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SUBJECT :- TH 3(SURVEYING 1)

SEMESTER :- 4TH

lesson :- 7

computation of area

surveying is to compute the areas

and volumes. Generally, the lands will be of irregular

shaped polygons.

There are formulae readily available for regular polygons like, triangle, rectangle, square and other polygons.

But for determining the areas of irregular polygons, different methods are used.

Earthwork computation is involved in the excavation of channels, digging of trenches for laying underground pipelines, formation of bunds, earthen embankments, digging farm ponds, land levelling and smoothening. In most of the computation the cross sectional areas at different interval along the length of the channels and embankments are first calculated and the volume of the prismoids are obtained between successive cross section either by trapezoidal or prismoidal formula.

Calculation of area is carried out by any one of the following methods:

- Mid-ordinate method
- Average ordinate method
- Trapezoidal rule
- Simpson's rule

The mid-ordinate rule

Let O_1, O_2, O_3, O_4..............On= ordinates at equal intervals

l=length of base line

d= common distance

between ordinates

h_1,h_2,.......... h_n=mid-

ordinates

Total area=d/2{ $O_1+2O_2+2O_3+\ldots\ldots+2O_n-1+O_n$}

Thus the trapezoidal rule may be stated as follows:

To the sum of the first and last ordinate, twice the sum of intermediate ordinates is added. This total sum is multiplied by the common distance. Half of this product is the required area.

Limitation: There is no limitation for this rule. This rule can be applied for any number of ordinates

SIMPSON'S RULE

In this rule, the boundaries between the ends of ordinates are assumed to form an arc of parabola. Hence simpson's rule is some times called as parabolic rule. Refer to figure:

Let

O_1, O_2, O_3= three consecutive ordinates

d= common distance between the ordinates

area AFeDC= area of trapezium AFDC+ area of

segment FeDEF Here,

Area of segment= 2/3* area of parallelogram FfdD

= 2/3* eE*2d

= 2/3 *{ O_2- O_1+O_3 /2 }*2d

So, the area between the first two divisions,

$= d/3(O_1+4O_2+O_3)$

Similarly, the area of next two divisions

$\Delta_2 = d/3(O_1+4O_2+O_3)$
and so on

Total area $= d/3[O_1+O_n+4(O_2+O_{4+}......) + 2(O_3+O_5)]$

Thus the rule may be stated as the follows

To the sum of the first and the last ordinate, four times the sum of even ordinates and twice the sum of the remaining odd ordinates are added. This total sum is multiplied by the common distance. One third of this product is the required area.

Limitation: This rule is applicable only when the number divisions is even i.e. the number of ordinates is odd.

The trapezoidal rule may be compared in the following manner:

Trapezoidal rule	**Simpson's rule**
1. The boundary between the ordinates is considered to be straight	The boundary between the ordinates is considered to be an arc of a parabola
1. There is no limitation. It can be applied for any number of ordinates	To apply this rule, the number of ordinates must be odd
1. It gives an approximate result	It gives a more accurate result.

Note: sometimes one or both the end of the ordinates may be zero. However they must be taken into account while applying these rules.

Worked- out problems

Problem 1: The following offsets were taken from a chain line to an irregular boundary line at an interval of 10 m:

0, 2.50, 3.50, 5.00, 4.60, 3.20, 0 m

Compute the area between the chain line, the irregular boundary line and the end of offsets by:

- mid ordinate rule
- the average –ordinate rule

Required area= 10(1.25+3.00+4.25+3.90+1.60)

= 10*18.80=188 m^2

By average-ordinate rule:

Here d=10 m and

n=6(no of devices)

Base length=

10*6=60 m

Number of ordinates= 7

Required area=10((1.25+3.00+5.00+4.60+3.20+0)/7)

By trapezoidal rule:

Here d=10m

Required area=10/2{0+0+2(2.50+3.50+5.00+4.60+3.20+)}

= 5*37.60=188 m^2

By Simpson's rule:

d=10m

required area=10/3{0+0+4(2.50+5.00+3.20)+2(3.50+4.60)}

= 10/3{

42.80+16.20}=10/3*59.00

10/3*59= 196.66m^2

Problem 2: The following offsets were taken at 15 m intervals from a survey line to an irregular boundary line

3.50,4.30, 6.75, 5.25, 7.50, 8.80, 7.90, 6.40, 4.40, 3.25 m

Calculate the area enclosed between the survey line, the irregular boundary line, and the offsets, by:

a) the trapezoidal rule

required area=15/2{3.50+3.25+2(4.30+6.75+5.25+7.50+8.80+7.90+6.40+4.40)}

= 15/2{6.75+102.60} = 820.125 m^2

b) simpson's rule

if this rule is to be applied, the number of ordinates must be odd. But here the number of ordinates must be odd. But here the number of ordinate is even(ten).

So, simpson's rule is applied from O_1 to O_9 and the area between O_9 and O_{10} is found out by the trapezoidal rule.

A_1= 15/3{ 3.50+4.40+4(4.30+5.25+8.80+6.40)}+2(6.75+7.50+7.90)

= 15/3(

7.90+99.00+44.30)=

756.00 m^2 A_2=

15/2(4.40+3.25)= 57.38

m_2

Total area= A_1+ A_2 =756.00+57.38 = 813.38 m^2

Problem 3: the following offsets are taken from a survey line to a curves boundary line, and the first and the last offsets by:

