Rajiv Gandhi University of Knowledge Technologies Basar

LABORATORYMANUAL

SURVEYINGLAB

DEPARTMENT OF CIVIL ENGINEERING

RGUKT BASAR

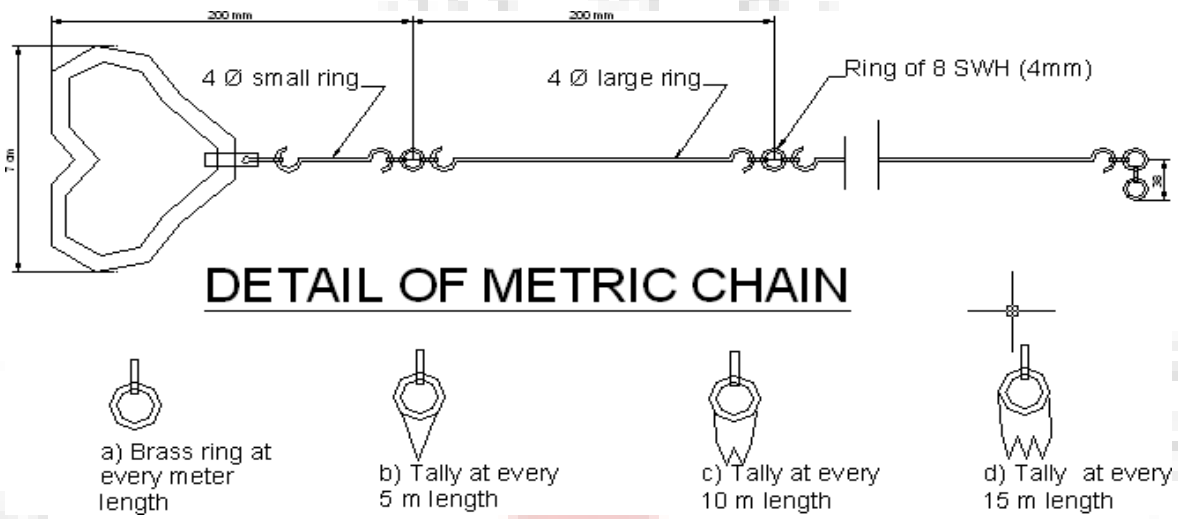
TELANGANA. -504107

List of Practical (Minimum 15 practical should be performed out of the following)	
1)	Measurement of distance by ranging and chaining.
2)	Locatingvariousobjectsbychain&crossstaffsurveying.
3)	Determinationofareaofpolygonbychainandcrossstaff survey.
4)	Measurementofbearingsofsidesoftraversewithprismatic compass and computation of correct includedangle.
5)	Locating given building by chain and compass traversing, (One full size drawing sheet)
6)	Determinationofelevationofvariouspointswith Auto level bycollimationplanemethodandrise&fallmethod.
7)	Fixing bench mark with respect to temporary bench mark with Auto level by fly leveling and check levelling.
8)	L-Section and cross section of road. (OnefullsizedrawingsheetforL-Sectionandcrosssection)
9)	Measurementofhorizontalanglestheodolitebymethodof repetition.
10)	Measurement of vertical angles with theodolite. (One full size drawing sheet)
11)	Determination of horizontal distance between two inaccessible points withthedolite.
12)	Locating given building by thedolite traversing. (One full size drawing sheet)
13)	Locatinggivenbuildingbyplaintabletraversing. (Onefullsizedrawingsheet)
14)	Three point problem in plane table traversing.
15)	Determinationofelevationofpointbytrigonometric levelling.
16)	Contour plan of given area. (Onefullsizedrawingsheet)
17)	Study of planimeter.
18)	Determinationofareaofirregularfigurebyusingplanimeter
19)	Study of Box Sextant, Abney Level, Optical Theodolite.
20)	To give layout of given plan of building.

AIM : Measurement of distance by Ranging andChaining

EQUIPMENT-:Chain,Arrows,Tapes,RangingRods,OffsetRods,Crossstafforopticalsquare, Plumbbob,woodenmallet,pegs.

Figure:



THEORY : By the various methods of determining distance the most accurate and common method is the method of measuring distance with a chain or tape is called Chaining. For work of ordinary precision a chain is used. But where great accuracy is Requiredasteeltapeisinvariablyused.

Thetermchainingwasoriginallyappliedtomeasure Distancewithachain.The termchainingisusedtodenotemeasuringdistancewitheitherchainortape,Intheprocess of chaining, The survey party consists of a leader (the surveyor at the forward end of the chain) a follower (the surveyor at the rare end of the chain and an assistant to establish intermediate points).

