AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY

(Vinayaka Mission's Research foundation- Deemed to be university)

Paiyanoor, Chennai - 603104

DEPARTMENT OF CIVIL ENGINEERING

SURVEYING PRACTICAL II LABORATORY

(REGULATION 2017)

LAB INSTRUCTION MANUAL

HoD/Civil Engg.

Specific Rules and Hazards Associated with this Lab Include

Capacity-Normal Occupancy during teaching labs is 18

- Students should enter the lab with proper uniform and ID card.
- Always keep work areas clean and tidy.
- Observe safety alerts in the laboratory.
- Always wear shoes that completely cover your feet. No sandals or opened toed shoes are allowed.
- Follow all written and verbal instructions carefully.
- Observe the safety alerts in the laboratory.
- Don't forget to bring Lab manual, Record, observation, calculator, graph sheet and other accessories when you come to lab.
- In the absence of Instructor no student shall be allowed to work in the laboratory.
- Don't use mobile phones during lab hours.
- Place tools and equipment in proper place after use.
- Turn off the power switches of weighing balance and equipments after used.
- Report to the staff if any injuries.
- Dont try to repair any faulty instruments.

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S. No.	Experiment	Date	Page	Remarks

17CVCC25	SURVEY PRACTICAL –II LAB	Category	L	T	P	Credit
		CC	0	0	4	2

Preamble

Knowledge on basic survey methods (Survey Lab I) is essential in order to determine the distance and heights of the objects using stadia, tangential as well as trignometrical principle.

Prerequisite

Fundamentals of surveying and Survey Lab I

Course Objectives

At the end of the course the student will posses knowledge about Survey field techniques.

Course Outcomes

On the successful completion of the course, students will be able to

(CO1) Use the surveying tools like Theodolite and Total Station in the field	Apply
(CO2) Take linear and angular measurements, booking and plotting accurately.	Apply
(CO3) Locate the position of the object after finding the distance and heights using stadia, tangential and trignometrical principle	Apply
(CO4 Set out a simple circular curve in the field	Apply

Syllabus

List of Experiments:

1. Study of theodolite and measurement of horizontal angle by repetition method.
2. Measurement of horizontal angle by reiteration method.
3. Determine the distance and heights of the objects using Stadia tacheometric method.
4. Determine the distance and heights of the objects using tangential tacheometric method.
5. Find the gradient between two points using stadia and tangential tacheometric principle.

6. Find the distance and elevation of the inaccessible (single) object by single plane method.
7. Find the distance and elevation of the inaccessible (single) object by double plane method.
8. Find the elevation of the inaccessible (double) object by double plane method.
9. Determine the elevation of the given point using subtense bar.
10. Measurement of horizontal, sloping and vertical distances of the object using Total station.
11. Setting out a circular curve using Total Station.
12. Using profile levelling, plot the longitudinal section and cross section of road

Text Books

1.SURVEYING II LAB MANUAL BY VMKV ENGINEERING COLLEGE

Course Designers:

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III SEMESTER LIST

OF EXPERIMENTS

STUDY OF THEODOLITE

Aim:
To study about the Temporary and Permanent adjustments of a Theodolite.
Instrument used: Theodolite
Procedure:
ADJUSTMENTS OF THEODOLITE

The Theodolite should be properly adjusted to obtain accurate observations. The adjustments are mainly of two types. They are as follows:

1. Permanent adjustments and
2. Temporary adjustments.

1. Permanent adjustments

The permanent adjustments are to be done to maintain the required standard relationship between the fundamental lines (axes) of a Theodolite. The fundamental lines are as follows:

a. Vertical axis
b. Horizontal axis or trunnion axis
c. Line of collimation or line of sight
d. Axis of plate level
e. Axis of altitude level.

Required relations between the fundamental lines (axes)

i) The axis of plate level must be perpendicular to the vertical axis.
ii) The line of collimation must be perpendicular to the horizontal axis
iii) The horizontal axis must be perpendicular to the vertical axis.
iv) The axis of the altitude level must be parallel to the line of collimation.
v) The vernier reading of vertical circle must read zero when the line of collimation is horizontal. The permanent adjustments of a Theodolite are:

- ✓ Adjustment of plate level.
- ✓ Adjustment of line of sight
- ✓ Adjustment of horizontal axis
- ✓ Adjustment of altitude bubble and vertical index frame.

2. Temporary adjustments

The adjustments which are carried out at every setting of the instrument before the observations are referred as temporary adjustments. There are three types of temporary adjustments as follows.

a. Setting up
b. Levelling up
c. Elimination of parallax.

a) Setting up

This adjustment includes the following two operations.

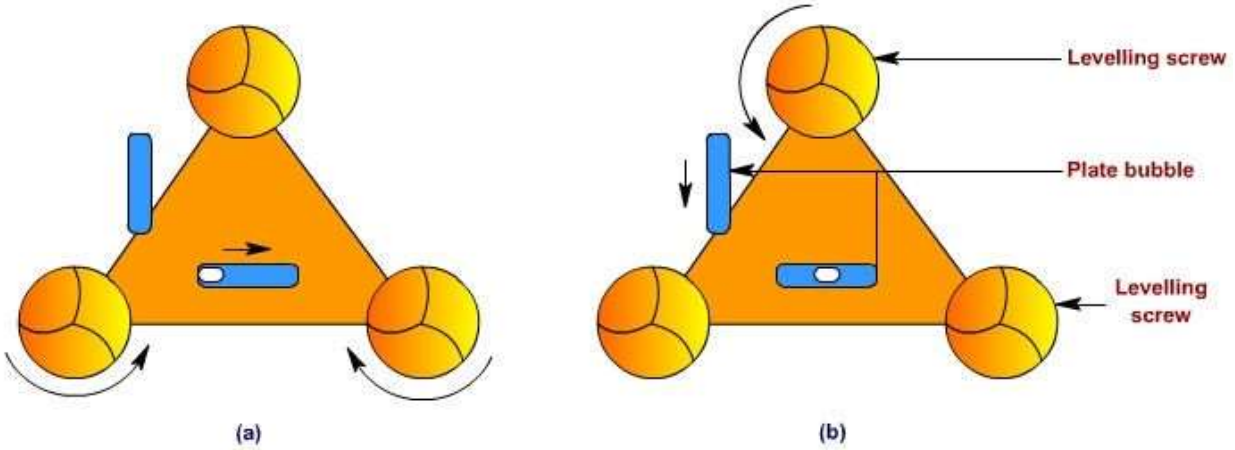
i. Centering the Theodolite over the instrument station.
ii. Approximate leveling of Theodolite with the help of the tripod legs only.