- the trapezoidal rule

here the intervals between the offsets are not reglar through

out the length. So, the section is divided into three

compartments

Let

Δ_I= area of the first section

Δ_{II}= area of 2^{nd} section

- by trapezoidal rule

Δ_I= 5/2{2.50+6.10+2(3.80+4.60+5.20)} = 89.50 m^2

Δ_{II}= 10/2{6.10+5.80+2(4.70)} =106.50 m^2

Δ_{III}= 20/2{5.80+2.20+2(3.90)}

= 158.00 m^2 Total area =

89.50+106.50+158.00 = 354.00

m^2

- by simpson's rule

Δ_I= 5/3{2.50+6.10+4(3.8+5.20) + 2(4.60)} = 89.66 m^2

Δ_{II}= 10/3{6.10+5.80+4(4.70)} =102.33 m^2

Δ_{III}= 20/3{5.80+2.20+4(3.90)}

= 157.33 m^2 Total area=

89.66+102.33+157.33 = 349.32

m^2

FORMULA FOR CALCULATION OF VOLUME:

D= common distance between the sections

A. trapezoidal rule

volume (cutting or filling), V=D/2(A1+An+2(A2+A3+….+An-1))

- Prismoidal formula

Volume(cutting or filling), V= D/3{A_1+ A_n +4(A_2+ A_4+ A_{n-1})+ 2(A_3+ A_5+….+ An_{n-1})}

i.e. V=common distance {area of 1st section+ area of last section+ 4(sum of areas of even sections)

3 +2(sum of areas of odd sections)

Note: the prismoidal formula is applicable whrn there is an odd number of sections. If the number of sections is even, the end strip is treated separately and the area is calculated according to the trapezoidal rule. The volume of the remaining strips is calculated in the usual manner by the prismoidal formula. Then both the results are added to obtain the total volume.

Works out problems

Problem 1: an embankment of width 10 m and side slopes 1 ½:1 is required to be made on a ground which is level in a direction transverseto the centre line. The central heights at 40 m intervals are as follows:

0.90,1.25,2.15,2.50,1.85,1.35, and 0.85

Calculate the volume of earth work according to

- Trapezoidal formula
- Prismoidal formula

Solution: the c/s areas are calculated by

Δ= (b+sh)*h

Δ_1= (10+1.5*0.90)*0.90 = 10.22 m^2

Δ_2= (10+1.5*1.25)*0.90 = 14.84 m^2

Δ_3= (10+1.5*1.25)*2.15 = 28.43 m^2

Δ_4= (10+1.5*2.50)*2.50 = 34.38 m^2

Δ_5= (10+1.5*1.85)*1.85 = 23.63 m^2

Contour (m)	270	275	280	285	290
Area (m^2)	2050	8400	16300	24600	31500

Calculate the volume of water between the contours 270 m and 290 m by:

	• Trapezoidal formula • Prismoidal formula Volume according to trapezoidal formula: =5/2{2050+31500+2(8400+16300+24600)} =330,250 m^3	

Δ_6=(10+1.5*1.35)*1.35 = 16.23 m^2

Δ_7=(10+1.5*0.85)*0.85= 9.58 m^2

- Volume according to trapezoidal formula

V= 40/2{10.22+ 9.58+2(14.84+28.43+34.38+23.63+16.23)}

= 20{19.80+235.02} = 5096.4 m^2

- Volume calculated in prismoidal formula:

V = 40/3 {10.22+9.58+4(14.84+34.38+16.23)+2(28.43+23.63)}

= 40/3 (19.80+ 261.80+104.12) = 5142.9 m^2

Problem the areas enclosed by the contours in the lake are as follows:

LESSON 15. Theodolite –description of the instrument & Traversing

THEODOLITE

- Theodolite is an instrument used to measure horizontal and vertical angles. The most important instrument for exact survey work, and many types are available to meet varying requirements of accuracy and precision, with direct readings of the circle ranging from 5 min to 0.1 sec.

5. Components of Transit theodolite

Transit theodolite consists of the following parts :

1. Levelling Head
2. Lower Plate or Scale Plate
3. Upper Plate or Vernier Plate
4. The standard or A Frame
5. T-Frame or Index Bar.

- Plate Levels

- Telescope

1. Levelling Head - Levelling Head consists of upper tribrach and lower Tribrach. Upper tribrach has three arms, each arm carries a levelling screw for levelling the equipment. Lower tribrach has got a circular hole through which a plumb bob may be suspended for centering.

Three distinct functions of levelling head are:
i) to support the main part of the instrument
- to attach the Theodolite to the Tripod
- to provide a means for levelling the theodolite

- Lower Plate (Scale Plate) : Lower Plate which is attached to outer spindle, carries a horizonta graduated circle, it is graduated from 0-360. Each degree is further divided into 10 minutes or 20 minutes. Scale plate can be clamped to any position by a clamping screw and a corresponding slow motion screw. When the lower plate is tightened, the lower plate is fixed to the upper tribrach of the levelling head. The size of the Theodolite is determined by the size of the diameter of this lower plate.

- Upper plate or Vernier Plate : Upper plate is attached to Inner spindle axis. Two verniers are screwed to the upper plats. It carries an upper clamp screw and tangent screw. On clamping the upper clamp and unclamping the lower clamp, the instrument may be rotated on its outer spindle without any relative motion between the two plates. On the other hand if lower clamp screw is tightened and upper clamp screw is unclamped, the instrument may be rotated about its inner spindle with a relative motion between the vernier and graduated scale of the lower plate. This property is utilised for measuring angles.

- Plate Levels - Upper plates carries two plate levels placed at right angles to each other. One of the plate bubble is kept parallel to the trunion axis. Plate levels can be centred with the help of foot screws.

- Telescope – Telescope is supported on the pivots of the trunion axis which affords its movement in the vertical plane.

IMPORTANT DEFINITIONS

- Line of Collimation - the line which passes through the Intersection of the cross hairs of the eye piece and optical centre of the objective and its continuation is called as line of collimation. This is also known as line of sight.

- Transiting - The process of turning the telescope in vertical plane through 180 deg. about its horizontal axis is known as transiting.