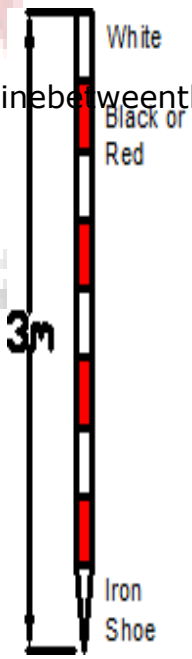
The accuracy to which measurement can be made with chain and tape varies with the methods used and precautions exercised. The precision of chaining. For

ordinarywork,rangesfrom1/1000to1/30,000andprecisemeasurementsuchasBaseline may be of the order of 1000000.

in diameter called links. The end of each link is bent into a loop and connected together by means of three oval rings which afford flexibility To the chain and make it less liable to become kinked. The ends of chain are provided with brass handles for dragging the chain on the ground, each with a swivel Joints so that the chain can be turned round without twisting.ThelengthoftheAlinkisthedistancebetweenthecentresofthetwoconsecutive middlerings.Theendlinksincludethehandlesmetallicringsindicatorsofdistinctivepointsof theChaintofacilitatequickreadingoffractionsofchaininsurveyingmeasurements.

RANGING RODS:

The ranging rods are used for marking the positions of Stations conspicuouslyandforrangingthelines.Ioordertomakethesevisible at a distance, they are painted alternately black and white, or red and white or red White and black successively.The adjustment of the chainshouldasfaraspossiblebeaffectedsymmetricallyoneitherside ofthemiddlesoasthatthepositionofcentraltagremainsunaltered. In measuring the length of survey line also called as chain line. It is necessarythatthechainshouldbelaidoutonthegroundinastraight linebetweentheendstations.



Two men are required for chaining operation; The chain man at the forward end ofchainiscalledtheleaderwhiletheothermanattherearendisknownasthefollower. Duties of leader&follower

Leader:- 1)Toputthechainforward

2) Tofixarrowsattheendofchain

3) Tofollowtheinstructionofthefollowers.

Follower:- 1)Todirecttheleadertothelinewiththerangingrod.

2) Tocarrytherearendofthechain.

3) Topickupthearrowsinsertedbytheleader.

Chaining 1) The follower holds the zero handle of the chain against the peg &directs the leadertobeinlineoftherangingrod.

2) Theleaderusuallywithtoarrowsdragsthechainalonetheline.

3) Usingcodeofsignalsthefollowerdirectstheleaderasrequiredtotheexactly in the line.

4) Theleaderthenfixesthearrowsattheendofchaintheprocessisrepeated.

Ranging 1)Placerangingrodsorpolesverticallybehindeachpoint

2) Standabout2mbehindtherangingrodatthebeginningoftheline.

3) Direct the person to move the rod to right or left until the three ranging rods appearexactlyinthestraightline.

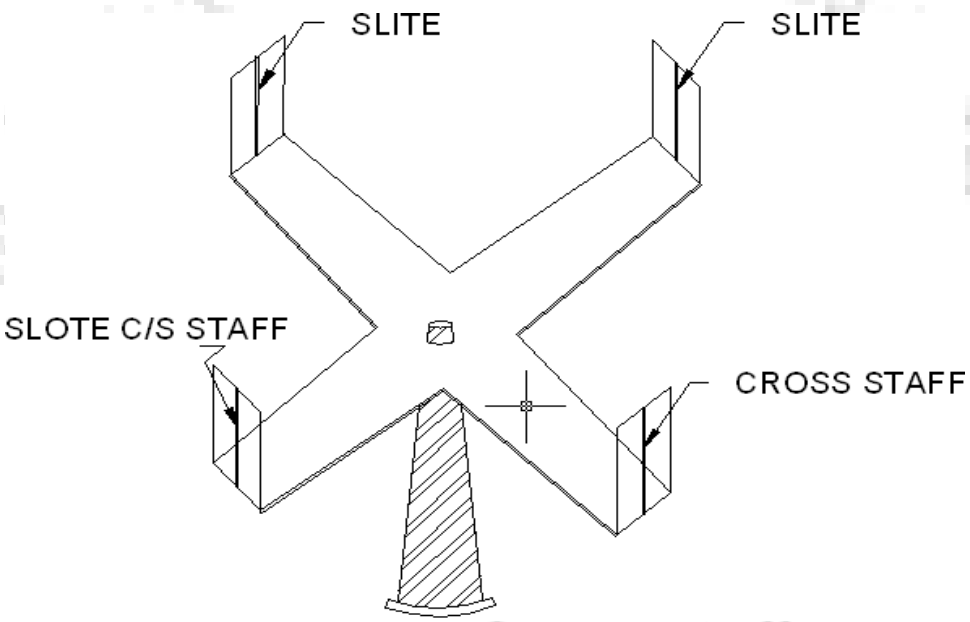
4) Sightonlythelowerportionofrodinordertoavoiderrorinnon-vertically.