Approximate levelling

The approximate leveling may be done with the reference to a small circular bubble provided on the tribrach or by eye judgements.

b) Levelling up

The operation of making the vertical axis truly vertical is known as leveling of the Theodolite. After the centering and approximate leveling an accurate leveling is to be done with the help of foot screws.



i) First the telescope is to be kept parallel to any of the two foot screws as in the figure.

ii) The bubble of plate level is to be brought to the centre of its run by turning the foot screws either inwards or outwards simultaneously.

iii) Then the telescope is to be turned through 90°, so that it lies over the third foot screw (i.e perpendicular to the first position)

iv) The bubble is to be brought to the centre of its run by turning the third foot screw either clockwise or anticlockwise.

v) Then the telescope is brought back to its original position (position at (i)) and the position of bubble is checked whether it remains in the center or not.

vi) If the bubble is not in centre the above operations are repeated till the bubble retain at centre in both the positions.

c) Elimination of parallax.

An apparent change in the position of an object caused by the change in position of the observer's eye is known as **parallax.** This can be eliminated in two steps.

i) Focusing the eye piece for distinct vision of the cross hairs.

ii) Focusing the objective to bring the image of the object in the plane of cross hairs.

i) Focusing the eye piece

The telescope is to be pointed towards the sky or a sheet of white paper is to be hold in front of the objective.
The eye piece is to be moved in or out by rotating it gradually until the appearance of cross hairs becomes sharp and distinct.

ii) Focusing the objective

Telescope is to be directed towards the object. Focusing screw is to be turned until the appearance of the object becomes sharp and clear.

Expt No. 2 **MEASUREMENT OF HORIZONTAL ANGLES** Date: ----------

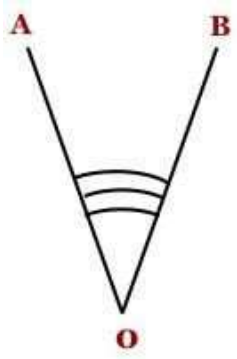
BY REPETITION METHOD

AIM

To measure the horizontal angle by Repetition method with the use of Theodolite.

APPARATUS USED

1.Theodolite, 2.Ranging rods,3.Pegs or Arrows.



PROCEDURE

1. Theodolite is set over an instrument station (O) exactly and all the temporary adjustments are done. Vertical circle is placed left to the observer (face left observation).

2. Vernier A is set to Zero with the help of upper clamp screw and tangent screws. Readings of Vernier A and B are noted.

3. Upper clamp is clamped. Lower clamp is loosened and the telescope is turned towards “A”. Lower clamp is clamped and the point “A” is bisected exactly using tangent screws.

4. Both the vernier A and B are read and noted (Must be equal to 0° and 180° respectively).Upper clamp is unclamped and the telescope is turned clockwise and “B” is bisected.

5. Upper clamp is clamped and “B” is bisected exactly using tangent screws. Both the verniers are read. Mean of the readings provide an approximate included angle of AOB.

6. The reading of vernier A gives directly the angle AOB, and 180° is subtracted by the reading of vernier B. The mean value of two readings gives the angle AOB with one face.

7. Lower clamp is unclamped and the telescope is turned anticlockwise to sight A again. Lower clamp is clamped and A is bisected exactly using tangent screws.

8. Upper clamp is loosened and the telescope is turned clockwise and B is bisected. Upper clamp is clamped and B is bisected exactly using tangent screws. The vernier now read twice the value of angle AOB.

9. Last two steps (7&8) are repeated once again to get the thrice value of angle AOB.

10. Finally obtained reading is divided by 3 to get the mean value of angle AOB.

11. The face is changed and the whole process is repeated. (Face right observations).

12. Average value of two horizontal angles obtained with face left and face right observations is determined.

Measurement of Horizontal Angle (Reiteration Method)																											
Instrument Station	**Sight to**	**Face: Swing:**											**Face: Swing:**											**Average Horizontal angle**		
		A			**B**			**Mean**			**Horizontal angle**			**A**			**B**			**Mean**			**Horizontal angle**					
		0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″

8

LT:

The horizontal angle measured at O between A and B. i.eAOB

a) With face left:-

b) With face right:-

c) Average:-

=

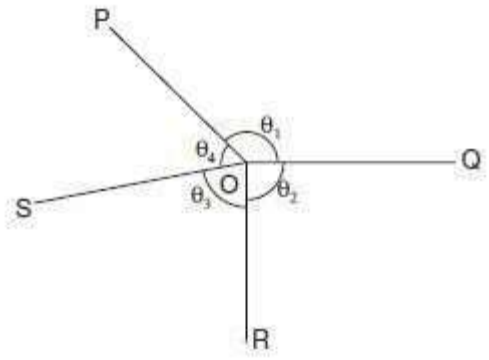
Exp No- 3
HORIZONTAL ANGLE BY REITERATION METHOD

AIM

To measure the horizontal angle by Reiteraion method with the use of Theodolite.

APPARATUS USED

Theodolite,
Ranging rods,
Pegs or Arrows.



PROCEDURE

1. .Theodolite is set over an instrument station (O) exactly and all the temporary adjustments are done. Vertical circle is placed left to the observer (face left observation).

2. Vernier A is set to Zero with the help of upper clamp screw and tangent screws. Readings of Vernier A and B are noted.

3. Upper clamp is clamped. Lower clamp is loosened and the telescope is turned towards “P”. Lower clamp is clamped and the point“P” is bisected exactly using tangent screws.

4. Upper clamp is loosened and the telescope is turned clockwise to bisect R.Lower clamp is clamped and R is bisected exactly using tangent screws. Both the verniers are read and noted.

5. The same procedure is repeated for all other points.

6. The face is changed and all the above steps are repeated. (Face right observations).

7. Reading from Q is subtracted by reading R to get included angle QOR. Reading from R is subtracted by reading S to get included angle ROS.

8. The same procedure is followed to get readings of all other included angles.

Measurement of Horizontal Angle (Reiteration Method)																											
Instrument Station	**Sight to**	**Face: Swing:**											**Face: Swing:**											**Average Horizontal angle**		
		A			**B**			**Mean**			**Horizontal angle**			**A**			**B**			**Mean**			**Horizontal angle**					
		0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″

RESULT

The horizontal angle between the points

i) Face Left **ii) Face Right**

POQ = POQ =

QOR = QOR =

ROS = ROS =

SOP = SOP =

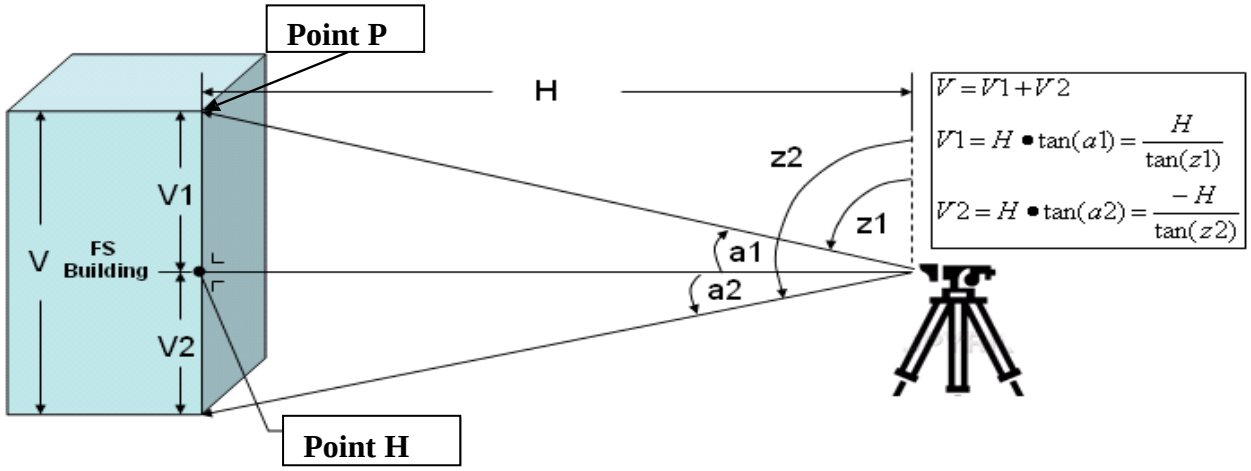
Experiment N0-4
MEASUREMENT OFVERTICAL ANGLES