- Permanent adjustment
- Temporary adjustment
- The permanent adjustment are made to establish the fixed relationships between the fundamental lines of the instrument, and once made, they last for long time.
- They are essential for the accuracy of observations. The permanent adjustment in case of transit theodolite are:

PERMANENT ADJUSTMENT

- Adjustment of the Horizontal Plate Levels.
- Collimation Adjustment
- Horizontal Axis Adjustment
- Adjustment of the Telescope Level or the Altitude level.
- Vertical Circle Index Adjustment.

- Turn the horizontal plate until the longitudinal axis of the plate level is approximately parallel to a line joining any two levelling screws.
- Bring the bubble to the centre of its run by turning both foot screws simultaneously in opposite directions either inwards or outwards. The movement of the left thumb indicates the directionof movement of bubble.
- Turn the instrument through 180^0 in azimuth.
- Note the position of the bubble. If it occupies a different position, move it by means of the same two foot screws to the approx. mean of the two positions.v) Turn the theodolite through 90 in azimuth so that the plate level becomes perpendicular to the previous position.
- With the help of third floor screw, move the bubble to the approx. mean position already indicated.
- Repeat the process until the bubble, retains the same position for every setting of the instrument.

3. Elimination of Parallax : Elimination of parallax may be done by focusing the eye piece for

distinct vision of cross hairs and focusing the objective to bring the image of the object in the plane of cross hairs.

Measurement of Horizontal Angle

Procedure : to measure a Horizontal Angle ABC between BA & BC the following procedure is followed.

- Set up, Centre and level the theodolite over the ground point B.
- Loosen the upper plate, set the vernier to read zero and clamp the upper clamp.
- Loosen the lower plate and swing the telescope until the left point A is sighted. Tighten the lower clamp. Accurate bisection of the arrow held on the Point A is done by using the lower tangent screw. Read both the vernier and take the mean of the reading.
- Unclamp the upper plate and swing the telescope in clockwise direction until point C is brought in the field of view. Tighten the upper clamp and bisect the mark of C accurately, using the upper clamp tangent screw.
- Read both the verniers and take the mean of readings. The difference of the means of the reading to C to A is the required angle ABC.
- Change the face of the instrument and repeat the show procedure, the measure of the angle is again obtained by taking the difference of the means of the readings to C&A on face right.

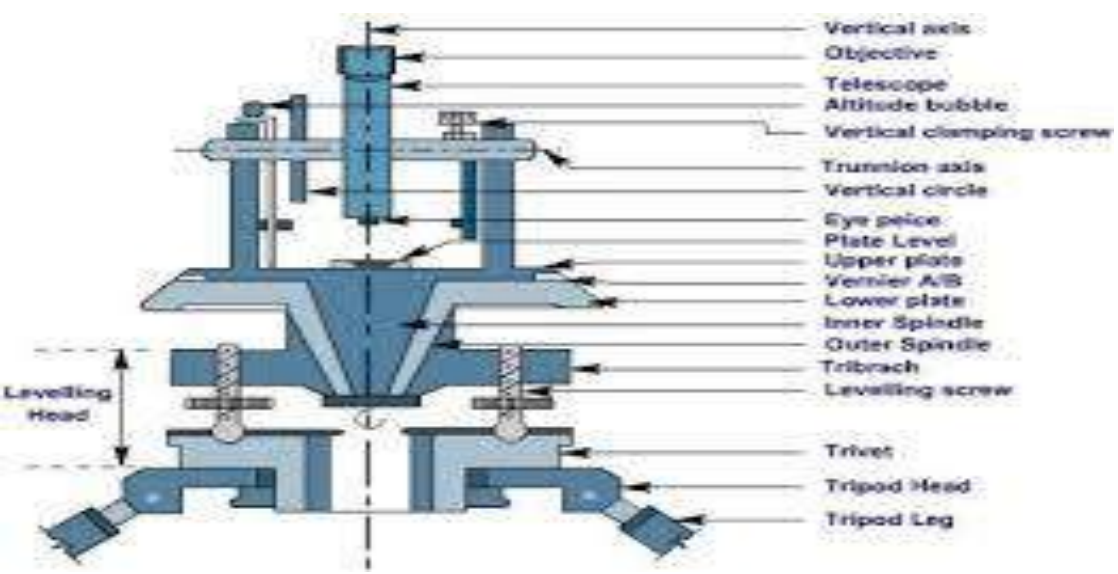


Fig 9.1 Parts of theodolite

- —The instrument is set over B.
- —The lower clamp is kept fixed and upper clamp is loosened.
- —Turn the telescope clockwise set vernier A to 0° and vernier B to approximately 180°.
- —Upper clamp is tightened and using the upper tangent screw the vernier A and B are exactly set to 0° and 180°.
- —Upper clamp is tightly fixed, lower one is loosened and telescope is directed towards A and bisect the ranging rod at A.
- —Tightened the lower clamp and turn the lower tangent screw to perfectly bisect ranging rod at A.
- —Loose the upper clamp and turn the telescope clockwise to bisect the ranging rod at C tightened the upper clamp and do the fine adjustment with upper tangent screw.
- —The reading on vernier A and B are noted. Vernier A gives the angle directly and vernier B gives the reading by subtracting the initial reading (180°) from final reading

Vertical angle measurement-1

- The theodolite is set up at O. It is centred and levelled properly. The zeros of the vernires (generally C and D) are set at the 0° - 0° mark of the vertical circle (which is fixed to the telescope). The telescope is then clamped.
- The plate bubble is brought to the centre with the help of food screws (in the usual manner). Then the altitude bubble is brought to the centre by means of a clip screw. At this position the line of collimation is exactly horizontal.

- Included angle method
- —Deflection angle method
- —Fast angle (or magnetic bearing method)

- Non adjustment of plate bubble

- —Line of collimation not being perpendicular to horizontal axis
- —Horizontal axis not being perpendicular to vertical axis
- —Line of collimation not being parallel to axis of telescope
- —Eccentricity of inner and outer axes
- —Graduation not being uniform
- —Verniers being eccentric

Personal errors

Natural errors

- High temperature causes error due to irregular refraction.
- —High winds cause vibration in the instrument, and this may lead to wrong readings on verniers

Lesson 8. Introduction to setting of curves

Curves are regular bends provided in the lines of communication like roads, railways and canals etc. to bring about gradual change of direction.