5) Afterascertainingthatthreerodsareinastraightline,askthepersontofixup the rod.

RESULT :ByChainingandrangingthetotaldistanceisfoundtobe_____

AIM: Locating various object by chain & cross staff survey

APPARATUS: Chain, Ranging rod, Arrows, Cross-staff, Metallic Survey(Tape)

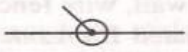
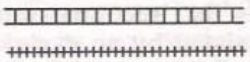
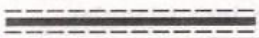
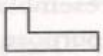
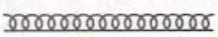
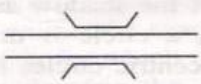
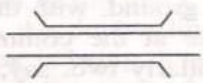
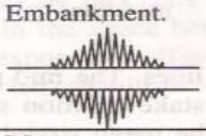
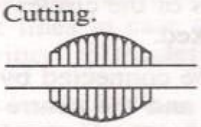
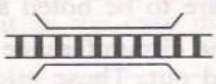
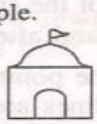


Cross staff

THEORY:Cross-Staffisthesimplestinstrumentusedforsettingoutperpendiculari.etaking offsets from a chain line. it is easier and quicker method ,but not very accurate .if greataccuracyisdesired,theworkshouldbecarriedoutbythetheodolite.

Open cross staff:- The simplest Type consists two parts 1) the head 2) the leg .the head is made of wooden block octagonal or round in shape about 15cm side or diameter an 4cm deep . on it are scribed two lines at right angles to another .At the end of these twolinesarefixedtwopointsofmetallicstriphavingslitsmadeinthem.Theseslitstwo

linesofsightwhichareatrightanglestooneanother.Theheadisfixedonawooden staff or pole about 3cm in diameter and 1.2 to 1.5m length .The pole is provided conicalmetalshoesothatitcanbedrivenintotheground.

1. Triangulation Station. 	2. Traverse station 	3. Tie station. 	4. Chain line.
5. Wood fencing.	6. Pipe railing.	7. Wire fencing.	8. Demarcated property boundary.
9. Undermarcated property boundary.	10. Compound wall. 	11. Stream. 	12. River. 
13. Cart track. 	14. Canal. 	15. Railway line. 	16. Railway double line.
17. Unmetalled road. 	18. Metalled road. 	19. Pucca building. 	20. Katcha building 
21. Hedge 	22. Trees. 	23. Woods. 	24. Orchard. 
25. Cultivated land. 	26. Swamps. 	27. Culvert. 	28. Bridge. 
29. Embankment. 	30. Cutting. 	31. Railway bridge. 	32. Temple. 
33. Mosque. 	34. Church. 	35. Pond or lake. 	36. North line. 
37. Gates. 	38. Well. 	39. Bench mark. BM 15.000 	40. Pucca drain.
41. Katcha drain.	42. Electric line.	43. Shed.	44. Gate and wall.
45. Pasture.	46. Cemetry	47. Foot path.	48. Lawn.

1) Tofindthefootoftheperpendicularfromtheobjectthecrossstaffisheld approximatelyinpositionandonepairofslitsisdirectedinthedirectionoftheranging rodfixedattheforwardandthechainline.Theobserverthenlooksthroughtheother pairofslitsandseeswhethertheparticularobjectisbisectedornot.ifnotthecross staffismovedtoandfromtillthenecessarybisectionisobtained.Beforenotingdown thechainageofthefootoftheperpendicularcaremustbetakentoseethatonepair ofslitisthedirectionofchainornot.Whileshiftingthepositionofthecross-staffitmay gettwistedandhenceprecautionisnecessary.
2) Tosetaperpendiculartothechainlineatagivenpointonepairofslitsisorientedin the direction of chain line by looking at the ranging rod fixed at the forward and by lookingthroughtheotherpairofslitsrangingrodisfixedinthedirectionofthelineof sightprovidedbythispair.

RESULT:Variousperpendiculartothechainlineobjectarecreatedusingcross-staff survey.

AIM : Determination of area of given polygon by chain & cross-staff survey

Equipment: - Two chains 20m or 30m, Arrows, Ranging rods. Cross staff or opticalsquare, Plumbbob

THEORY :Theobjectofcrossstaffsurveyistolocatedtheboundariesoffieldorplotand tofindoutitsarea.