AIM

To measure the vertical angle between two objects with the use of Theodolite.

APPARATUS USED

Theodolite
Ranging rod
Peg or an Arrow.



1. Theodolite is set up, centered and leveled with reference to the plate bubble.

2. Telescope is placed horizontally by setting the reading of 0°0’0”in the verniers of C and D.

3. Levelling process is carried out with the help of foot screws and the altitude bubble is brought in its central run.

4. Vertical circle clamp is loosened and the telescope is directed upwards to bisect P.

5. Vertical circle clamp is clamped and the point P is exactly bisected using vertical tangent screws.

6. Both the verniers of C and D are read and noted. Mean of the two verniers provide the vertical angle HOP.

7. Face is changed and all the above steps are repeated to get one more vertical angle HOP.

8. Average of the vertical angles taken to get an accurate vertical angle.

9. The same procedure may be adopted to determine the angle of depression HOR by directing the telescope downwards.

Measurement of Vertical Angle																											
Instrument Station	**Sight to**	**Face: Swing:**												**Face: Swing:**												**Average Vertical angle**		
		A			**B**			**Mean**			**Vertical angle**			**A**			**B**			**Mean**			**Vertical angle**					
		0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″

RESULT

1. The observed angle of Elevation is ----------

2. The observed angle of Depression is ----------

Expt No. 5 Date: ----------

TRIGONOMETRICAL LEVELLING
HEIGHTS AND DISTANCES: BASE ACCESSIBLE

AIM

To determine the reduced level and height of given object by trigonometric leveling, when the base is accessible.

INSTRUMENT REQUIRED

Theodolite with tripod
Ranging Rod
Arrows
Tape

FORMULA

Elevation height $h_2 = D \tan \alpha_1$

Depression height $h_3 = D \tan \alpha_2$

Total height $H = h_2 + h_3$

Height of instrument (HI) = RL of BM + h_1

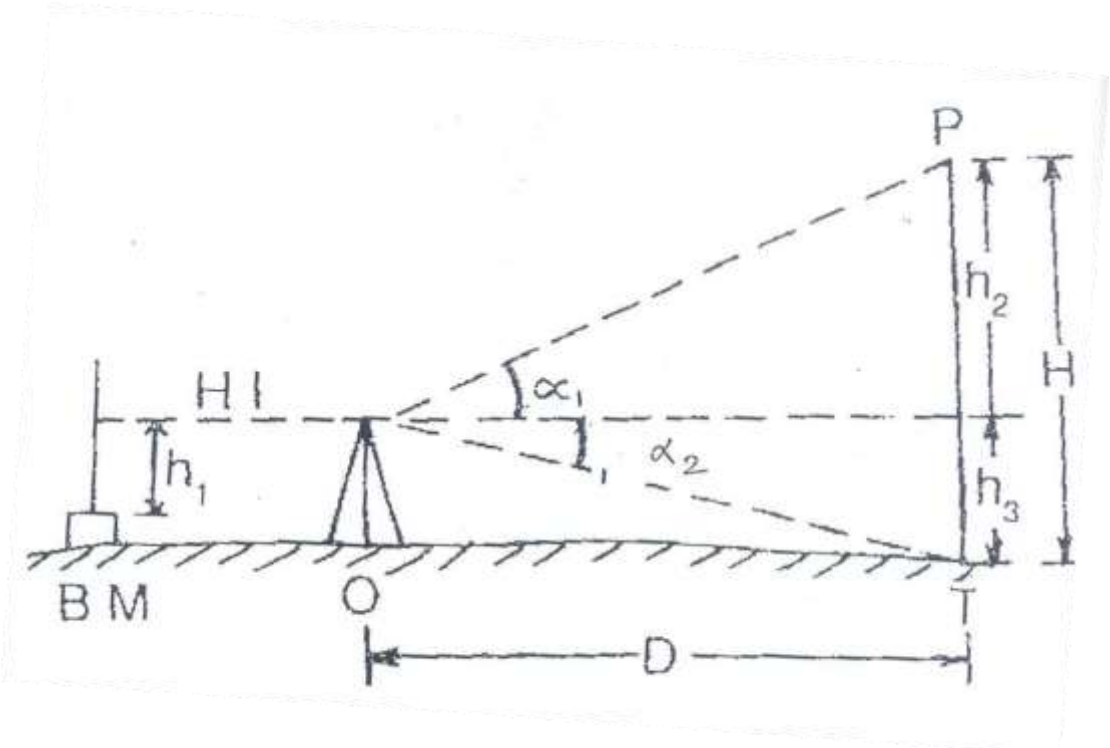
RL of the top of object = HI +h_2

Where,

h_1 – Staff reading on the BM

D – Distance between the object and instrument

$\alpha_1 \& \alpha_2$ – Top and bottom inclined angle of the object.



PROCEDURE

1. The instrument is set up at a convenient point from when the object is clearly visible.
2. Temporary adjustment are made and the line of sight is made horizontal. The staff is held vertically over the bench mark and staff reading corresponding to the middle hair is taken. Let it be h_1
3. The distance D is measured by chain or tape.
4. Now, the top and bottom of the object is bisected. Corresponding vertical angle of elevation α_1 and angle of depression α_2 is noted down.
5. By using suitable formula, the R.L of the top of object can be calculated.

Instrument Station	Object	Observation	Angle	Reading on vernier						Angle on vernier						Mean angle of vernier			Mean angle of observation			Distance
				C			D			C			D									
1	2	3	4	5			6			7			8			9			10			
				0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	
O	A B	Face : Left Swing : Right	AOC BOC																			
O	A B	Face : Right Swing : Right	AOC BOC																			

R.L. of B.M = _____ m.

RESULT:

1. The height of the given object is _____m.

2. The RL of the top of the object is _____m.

Expt No. 6 Date: ----------

TRIGONOMETRICAL LEVELLING
HEIGHTS AND DISTANCES: BASE INACCESSIBLE – SINGLE PLANE METHOD

AIM

To determine the RL of given object by single plane method.