They enable the vehicle to pass from one path on to another when the two paths meet at an angle. They are also used in the vertical plane at all changes of grade to avoid the abrupt change of grade at the apex.

HORIZONTAL CURVES

Curves provided in the horizontal plane to have the gradual change in direction are known as horizontal curves.

VERTICAL CURVES

Curves provided in the vertical plane to obtain the gradual change in grade are called as vertical curves.

Curves may be circular or parabolic. Curves are generally arcs of parabolas. Curves are laid out on the ground along the centre line of the work.

NEED FOR PROVIDING CURVES

Curves are needed on Highways, railways and canals for bringing about gradual change of direction of motion. They are provided for following reasons:-

- To bring about gradual change in direction of motion.
- To bring about gradual change in grade and for good visibility.
- To alert the driver so that he may not fall asleep.
- To layout Canal alignment.
- To control erosion of canal banks by the thrust of flowing water in a canal.

CLASSIFICATION OF CURVES

Most types of transportation routes, such as highways, railroads, and pipelines, are connected by curves in both horizontal and vertical planes.

Horizontal Curves: Curves used in horizontal planes to connect two straight tangent sections. Two types of horizontal cures:

Circular arcs, and

Spirals

Simple Curve: A circular arc connecting two tangents.

Compound Curve: Two or more circular arcs of different radii tangent to each other.

Broken-back Curve: Combination of a short length of tangent connecting two circular arcs that have centers on the same side.

Reverse Curve: Two circular arcs tangent to each other, with their centers on opposite side of the alignment.

Circular curves are further classified as :

- Simple Curves.
- Compound Curves.

- Serpentine Curves.
- Deviation Curves.

- **Simple Curve:**

A simple curve Consists of a single arc of circle connecting two straights. It has radius of the same magnitude throughout.

- **Compound Curves.**

A compound Curve consists of two or more simple curves having different radii bending in the same direction and lying on the same side of the common tangent. Their centres lie on the same side of the curve.

- **Reverse or serpentine curve**

A reverse or serpentine curve is made up of two arcs having equal or different radii bending in opposite direction with a common tangent at their junction . Their centres lie on opposite sides of the curve. Reverse curves are used when the straights are parallel or intersect at a very small angle.

- **Deviation curve**

A deviation curve is simply a combination of two reverse curves. it is used when it becomes necessary to deviate from a given straight path in order to avoid intervening obstructions such as bend of river, a building , etc.

They should be avoided as far as possible on main lines and highways where speeds are necessarily high.

Degree of Circular Curve

- The rate of curvature of circular curves can be designated either by their radius (100-m curve), or by their degree of curve.
- The degree of curve:
- **Arc definition**: The central angle subtended by a circular arc of 30m (100-ft).
- **Chord definition**: The angle at the center of a circular arc subtended by a chord of 30m (100 ft)

Stationing

Stationing: In route surveying, stationing is used to specify the relative horizontal positioning of any point along the reference line. The starting point is usually designated with some arbitrary value.

English Unit System:

Starting point: Usually 10 + 00 ft or 100 + 00 ft is selected.

Metric Unit System:

- Layout of a curve by deflection angles can be done by
- The incremental chord method, and
- The total chord method

- Assume that the instrument is set up over the PC and each full station is to be marked along the curve.
- The first station to be set in this example is 63 + 00.
- To mark that point form the PC, a backsight is taken on the PI with zero set on the instrument's horizontal circle.
- Deflection angle δa to station 63 + 00 is then turned and two tape persons measure chord ca from the PC and set 63 + 00 at the end of the chord on the instrument's line of sight.
- With station 63 + 00 set, the tape persons next measure the chord length c from it and stake station 64 + 00, where the line of sight of the instrument , now set to δ64, intersects the end of that chord.
- This process is repeated until the entire curve is laid out.

Layout of a curve by the total chord method:

- The total station instrument is set up over the PC and each full station is to be marked along the curve.
- The first station to be set in this example is 63 + 00.
- To mark that point form the PC, a backsight is taken on the PI with zero set on the total station's horizontal circle.
- Deflection angle δa to station 63 + 00 is then turned and the reflector placed on line and adjusted until its distance from the instrument is ca from the PC and the stake set at 63 + 00.
- To set station 64 + 00, the deflection angle δ64 is turned, reflector placed on this line of sight, and adjusted in position until the total chord from the PC to station 64 + 00 is obtained, and the stake set.

- This process is repeated until the entire curve is laidout.
- For deflection angle method, deflection angles and chords are important values that must be calculated.
- To stake the first station,which is normally anodd

- Thus subdeflection angle δa needed to stake station 63 + 00 is da/2, or da= sa I / 2L.

LESSON :- 8

PLANE TABLE SURVEYING

What is Plane Table Surveying?

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.

Equipment Used in Plane Table Survey

General equipment used for conducting plane table survey are

Plane table

Alidade for sighting (telescopic or simple)

Plumb bob and plumb fork

Compass

Spirit level

Chain

Ranging rods

Tripod

Drawing sheet and drawing tools

Paper clips or screws

Plane table survey equipment is arranged in 4 steps as follows

Fixing of Plane Table

Fix the plane table to the tripod stand. Arrange the drawing sheet on the plane table using paper clips or thumb screws. The sheet should be in one position from first to last.

Leveling of Plane Table

Plane table should be leveled using spirit level. For small works, eye estimation can be ok .

Centering of Plane Table

The table should be centered by using plumbing fork. By which we can arrange the plotted point exactly over the ground point.