Inthismethodabaselineinthecentreoftheareaisselected.Chainingalongthisline isdoneandtheoffsetsofthepointslyingontheboundariesoftheplotaretakenatdifferent chainages.by using a cross staff and tape on either side of the chain line and recorded against the chainagesin the field note book as already discussed .The offsets length are written on the left hand side or right hand side of the line as per position until whole ofthe area issurveyed.

Theplotisthendividedintotrianglesandtrapezoidsbecauseititeasytofindoutthe areaoftriangleandatrapezoids.

The area of the field is computed by the following formulae.

(1) Theareaofarightangletriangleisequaltothebasemultipliedbyhalfthe perpendicular

(2)Theareaofatrapezoidisequaltothebasemultipliedbyhalfthesumofthe Perpendicular.

Procedure:Tostartthecrossstaffsurvey,achainlineisrunthroughthecentreoftheareato besurveyed.itisdividedintorightangledtrianglesandtrapezoids.Theperpendicular totheboundaryaretakeninorderoftheirchainages.

morethan15m.Careshouldbetakenthatnooffsetisoverlookedbeforethechainis removed .The chainages of the points of intersection of the chain line and the boundariesshouldberecorded.Thelengthoftheboundarylinemaybemeasuredby direct measurement to check the accuracy of field work.After the field work is over, the survey is plotted to some convenient scale. The figure thus formed by the boundarylinesisdividedinthetabularfromasgivenbelow

Observation Table;-

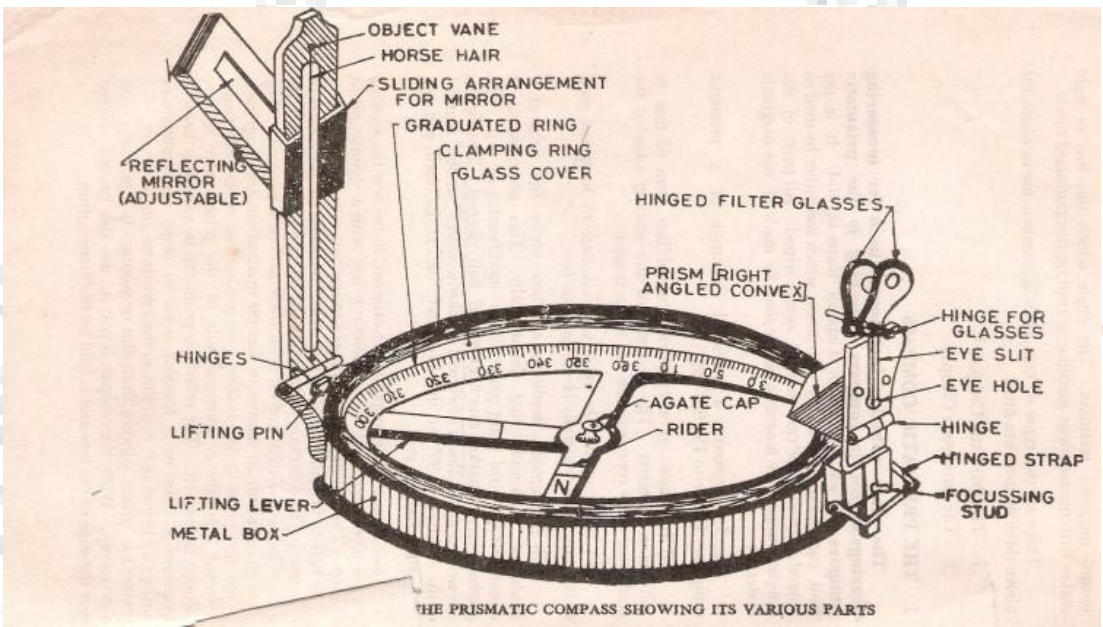
Sr. No.	Figure	Chainage In m.	Base in (meter)	Offset in (meter)	Mean offset	Area in m^2		Remarks
						+Ve	-Ve	
1	2	3	4	5	6	7	8	9

RESULT:Areaofpolygonbychain&staffmethodisfoundtobe ---------- squaremeter.