INSTRUMENT REQUIRED

Theodolite with tripod
Pegs
Levelling staff
Arrows
Tape

FORMULA

$h_1 = D \tan \alpha_1$
$h_2 = (D+d) \tan \alpha_2$
R.L. of top of object = RL of BM + S_1+h_1
= RL of BM + S_2+h_2
$S = S_1 \sim S_2 = h_1 \sim h_2$ = Difference in level of instrument.

$D = (S \pm d \tan \alpha_2) / (\tan \alpha_1 – \tan \alpha_2)$

(Use + sign, when the instrument axis A is lower and – sign, when it is higher than at B)

PROCEDURE

1. The instrument is set up at a convenient point A and temporary adjustments are made.

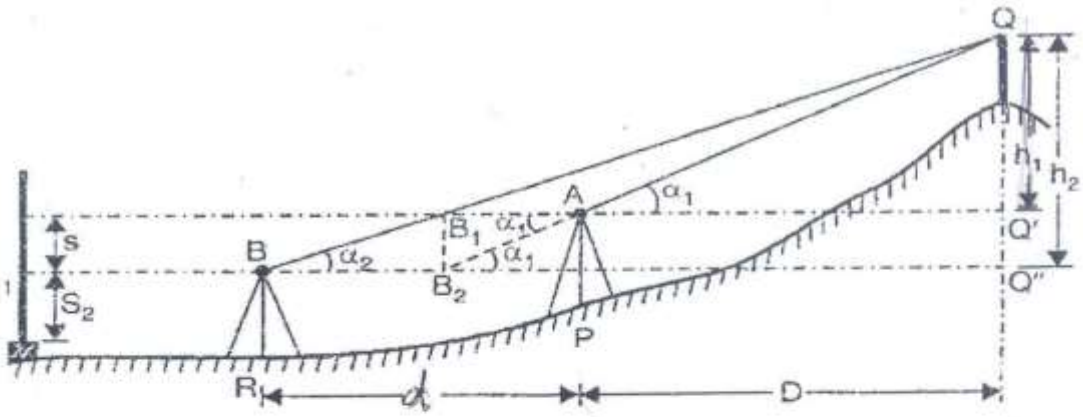
2. Keeping one line of sight horizontal, staff reading is taken over the bench mark (S_1)

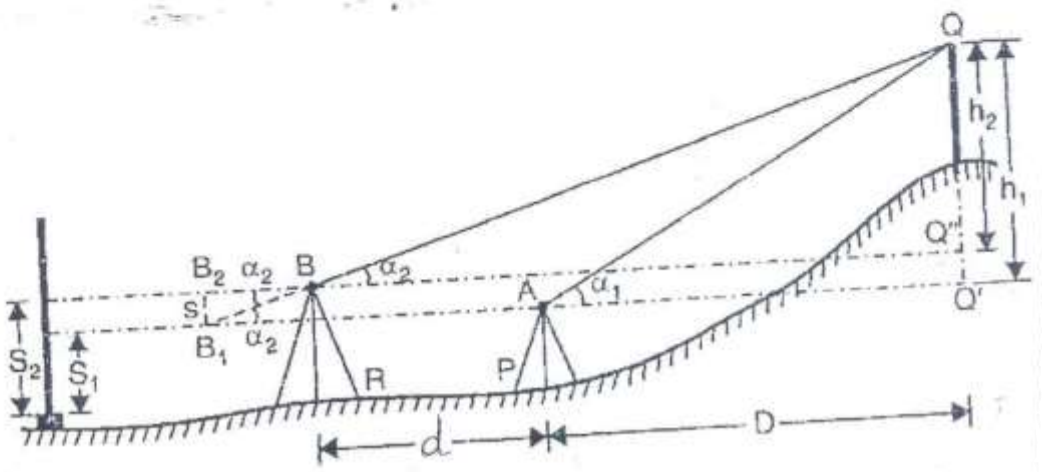
3. The telescope is inclined and the top of the object is bisected. Vertical angle is noted down (α_1)

4. The instrument is transited. So that the line of sight is reversed. The second instrument station B is marked on the ground. The distance AB is measured accurately.

5. The theodolite is shifted and set up at B at a distance d from A. The telescope is inclined and the top of the object is bisected. Vertical angle is noted down (α_2). A staff reading on the B.M is taken (S_2)

6. The R.L. of the object is calculated using above formula.


Q
h1
h2
A
α1
B1
α2
α1
Q'
s
B
α2
B2
Q''
1
S2
P
R
d
D


Q
h2
h1
Q''
B2
α2
B
α2
A
α1
Q'
s
B1
α2
S2
S1
R
P
d
D

2'Instrument Station	Object	Observation	Angle	Reading on vernier						Angle on vernier						Mean angle of vernier			Mean angle of observation			Staff reading
				C			D			C			D									
1	2	3	4	5			6			7			8			9			10			
				0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	
A	BM Q	Face : Left Swing : Right	α_1																			S_1=
	Q	Face : Right Swing : Right	α_1																			
B	BM Q	Face : Left Swing : Right	α_2																			S_2=
	Q	Face : Right Swing : Right	α_2																			

R.L. of B.M = _____ m.

RESULT:

The RL of the top of the object is _____m.

TRIGONOMETRICAL LEVELLING
HEIGHTS AND DISTANCES – DOUBLE PLANE METHOD

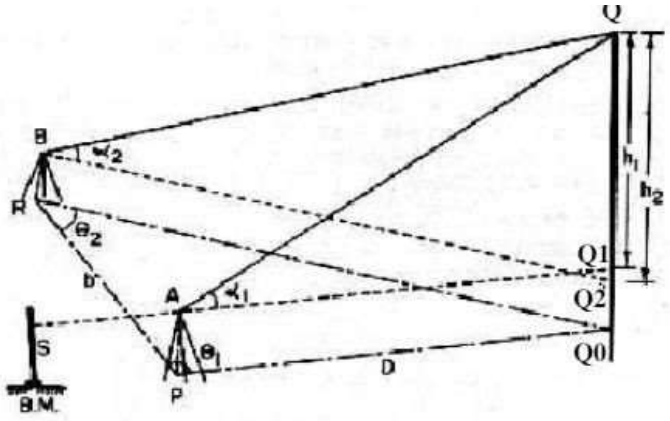
Aim:
To find the R.L. of the top of an object, when the base of the object s inaccessible and the instrument stations are not in the same vertical plane as the elevated object, adopt trigonometrical leveling (double plane method).

Equipment:
Transit Vernier theodolite, tripod stand, plumb bob, tape, leveling staff and pegs.

Procedure: Let P &R be the two instruments stations which are not in the same vertical plane as that of the elevated object 'Q' as shown in figure P&Q should be selected such that the triangle PQR is a well conditioned triangle.