Orientation of Plane Table

Whenever we are using more than one instrument station, orientation is essential. It can be done by using compass or back sighting. In this case, the plane table is rotated such that plotted lines in the drawing sheet are parallel to corresponding lines on the ground.

Methods of Plane Table Surveying

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

Radiation

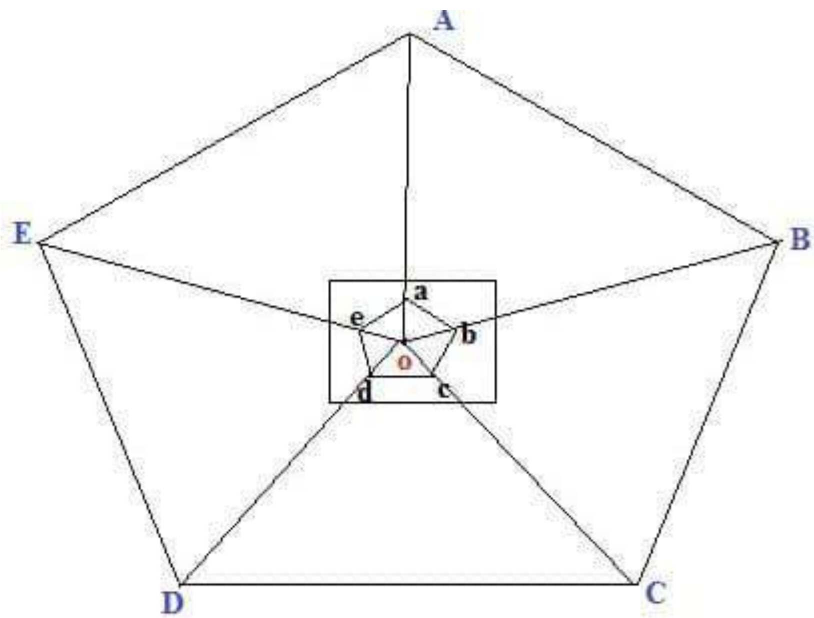
Intersection

Traversing

Resection

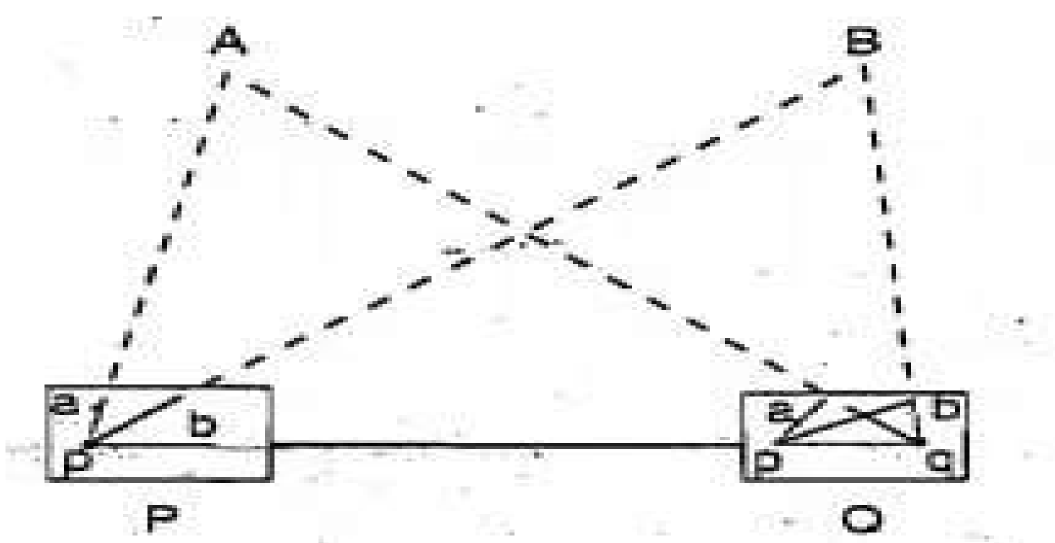
Radiation

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.



Intersection

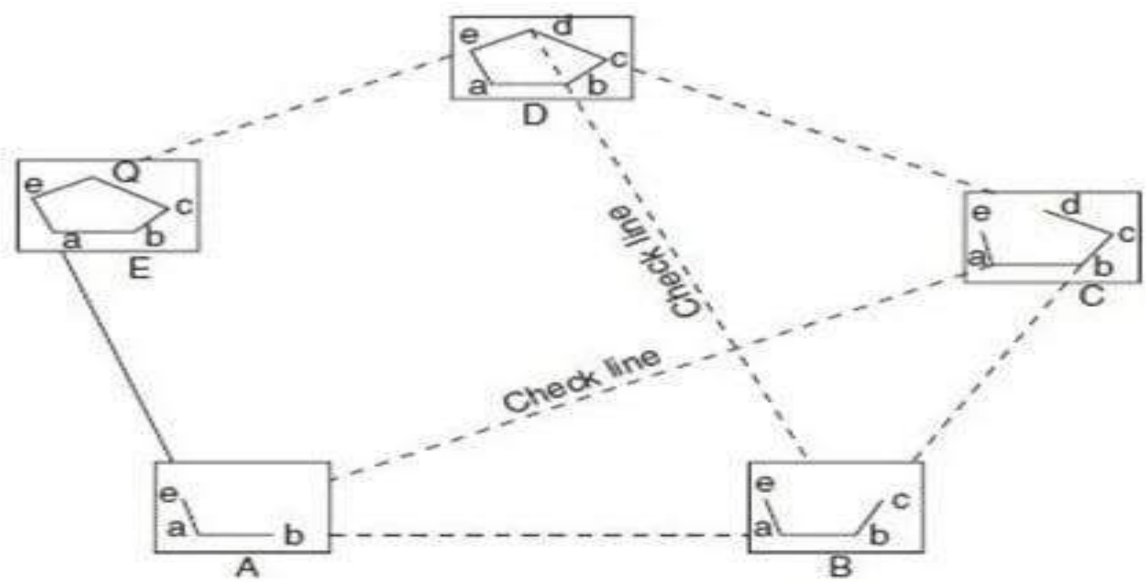
In this method we can locate the point by plotting two rays from two known stations. As shown in figure, P and Q are the known station. First the equipment is placed on P and plot the lines by sighting the stations A, B and Q. then shift the equipment to station Q and plot the lines by sighting stations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



Plane Table Survey - Intersection

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.