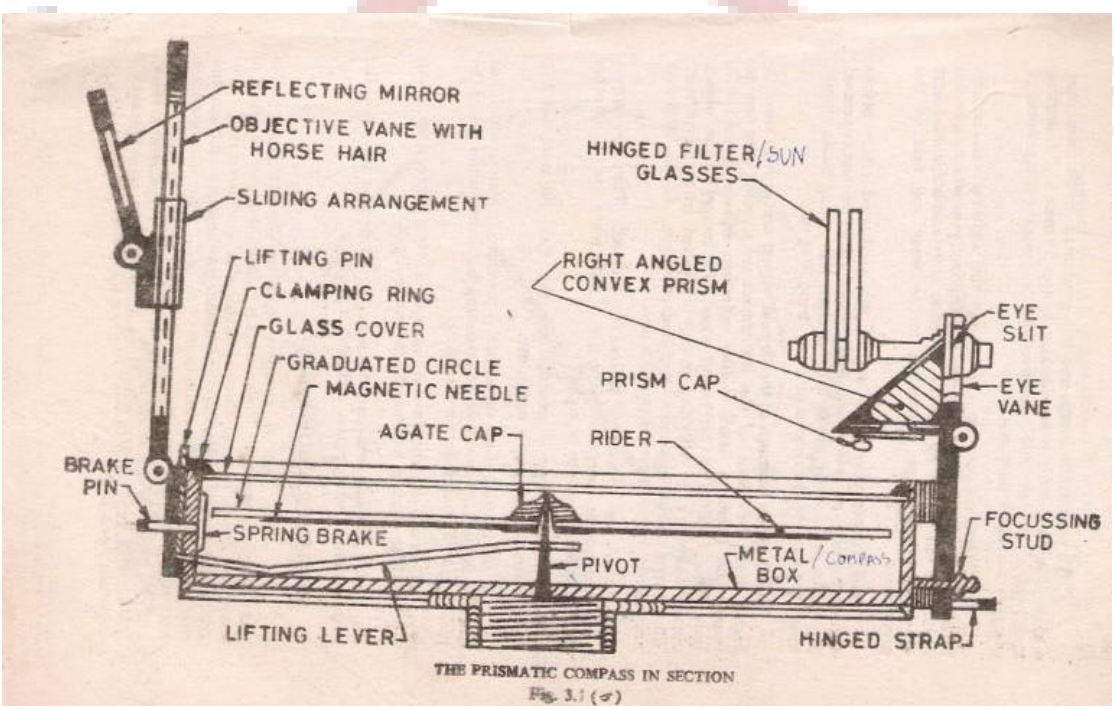
EXPERIMENT NO-4

AIM: Measurement of bearings of sides of traverse with prismatic compass and computationofcorrectincludedangle.

APPARATUS:Prismaticcompass,rangingrod,chain,tape,pegTripodstand,small pieces ofstones.



THE PRISMATIC COMPASS SHOWING ITS VARIOUS PARTS



THE PRISMATIC COMPASS IN SECTION

Fig. 3.1 (a)

THEORY: The important parts of compass are:-

1) Aboxwithgraduatedcircle.
2) A magneticneedle
3) A line ofsight

When the line of sight is pointed to point, the magnetic needle of compass points towardsnorth(Magneticmeridian).Theanglewhichthislineofsightmakeswiththe magnetic meridian is read on graduated circle.it is known as magnetic bearing ofthe line.

There are two types of compasses:-

1) Prismaticcompass
2) Surveyor'scompass.

Prismatic Compass:-

Prismaticcompassisveryvaluableinstrument.Itisusuallyusedforroughsurveyfor measuringbearingandsurveylines.Theleastcountofprismaticcompassis30min. Itconsistsofcircularboxof10cm-12cmdia.ofnonmagneticmaterial.pivotisfixedat the centre of box and is made up of hard steel with a Sharp pivot. graduated aluminum is attached to the needle. It is graduated in clockwise direction from 0^0 to 360^0.thefiguresarewritteninverted.ZeroIswrittenatsouthendand180atnorth endand270attheeast.Diametricallyoppositearefixedtothebox.Thesightingvane consists of a hinged metal frame in the centre of which is stretched a vertical Horse hairfinesilkthreadofwhichisstretchedaverticalhair.itpressesagainstaliftingpin whichlifttheneedleofthepivotandholdsitagainsttheglasslid.Thuspreventingthe wear of the pivot point to damp the oscillations of the needle when about totake

face of the prism can be folded out the edge of the box when North end is used Sometime the sighting vanes is provided with a hinge mirror Which can be placed upward or downwards on the frame and can be also Slided along it is required. The mirrorcanbemadeinclinedatanyanglesothatObjectswhicharetoohighortoo low can be sighted directly by reflecting.

BEARINGOFLINES:Abearingofalineisahorizontalanglemadebythesurveylinewithsome referencedirectionormeridian.Meridianmaybe

1) A truemeridian
2) A magneticmeridian
3) An arbitrary or assumedmeridian

True meridian: The true geographical meridian passing through a point is a line of intersection of earth's surface by a plane containing north south pole and given point. They are not parallel to each other at different places.