It is required to find out the elevation of the top of an object 'Q'

1. Setup the instruments at P and level it accurately w.r.t the altitude bubble. Bisect the point Q and measure the angle of elevation 'α_1'.
2. Sight to point R ith reading on horizontal circle as zero and measure the horizontal angle RPQ_1 (θ_1) from P.
3. Take a back sight 'S' on the staff kept at A. (B.M.)
4. Shift the instrument to R and measure 'α_2' and 'θ_2' from R.
5. Measure the distance between two instrument stations R&P (equal to 'b')



Let
Q_1 = projection of Q on the horizontal line thought A,
Q_2 = projection of Q on the horizontal line thought B,
AQ_1 = horizontal line though A
BQ_1 = horizontal line though B
AQQ_1 is the vertical plane simultaneously,
BQQ_1 is the vertical plane simultaneously,
PRQ_3 is the horizontal plane
θ_1 = Horizontal angle measure at P
θ_2 = Horizontal angle measure at R
α_1 = Vertical angle measure at A.

Instrument Station	Object	Observation	Angle	Reading on vernier						Angle on vernier						Mean angle of vernier			Mean angle of observation			Distance
				C			D			C			D									
1	2	3	4	5			6			7			8			9			10			
				0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	
O	A B	Face : Left Swing : Right	AOC BOC																			
O	A B	Face : Right Swing : Right	AOC BOC																			

Angle $PQ_0R = 180 - \theta_1 - \theta_2$

R.L. of B.M = _____ m.

Instrument Station	Object	Observation	Angle	Reading on vernier						Angle on vernier						Mean angle of vernier			Mean angle of observation			Staff reading
				C			D			C			D									
1	2	3	4	5			6			7			8			9			10			
				0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	
A	BM Q	Face : Left Swing : Right	α_1																			S_1=
	Q	Face : Right Swing : Right	α_1																			
B	BM Q	Face : Left Swing : Right	α_2																			S_2=
	Q	Face : Right Swing : Right	α_2																			

R.L. of B.M = _____ m.

RESULT:

The RL of the top of the object is _____m.

Expt No. 08 Date: ----------

DETERMINATION OF TACHEOMETER CONSTANT

AIM

To determine the Tacheometer constants

INSTRUMENT REQUIRED

Tacheometer with tripod
Pegs
Levelling staff
Arrows
Tape

FORMULA

TacheometricequationD = Ks+C

Where,

K = Multiplying constant
C = Additive constant
S = staff intercept
D = distance of peg points

PROCEDURE

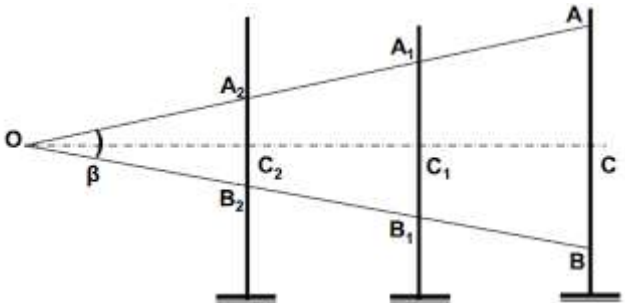
1. A line of fixed length is fixed on the ground and pegs are driven at some specified interval.

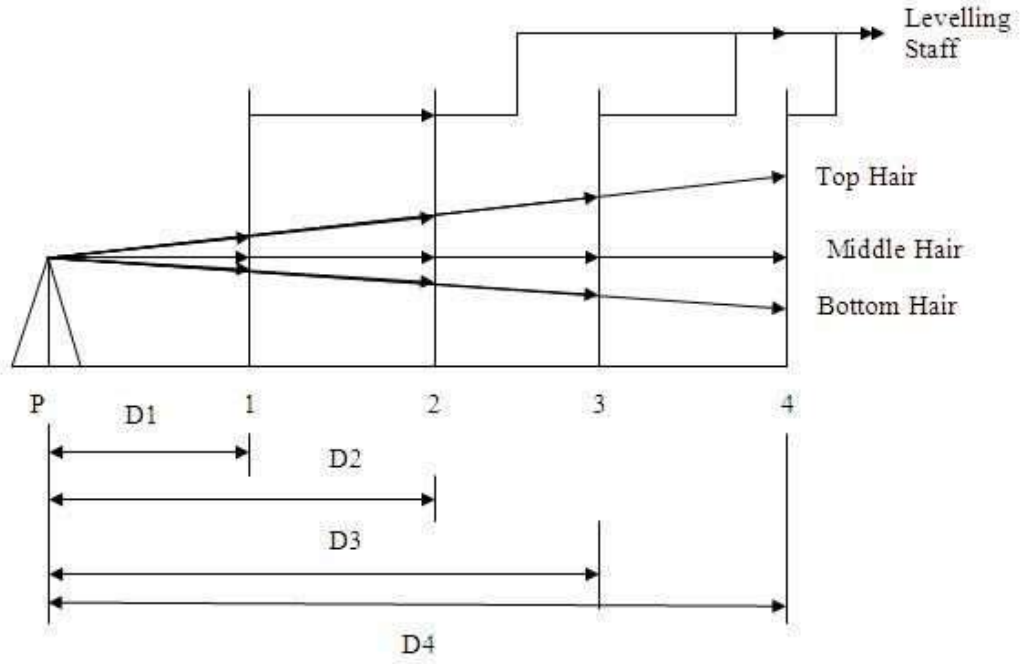
2. The instrument is set up at a convenient point from which all the pegs can be seen;

3. Temporary adjustments are made and the line of sight iskept horizontal.

4. Levelling staff is kept at peg fronts and staff intercept is noted down.

5. Knowing the staff intercept and distance, the tacheometric constants can be found bysolving the tacheometric equations.





Instrument at	Staff at	Staff hair reading		Staff intercept	Distance (m)
		Top	Bottom		

RESULT:

The constants of tachometer are

Multiplying constant K =

Additive Constant C =

Expt No. 09 Date: ----------

STADIA TACHEOMETER

STADIA HAIR METHOD – HORIZONTAL LINE OF SIGHT (Staff held vertical)

AIM

To determine the length of the traverse legs and to find the area enclosed by the traverse.

INSTRUMENT REQUIRED

Tacheometer with tripod

Levelling staff

FORMULA

Tacheometricequation: $D = Ks+C$

Where,

K = Multiplying constant
C = Additive constant
s = staff intercept
D = distance of peg points

$C^2 = a^2 + b^2 - 2ab\cos\theta$

Area = (1/2) ab sin C

PROCEDURE

1. The instrument is kept at O from which observation can be taken to all the given points and the temporary arrangements are made.
2. Levelling staff is kept at various points and after keeping the line of sight horizontal, staff intercepts are taken.
3. Horizontal angles subtended by these stations with the instrument are also observed.
4. With these set of readings, area & the lengths are computed.