Plane Table Survey - Traversing

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 and it can be conducted by two field conditions as follows.

The three-point problem

The two-point problem

The Three Point Problem

In this condition, three points and their positions in the field are known. Plane table is placed at apposition from where all the three points are visible. So, by sighting those three points we can locate the point where equipment is located. This can be achieved by many methods as follows.

Tracing method

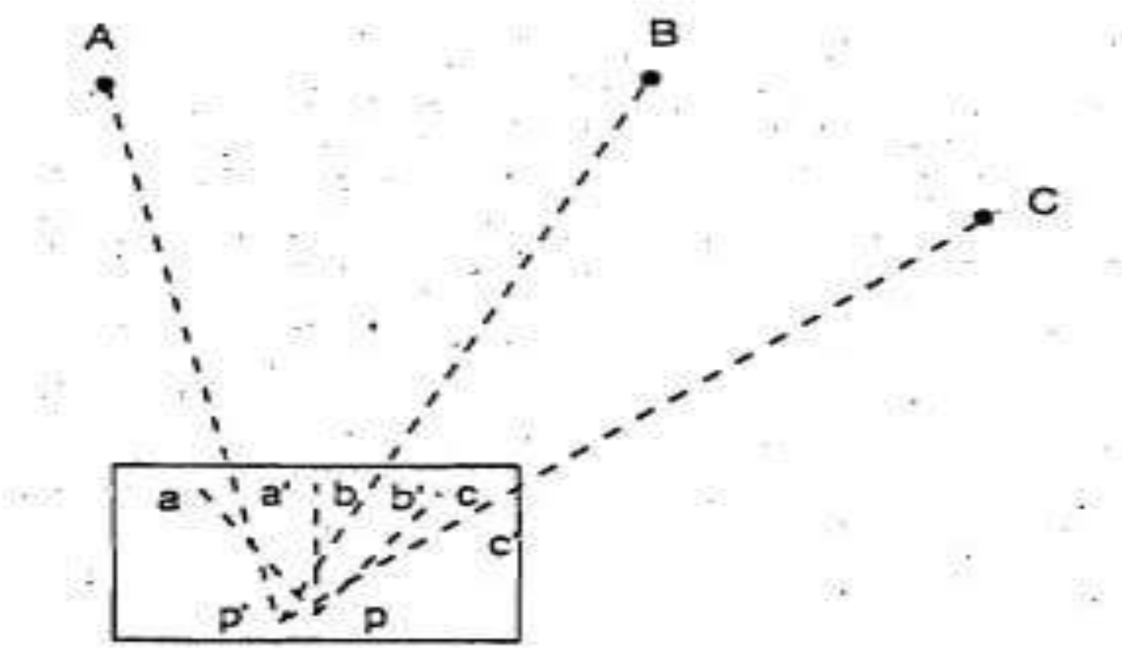
Lehmann method

Analytical methods

Graphical method

Tracing Method in Plane Table Surveying

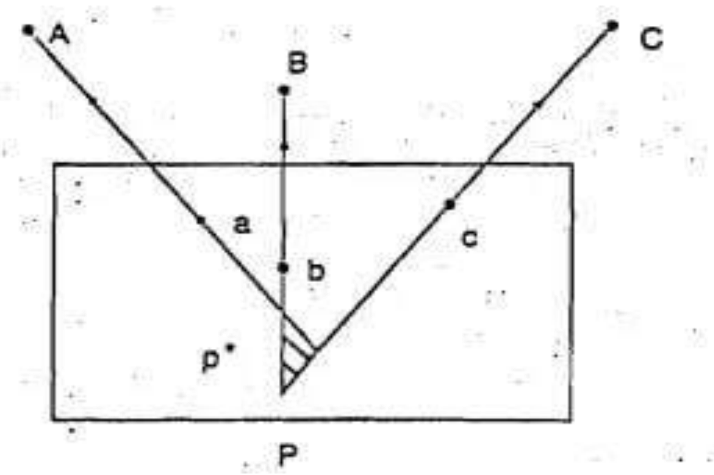
In tracing method, plane table is located at a point from where three points are visible. The table is oriented with respect to the plotted lines of those three points. Place the tracing paper on the drawing sheet and again sight the three points and plot the radiating lines. The tracing paper is then moved above the drawing sheet until the three radiating lines pass through corresponding points previously plotted on the map. Finally, the position of plane table is marked.



(Tracing Method in Plane Table Surveying)

Lehmann Method

In this method, Plane table is located at a point P and sight the station A, B and C and plot the rays Aa, Bb, and Cc. The rays form small triangle which is called triangle of error. Another point P1 is chosen to reduce the error and sight the point A from P1 similarly to B and C. which will give another triangle of error. Repeat this procedure until error becomes zero.



Lehmann Method of Plane Table Surveying

Analytical Methods

There are many analytical methods are developed in three-point problem condition. In this method, from station P A, B and C are sighted and note the values of angles and lengths. From these values determine the position of unknown points by using analytical formulae.