Magnetic meridian:-the direction indicate by a free suspended and a properly balanced magnetic needle Free from all other attractive forces. The direction of magnetic meridian can be established with the help of Magnetic compass.

Arbitrarymeridian:AnydirectionisassumedtobetheReferencemeridianto Carry out smallsurvey.

measured clockwise from the north point of the reference meridian towards the line right round the circle. The angle thus measured between the reference meridian and the line is called Whole circle bearing of the line. Angles measured will have value between 0 to 360 degrees.

Conversion of W.C.B. in R.B

Case	WCB between	R.B.	QUADRANT
1	0^0 TO90^0	WCB	N-E
2	90^0 TO -180^0	180-WCB	S-E
3	180^0 TO -270^0	WCB-180^0	S-W
4	270^0 TO 360^0	360-WCB	N-W

Reduced bearing (R.B): In this system of bearing of a line is measured clockwise or anticlockwisefromnorthorsouthdirectionwhicheverisnearertothelinetowardseast or west. The concept of reduced bearing facilitates computations in traverse surveying.

Conversion of R.B in W.C.B.

Case	R.Bin quadrant	Rule ofW.C.B.	W.C.B between
1	N-E	WCB=R.B	0^0 TO90^0
2	S-E	WCB =180-R.B	90^0 TO -180^0
3	S-W	WCB =R.B+180	180^0 TO -270^0
4	N-W	WCB =360-R.B	270^0 TO 360^0

The compass may be held in hand but for better results it should be fitted at the topof tripodhavingballandsocketarrangement.Theadjustmentofacompassisdoneinthe following threesteps.

1) Centering:-Thecompassfittedoverthetripodlsliftedbodilyandplacedapproximately onthestationpegbyspreadingthelegofatripodequally,Thecentreofthecompassis checked by dropping a small piece of stone from the centre of the bottom of the compass so that it falls on the top of the station peg. A plumb bob may be used to judge the centering either bt attaching it with a hook providing at the bottom or otherwisebyholdingitbyhand.
2) Levelling:-After the compass is centred, it is leveled by means of ball and soketarrangementsothatthegraduatedcirclemayswingfreely.Itcanbecheckedroughly by placing a round pencil on the top of the compass, when the pencil does not move, thatisroughlythehorizontalposition.
3) Focusing the prism: - The prism attached is moved up and down so that grauation on thegraduatedcircleshouldbecomesharpandclear.

LOCAL ATTRACTION:

Sometimes.themagneticneedledoesnotpointtowardsmagneticNorthorSouth.The reasonbeingthattheneedlemaybeundertheinfluenceofexternalattractiveforces which are produced due to magnetic substances Thus the deflection of the needle fromitsoriginalposition,duetothepresenceofsomemagneticsubstances isknown as local attraction. To detect local attraction at a particular place, fore and back bearingofeachlinearetaken.Thendifferencecomesouttobe180°thereisnolocal attractionateitherstation.Ontheotherhandofthedifferenceisotherthan180°,the

presenceofironsubstanceneartothecompass.Ifthedifferencestillremainsthelocal attractionexistsatonorboththestations.

Elimination of Localattraction:-

1st method: - In this method, the bearing of the other lines are corrected and calculated on the basis of the a line which has the difference between its fore bearing and back bearing equal to 180°.

The magnetic of the error is formed due to local attraction by drawing a sketch of observed and correct bearing of the line at each station. The error will be negative whentheobservedbearingislessthanthecorrectedoneandthecorrectionwillbe positive and viceversa.

If however, there is no such line in which the difference of fore bearing and back bearingisequalto180°,thecorrectionshouldbemadefromthemeanvalueofthe bearing of that line in which the difference between the fore and the back bearing is theleast.

Ifthebearingsareobservedinquadrantalsystem,thecorrectionshouldbeapplied inproperdirectionbydrawinganeatsketchroughly.

2nd Method: - This method is more general as the bearing at a station locally affected may be incorrect but include angles calculated from these bearing will be correct since the amount of the error will be the same for all the bearing observed from that station. Thus starting from the unaffected line and using these included angles the correct bearing of all other lines can be calculated.

Note: - The sum of the internal included angles must be equal to (2n-4) right angles where n=number of sides of a closed traverse.