Instrument Station	Sight to	Stadia horizontal readings		Horizontal angles
		Top	Bottom	
O	A			AOB =
	B			BOC =
	C			COD =
	D			DOE =
	E			EOA =

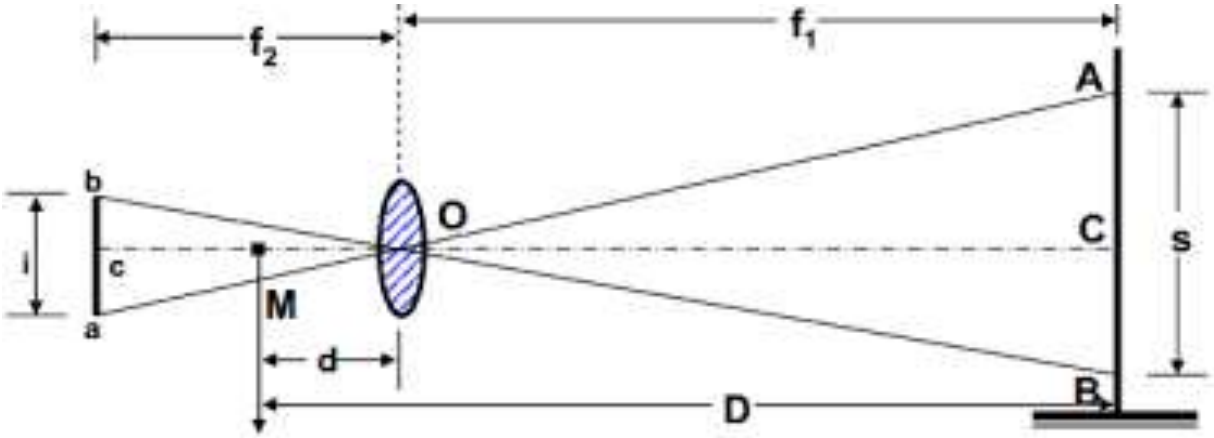


Figure: PRINCIPLE OF STADIA METHOD

Instrument Station	Station bisected	Observation	Angle	Reading on vernier						Angle on vernier						Mean angle of vernier			Mean angle of observation			Correction			Corrected angle		
				A			B			A			B														
1	2	3	4	5			6			7			8			9			10			11			12		
				0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″
O	A B C D E A	Face : Left Swing : Right	AOB BOC COD DOE EOA																AOB = BOC = COD = DOE = EOA =						AOB = BOC = COD = DOE = EOA =		
O	A B C D E A	Face : Right Swing : Right	AOB BOC COD DOE EOA																								

RESULT:

1. The length of traverse legs:

AB =

BC =

CD =

DE =

ED =

Experiment N0-10

STADIA HAIR METHOD – INCLINED LINE OF SIGHT (Staff held vertical)

AIM

To determine the reduced level of points A and B and also the gradient of the line joining A & B.

INSTRUMENT REQUIRED

Tacheometer with tripod
Levelling staff

FORMULA

1. Distance $D = Ks \cos 2\theta + C \cos\theta$

Where,

K = Multiplying constant
C = Additive constant
s = staff intercept
D = distance of peg points

2. $V = (Ks \sin 2\theta)/2 + C \sin \theta$

Where θ = vertical angle
V = height of middlehair above the line of sight.

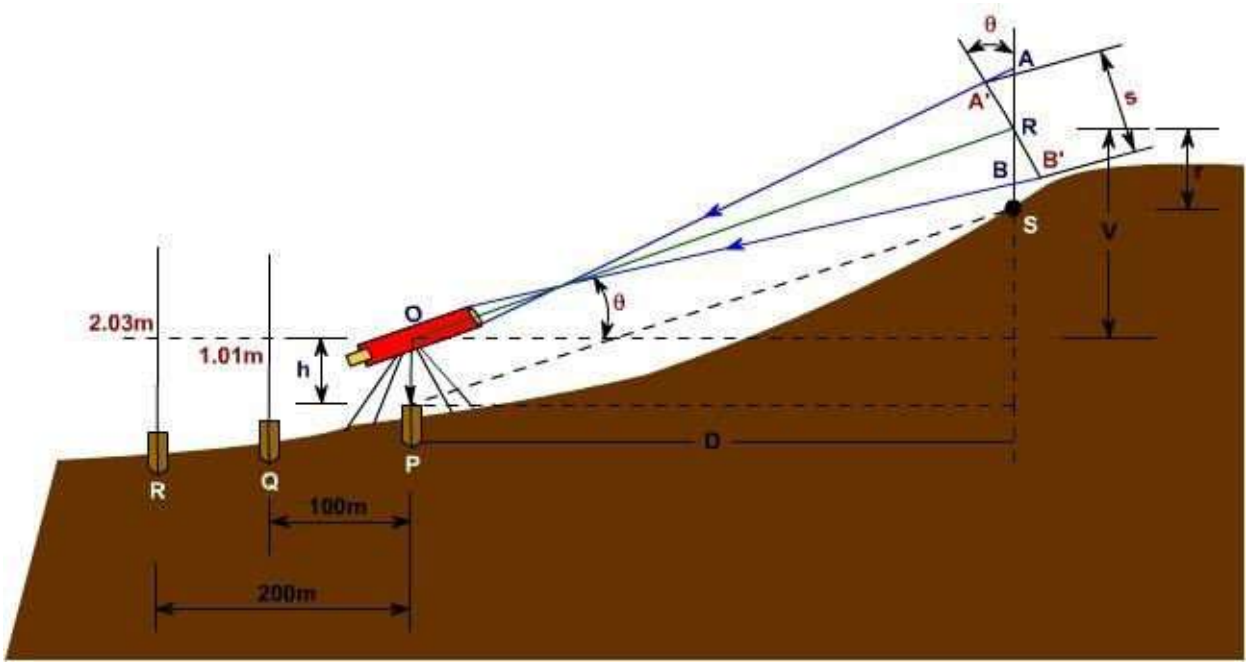
3. Gradient = (RL of A – RL of B)/ Distance

4. Elevation of staff station (RL of A or B) = Elevation of P + h+V-r

PROCEDURE

1. The instrument is set up at a convenient point (O) so that the points A and B are visible.
2. Staff and stadia hair readings are observed at A and B after leveling it accurately.
3. The vertical angles to A and B are also observed.
4. A staff reading is taken on the BM with a horizontal line of sight.
5. The horizontal angle subtended at O between A and B is also noted down.
6. The RL and the gradient are calculated by using the relevant formulas.

Instrument Station	Sight to	Stadia hair reading			Vertical angle	Horizontal angle
		Top	Middle	Bottom		
O	BM					
	A					
	B					



ELEVATED SIGHT : VERTICAL HOLDING

Instrument Station	Station bisected	Observation	Reading on vernier						Angle on vernier						Mean angle of vernier			Mean angle of observation		
			C			D			C			D								
1	2	3	4			5			6			7			8			9		
			0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″
O	A	Face : Left Swing : Right																		
		Face : Right Swing : Right																		
O	B	Face : Left Swing : Right																		
		Face : Right Swing : Right																		

RL of BM = _____ m

Instrument Station	Object	Observation	Reading on vernier						Angle on vernier						Mean angle of vernier			Mean angle of observati		
			A			B			A			B								
1	2	3	4			5			6			7			8			9		
O	A B	Face : Left Swing : Right	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″
	A B	Face : Right Swing : Right																		

RESULT:

1. The RL of A =

   RL of B =

2. Gradient =

Expt No. 11 Date: ----------

TANGNETIAL METHOD OF TACHEOMETRY

AIM

To determine the reduced level of the object by using tangential tacheometry.