Graphical Method

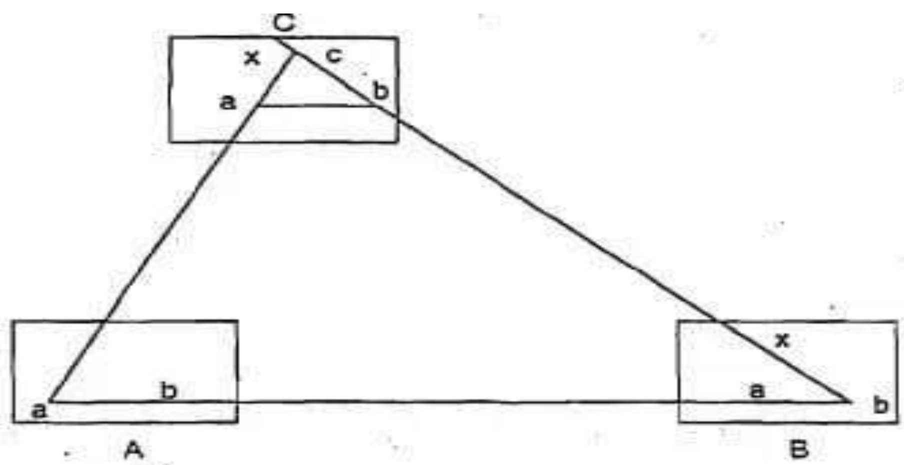
In graphical method also, angles and lengths are determined and represented it on a graph and determines the location of plane table.

The Two-Point Problem

In the two-point problem, two points are sighted from other point corresponding to the points given in plane table sheet. Here two cases are to be discussed.

Case 1: when the points can be occupied by the plane table

As shown in fig. A and B are the two points corresponding to the points a and b. Now, plane table is located at B and oriented by sighting A. sight C from B and bx is plotted on the sheet. Then shift the plane table to C, oriented by backsighting B along xb. Then alidade is placed over a and sight station A, then line Aa cuts the line bx at somewhere which is located as point c at station C.

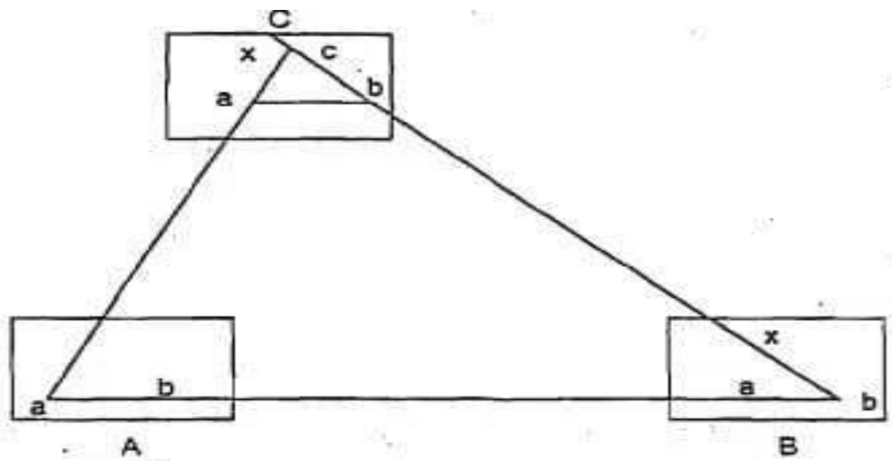


__The Two-Point Problem__

Case2: When the plane table cannot occupy the controlling stations

In this case, an auxiliary point D is considered nearer to C. Locate the plane table at D according to the line ab parallel to AB. Then sight the station A and B corresponding to a and b. the rays drawn are intersected at some point which is marked as d. then sight towards C by placing alidade at d. mark the distance Dc as c1. Shift the table to C and backsight to D with reference to c1.

Then sight A corresponding to a, the ray drawn is intersects the previously drawn ray from D in c2. From c2 sight B draw a ray which intersects db and marked the intersection as b1. The table is oriented till ab comes in line with P. From P sight and draw rays Aa and Ba. The intersection of these two rays will give the Location of Point C.



QUESTION WITH ANSWER (LESSON 7,8)

1. **Which of the following doesn't involve the method of traversing?**

a) Chain surveying

b) Theodolite surveying

c) Plane Table surveying

d) Tacheometric surveying

Answer: d

Explanation: Depending on the instruments used in determining the relative directions of the traverse lines. The principal methods adopted are Chain traversing, Compass traversing, Transit tape traversing, Plane-table traversing. Tacheometric surveying involves a lot of instrumental work rather than ground work.

2. **Which among the following is a procedure for computation of traverse area?**

a) Calculation and adjustment of latitudes and departures

b) Adjustment of instrument

c) Calculation of consecutive co-ordinates

d) Determination of R.L

Answer: a

Explanation: The procedure for traverse calculations involves Adjusting angles or directions, determining bearings or azimuths, calculation and adjustment of latitudes and departures, calculation of rectangular coordinates.

3. Adjustments applied to angles are independent of the size of the angle.

a) False

b) True

Answer: b

Explanation: The adjustments applied to angles are independent of the size of the angle because they depend on the direction in which they are present.

4. Which of the following is the first step for determining the azimuth or bearing?

a) Determination of angles or bearings

b) To determine the true direction

c) The direction of at least one line within the traverse must be known or assumed

d) Determining the latitudes and departures

Answer: c

Explanation: The direction of at least one line within the traverse must be known or assumed because it would be easy for calculating the bearings by taking reference from that assumed direction.

5 .For calculating the traverse area, which of the following is crucial?

a) L = 0, D = 0

b) $\sum L2 = 0, \sum D2 = 0$

c) $\sum L \neq 0, \sum D \neq 0$

d) $\sum L = 0, \sum D = 0$

Answer: d

Explanation: In order to nullify the closing error, the algebraic sum of latitudes and the algebraic sum of departures must be equal to zero, which is necessary for obtaining the total traverse area.

6. For adjusting the traverse, which of the following methods can be used?

a) Compass traversing

b) Chain traversing

c) Theodolite traversing

d) Bowditch's method

Answer: d

Explanation: Adjusting is generally applied to the operation of applying corrections to latitudes and departures so that $\sum L = 0, \sum D = 0$. This applies only when the survey forms a closed polygon. The common methods of adjusting a traverse include Bowditch's method, Transit method, Graphical method and Axis method.