1) Fourrangingrodsarefixedatdifferentpointsi.e.A,B,C,D,Eetc.suchthatitshouldbe mutuallyvisibleandmaybemeasuredeasily.
2) Measure the distance betweenthem.
1) At point A the prismatic compass is set on the tripod Stand, centering and levelingis then properlydone.
2) TherangingrodatBisrangedthroughsightingslitsandobjectivevaneattachedwith horsehairandreadingonprismaticcompassisnoteddown.
3) itisforebearingoflineAB.Thentheprismaticcompassisfixedat Bandrangingrodat

C. AND A are sighted. And reading is taken as forbearing of BC and back bearing Of AB.

4) RepeatthesameprocedureatthestationsC,Detc.

Observation Table

Sr. no	Line	Observed bearing	Local attraction	error	Correction	Corrected bearing	Included angle
A	AB						
B	AD						
	BC						
C	BA						
	CD						
D	CB						
	DA						
	DC						

SAMPLECALCULATION:- Error=observedbearing–correctedbearing

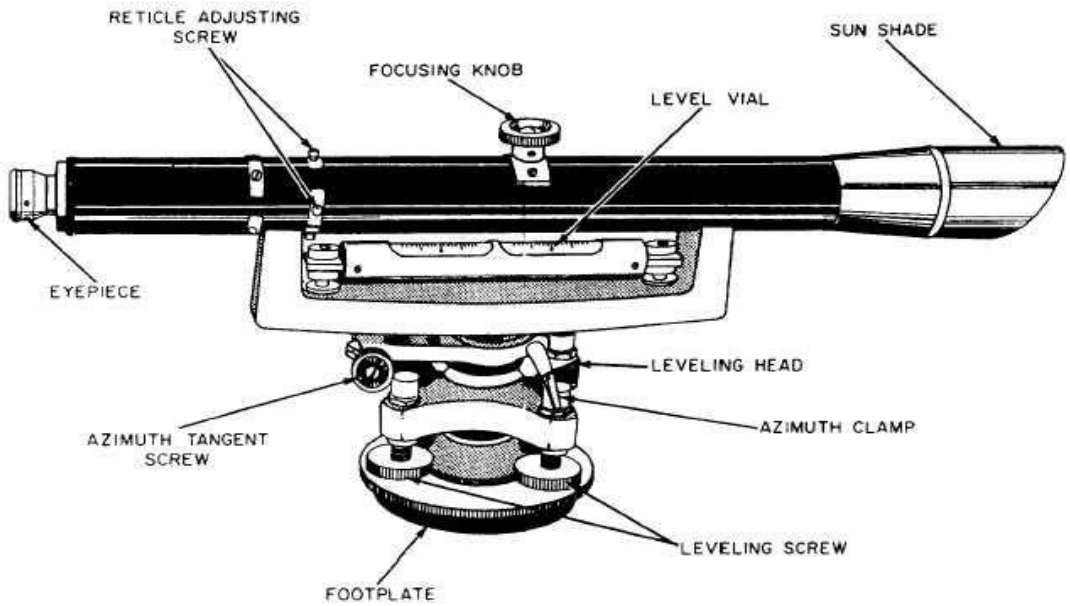
Check =(2n-4)x90^0

RESULT:Theprismaticcompassisstudiedandbearingoflinesoftraverseare Observed,the correction due to local attraction at affected station is done and corrected bearings arewrittenintabularform.

AIM: Determination of elevation of various points with Auto level by collimation plan method and rise & fall method.

APPARATUS: Auto level, leveling staff

Figure:-



Dumpy Level

THEORY:

Levelling: The art of determining and representing the relative height or elevation ofdifferentobject/pointsonthesurfaceofearthiscalledleveling.Itdealswith measurement in verticalplane.

By leveling operation, the relative position of two points is known whether thepoints are near or far off. Similarly, the point at different elevation with respect to a given datumcanbeestablishedbyleveling.

LEVELLING INSTRUMENTS:- The instrument which are directly used for leveling operationare:- Level, Levellingstaff

Level: - An instrument which is used for observing staff reading on leveling staff kept over different points after creating a line of sight is called a level.

consists of the following points:

1) LevellingHeads
2) Limbplate
3) Telescope

Telescope consists of two tubes, one slide into the other and fitted with lensanddiaphragmhavingcrosshairs.itcreatesalineofsightbywhich thereadingonthestaffistaken

The essential parts of a telescope are

1) body2)objectglass3)Eye-piece4)Diaphragm5)Rayshade6)The rackandpinionarrangement7)Focusingscrew8)Diaphragmscrew.
4) Bubbletube
5) Tripodstand

Auto level:

TheAutolevelissimple,compactandstableinstrument.Thetelescopeisrigidlyfixedto itssupports.Henceitcannotberotatedaboutits Longitudinalaxisorcannotberemoved fromitssupport.ThenameAutoisbecauseofitscompactandstableconstruction.The axis of telescope is perpendicular to the vertical axis of the level. The level tube is permanentlyplacedsothatitsaxisliesinthesameverticalplaneofthetelescopebutitis adjustablebymeansofcaptainheadnotatoneend.