INSTRUMENT REQUIRED

Tacheometer with tripod
Levelling staff

FORMULA

1. For Both angles of elevation

$D = S/(\tan \alpha_1 - \tan \alpha_2)$
$V = D \tan \alpha_2$
RL of Q = HI+ V-r

2. For both angles of depression

$D = S /(\tan \alpha_2 – \tan \alpha_1)$
$V = D \tan \alpha_2$
RL of Q = HI- V-r

3. For one angle of elevation and one depression

$D = S /(\tan \alpha_2 + \tan \alpha_1)$
$V = D \tan \alpha_2$
RL of Q = HI- V-r

PROCEDURE

1. The instrument is set up at station P and temporary adjustments are made.
2. A Staff reading is taken on the BM with a horizontal line of sight.
3. The telescope is transited. Upper tangent is sighted on the staff held at station Q and the angle of elevation α_1 is noted.
4. The telescope is depressed. The lower tangent is sighted on the same staff and the angle α_2 is noted.
5. The staff intercept between the two tangents is noted.
6. Using the relevant formula, the RL of the given point.

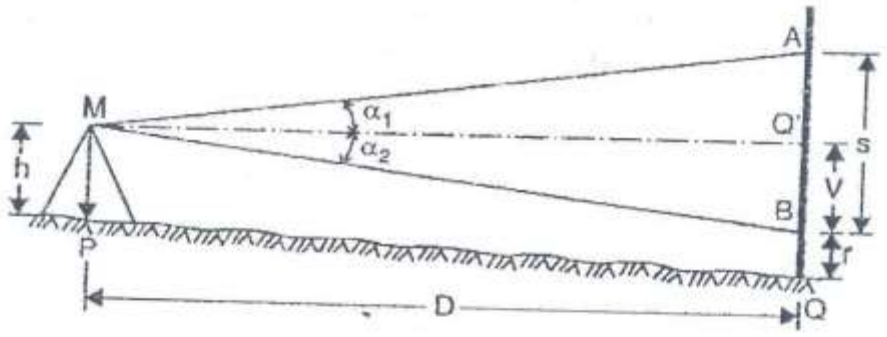


FIG. 22.22. ONE ANGLE OF ELEVATION AND THE

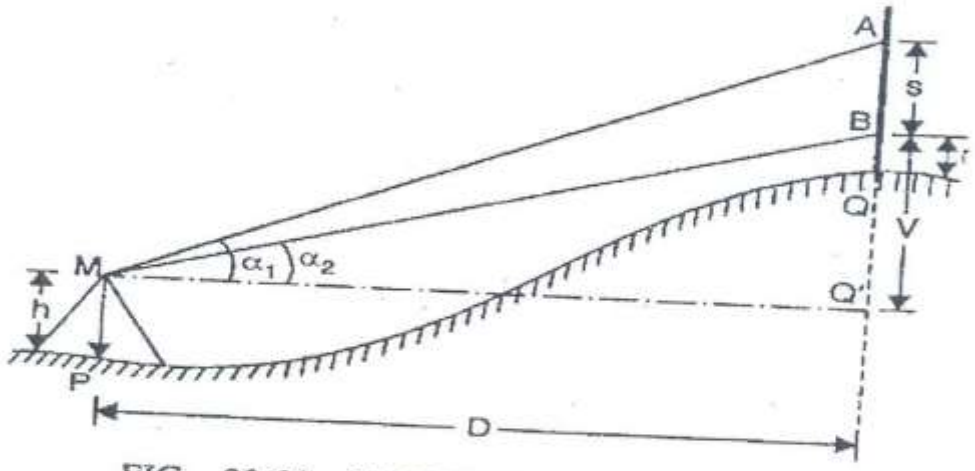


FIG. 22.20. TANGENTIAL METHOD : ANGLES OF ELEVATION

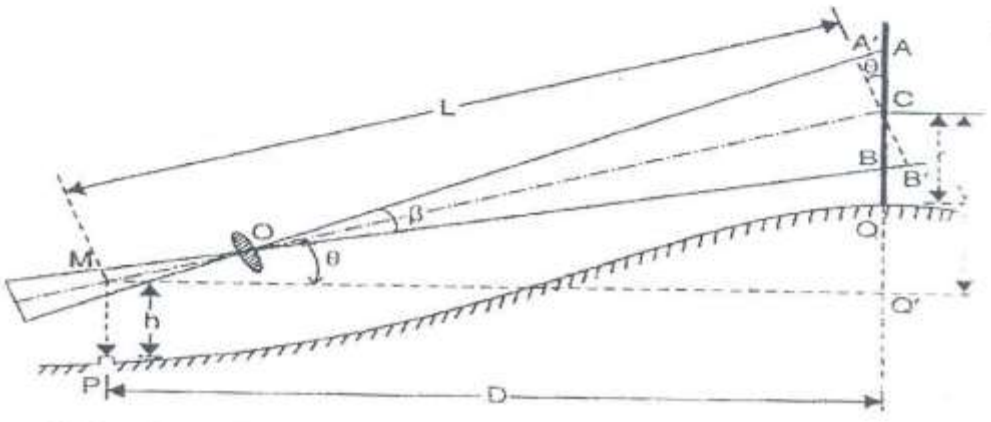


FIG. 22.5. ELEVATED SIGHT : VERTICAL HOLDING.

Instrument Station	Object	Observation	Reading on vernier						Angle on vernier						Mean angle of vernier			Mean angle of observation			Stadia readings	Stadia Intercept	Height of instrument
			C			D			C			D												
1	2	3	4			5			6			7			8			9			10	11	12
	P		0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	0	′	″	m	m	m
	Q	Face : Left Swing : Right																					
O	P	Face : Right Swing : Right																					
	Q																						

RL of BM = _____ m

RESULT:

1. The RL of a given object = _____ m

2. Distance between the instrument station and staff station = _____m

Expt No. 12 Date: ----------

TRAVERSE USING TOTAL STATION AND AREA OF TRAVERSE

AIM:

To form a closed traverse using total station.