7. Angle and distance is one of the methods for plotting a traverse survey.

a) True

b) False

Answer: a

Explanation: The two principal methods of plotting a traverse survey are angle and distance method, Co-ordinate method. In this method, distance

8. Which of the following is the accurate method for plotting traverse area?

a) Transit method

b) Angle and distance method

c) Co-ordinate method

d) Bowditch's method

Answer: c

Explanation: In Co-ordinate method, survey stations are plotted by calculating their co-ordinates. It is the most practical and accurate one for plotting traverses or any other extensive system of horizontal control. The advantage in this method of plotting is that the closing error can be eliminated by balancing.

9. Which of the following methods will give the accurate result while traversing?

a) Loose needle method

b) Fast needle method

c) Chain traversing

d) Compass traversing

Answer: b

Explanation: In fast needle method, the magnetic bearings of traverse lines are measured by a theodolite. The magnetic bearings of the lines are measured with reference so the direction of magnetic meridian is established at the first station. This method is, therefore, more accurate than the loose needle method. Fast needle method includes direct method with transiting, direct method without transiting, back bearing method.

10. Among the following, which indicates the formula for balancing angles of closed traverse?

a) ∑ Interior angles = (n+2) * 1800

b) ∑ Interior angles = (n-2) / 1800

c) ∑ Exterior angles = (n-2) * 1800

Answer: d

Explanation: The formula for balancing the angles of closed traverse

∑ Interior angles = (n-2) * 1800

Where, n = number of interior angles.

By using this, the error in the interior angles can be checked and can be minimised.

SHORT QUESTIONS

a) Define Survey.

b) List the Principle of survey.

c) List the types of B.M.

d) Define True Bearing and Magnetic bearing.

e) State the Function of reflecting mirror in prismatic compass.

f) State the Principle of Plane table surveying.

g) List different instruments for linear measurement.

h) Define fore sight and back sight.

(b) Attempt Any TWO of the following: 08 Marks

a) Classify the survey based on Nature of Field and state their objectives.

b) Draw a well labeled Diagram of 30m metric chain and state the function of Swivel joint,

oval rings.

c) Draw Conventional Symbol for i) Embankment ii) Cultivated Land iii) Forest iv) River

Q2. Attempt any FOUR of the following: 16 Marks

a) State the use of Chain / tape, ranging rod, Peg, Arrows in chaining process.

b) Describe stepping method of chaining on Sloping Ground.

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c) Define Base line, Tie line and state their significance in chain Triangulation.

d) State the Procedure of setting Offsets with open cross staff.

e) Distance between two stations when measured with 20m. chain was 1423m. It was

afterward found that the chain was 10cm too long. Calculate true distance between two stations.

f) Describe the construction of Optical Square with neat sketch.

Q3. Attempt any FOUR of the following: 16 Marks

a) Suggest the method to overcome an obstacle in chaining, where vision and chaining both

are obstructed.

b) Draw well labeled diagram of Prismatic compass. .

c) Write B.B for followings bearings

a) 125° 15’ b) N30° E c) 360° d) S45° 45’W

d) Compare WCB system and R.B. system on four points.

e) State the procedure of correcting closed traverse by Graphical adjustment. (Bowditch Rule)

f) State any four instrumental errors and four personnel errors in prismatic compass survey.

Q4. Attempt any FOUR of the following: 16 Marks

a) Convert following bearings from W.C.B to R.B.

i) 210 0 ii) 450

15’ iii) 1350

45’ iv) 3150

15’

b) List four Accessories of plane table and state their uses.

c) State four Advantages of Telescopic alidade over plane alidade.

d) State four Merits and four Demerits of plane Table survey.

e) Describe Intersection method of plane table survey..

f) State the types of bench marks and state situation where each B.M.is applicable.

Q5. Attempt any FOUR of the following: 16 Marks

a) State the Fundamental lines of Dumpy Level and give their relationship.

b) Describe the method of Temporary Adjustment of Dumpy level.

c) State four personal and four instrumental errors in leveling.

d) Describe the method of Profile leveling.

e) Compare Rise and Fall method With Height of plain of Collimation method on any four

points..

f) Fill up the missing readings and apply usual checks in level book page.

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Point B.S I.S F.S Rise Fall R.L. Remark

1 3.125 * B.M

2 * * 1.325 125.005 C.P

3 2.320 0.055 *

4 * * 125.350

5 * 2.655 * * C.P

6 1.620 3.205 2.165 * C.P

7 3.625 * *

8 * * 122.590 T.B.M

Q6. Attempt any TWO of the following: 16 Marks

a) Draw and Calculate a Area of a plot from given following data

Chainage of line AB is 90m,

The offsets taken on chain line are as follow

Chainage- 0 15 40 70 80

Offset(left)- 5(C) 0 (D) 10 (E) 15 (F) 8(G)

Chainage- 15 25 60 85

Offset(right)- - 0(D) 15 (H) 12 (I) 10(J)

Where C,D,E,FG,H,I&J are offset points.

b) Calculate the reduce level by Rise and Fall method on a continuous sloping ground

with four meter leveling staff at common interval of 30m.

0.855(onA),1.545,2.335,3.115,3.825,0.455,1.380,2.055,2.855,3.455,0.585,1.015, 1.850,

2.755,3.845 (on B);The reduced level of A was 380.500. Make the entries in a level

book and apply usual checks. Determine the gradient of AB.

c) Detect the Local attraction at stations and correct the bearings of lines of a traverse

ABCDEA. Also calculate included angles..

Line F.B B.B

AB 59°00’ 239°00’

BC 139°30’ 317°00’

CD 215°15’ 36°30’

DE 208°00’ 29°00’

EA 318°30’ 138°45’