problem, orientation and resection are accomplished in the same operation.**
- **The trial and error method of three point problem, also known as Lehman's method minimises the triangle of error to a point iteratively.**
- **The iterative operation consist of drawing of resectors from known points through their plotted position and the adjustment of orientation of the plane table.**