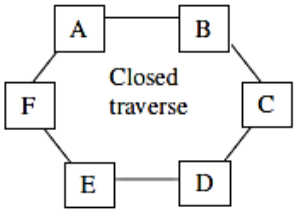
RESOURCES:

1 total station 1
2 Prism 1
3 Tripod 1
4 Pegs

PROCEDURE:

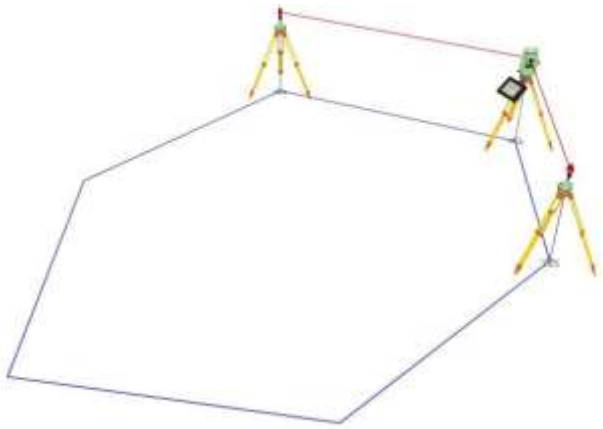
1. Fix the total station over a station and level it
2. press the power button to switch on the instrument.
3. select MODE B -------> S function------->file management------>create(enter a name)------->accept
4. then press ESC to go to the starting page
5. then set zero by double clicking on 0 set(F3)
6. Then go to S function ------> measure-----> rectangular co-ordinate---->station --->press enter.
7. Here enter the point number or name, instrument height and prism code.

PN.....
E.....
N.....
IH.....
PC.....



8. Then press accept(Fs)
9. keep the reflecting prism on the first point and turn the total station to the prism ,focus it and bisect it exactly using a horizontal and vertical clamps.
10. Then select MEAS and the display panel will show the point specification
11. Now select edit and re-enter the point number or name point code and enter the prism height that we have set.
12. Then press MEAS/SAVE (F3) so that the measurement to the first point will automatically be saved and the display panel will show the second point.
13. Then turn the total station to second point and do the same procedure.
14. Repeat the steps to the rest of the stations and close the traverse
15. Now go to S function----> view/edit----graphical view.
16. It will show the graphical view of the traverse.

DIAGRAM:



CALCULATION :

Select S function---> calculation---> 2D surface----->All------> accept

RESULTS:

Select S function---> calculation---> 2D surface----->All------> accept

This will give the area of the closed traverse. Area of the closed traverse is calculated.

Expt No. 13 Date: ----------

DETERMINATION OF DISTANCE AND DIFFERENCE IN ELEVATION BETWEEN TWO INACCESSIBLE POINTS USING TOTAL STATION

AIM:

To find the height of a remote point using total station.

RESOURCES:

1 total station 1
2 Prism 1
3 Tripod 1
4 Pegs

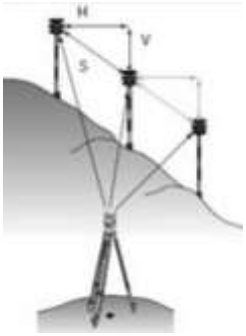
PROCEDURE:

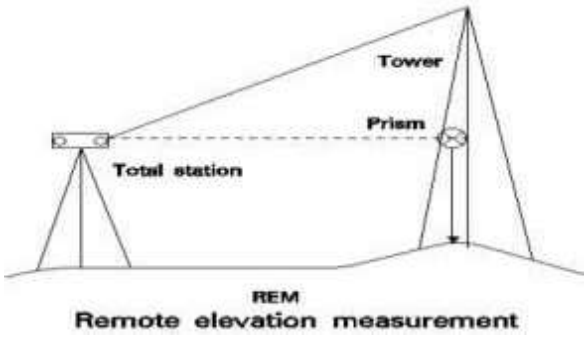
1. Fix the total station over a station and level it
2. press the power button to switch on the instrument.
3. select MODE B -------> S function-------->file management------>create(enter a name) ----->accept
4. Press ESC to go to the starting page
5. Then set zero by double clicking on 0 set(F3)
6. Then go to S function ------> measure-----> rectangular co-ordinate---->station --->press enter.
7. Here enter the point number or name, instrument height and prism code.

PN.....
E.....
N.....
IH.....
PC.....

8. Then press accept (Fs)
9. Setup a reflector vertically beneath the point, the height of which is to be determined.
10. Enter the reflector height, target to it, and measure the distance.
11. Target the high point.
12. The height difference H between the ground point and the high point is now calculated and displayed at the touch of a button

DIAGRAM:





CALCULATION:

Select S function---> calculation---> 2D surface----->All------> accept

RESULTS:

Select S function---> calculation---> 2D surface----->All------> accept

Height of a remote point using total station is obtained

VIVA QUESTIONS

THEODOLITE

What is transit Theodolite?
Transit theodolite is defined as the theodolite, in which its telescope can be rotated horizontally through 180^o in the vertical plane.

List the qualities of a Theodolite telescope?
Internal focusing telescopes are best suited instead of external telescopes. The magnification factor of the internal focusing telescope should be from 15 to 30 times of the diameter.

State the location and function of a plate bubble of a Theodolite.
Plate bubble is placed parallel to the trunnion axis at the upper plate (or vernier plate)

How do you eliminate parallax in Theodolite?
Parallax effect can be eliminated as follows. (a) Focussing the eye piece (b) Focussing the objective

What are the two methods of measuring the horizontal angle using a Theodolite?
Repetition Method Reiteration Method

What are the errors eliminated in measurements of horizontal angle by method of repetition?
Instrumental and Observational errors are eliminated in measurements of horizontal angle by method of repetition.

What you mean by temporary adjustments of a Theodolite?
The adjustments required to be made at every instrument station before taking observations are called temporary adjustments. The temporary adjustments of a theodolite consist of the following operations. 1. Setting and centering the theodolite 2. Levelling of the theodolite 3. Elimination of parallax

What is a spire test?
the horizontal axis (trunnion axis) is made perpendicular to the vertical axis. The objective of this adjustment is to ensure that the line of collimation revolves in a vertical plane, perpendicular to the vertical axis. This adjustment is carried out by Spire Test.

Explain face left and face right observations in Theodolite traversing?
When the vertical circle of the theodolite is on the left of the observer, the telescope position is called Face Left. When the vertical circle of the theodolite is on the right of the observer, then the telescope position is called Face Right.

What kind of error can be eliminated by taking face left and face right observations?
Instrumental error can be eliminated by taking face left and face right observations Line of collimation not perpendicular to the trunnion axis Horizontal axis not perpendicular to vertical axis Vertical Index Errors

TACHEOMETRY

Define Tacheometry

Tacheometry is a branch of angular surveying in which the horizontal and vertical distances (or) points are obtained by optional means as opposed to the ordinary slower process of measurements by chain (or) tape.

Define Analytic lens

Analytic lens is an additional lens placed between the diaphragm and the objective at a fixed distance from the objective. This lens will be fitted in ordinary transit theodolite. After fitting this additional lens the telescope is called as external focusing analytic telescope. The purpose of fitting the analytic lens is to reduce the additive constant to zero.

Define the tangential method

In this method, the stadia hairs are not for taking readings. The readings being taken against the horizontal cross hair.

What is the principle of stadia method

The method is based on the principle that the ratio of the perpendicular to the base is constant to similar isosceles triangle.

Define the Azimuth

The azimuth of a heavenly body is the angle between the observer's meridian and the vertical circle passing through the body.

Define the hour angle

The hour angle of a heavenly body is the angle between the observer's meridian and the declination