Therayshadeisprovidedtoprotecttheobjectglass.Aclampandslowmotion screwareprovidedinmodernleveltocontrolthemovementofspindle, abouttheverticalaxis.Thetelescopehasmagnifyingpowerofaboutthirtydiameters. Theleveltubeisgraduatedto2mmdivisionsandithasnormallyasensitivenessof20

Focusing type.

Adjustment of the level

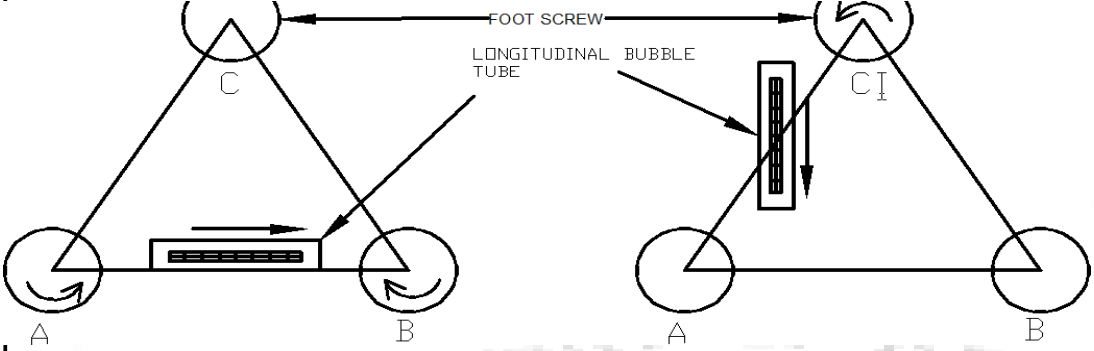
The level needs two type of adjustment

1) Temporary adjustmentand
2) Permanentadjustment

Temporary adjustments of Auto level

These adjustments are performed at each set-up the level before taking any observation.

A) Settingupthelevel:-thisincludes
    1) Fixingtheinstrumentinthetripod:-thetripodlegsarewellspreadontheground with tripod head nearly level and at convenient height. Fix up the level on the tripod.
    2) Legadjustment:-Bringallthefootscrewsofthelevelinthecentreoftheirrun.Fix any two legs firmly into the ground by pressing them with hand and move the thirdlegtolegtorightorleftuntilthemainbubbleisroughlyinthecentre.Finally thelegsisfixedaftercenteringapproximatelybothbubbles.Thisoperationwill savethetimerequiredforleveling.
B) Levelling:-Levellingisdonewiththehelpoffootscrewsandbubbles.Thepurposeof levellingistomaketheverticalaxistrulyvertical.Themethodoflevelingtheinstrument depends upon whether there are three foot screws or four foot screws. In allmodern instrumentsthreefootscrewsareprovidedandthismethodonlyisdescribed.



1) Placethetelescopeparalleltopairoffootscrews.
2) Holdthesetwofootscrewbetweenthethumbandfirstfingerofeachhandand turnthemuniformlysothatthethumbsmoveeithertowardeachotheruntilthe bubble is incentre.
3) Turnthetelescopethrough90°sothatitliesoverthethirdfootscrew.
4) Turnthisfootscrewonlyuntilthebubbleiscentred.
5) Bring the tescope back to its original position without reversing the eye piece andobjectglassends.
6) Again bring the bubble to the centre of its run and repeat these operationuntil the bubble remains in the centre of its run in both position which are at right angle to eachother.
7) Now rotate the instrument through 180°,the bubble should remain in centre providedtheinstrumentisinadjustment:ifnot,itneedspermanentadjustment.

c)Focusingtheeyepiece:-Tofocustheeyepiece,holdawhitepaperinfrontofthe objectglass,andmovetheeyepieceinoroutttillthecrosshairsaredistinctlyseen. Care should be taken that the eye piece is not wholly taken out ,some times graduationareprovidedattheeyepieceandthatonecanalwaysremberthe

eye piece.

(d)Focusingtheobjectglass:-Directthetelescopetothelevelingstaffandonlooking through the telescope, turn the focusing screw until the image appears clears and sharp. The image is thus formed inside the plane of cross hairs, Parallax,if any is removed by exact focusing. It may be noted that parallax is completely eliminated whenthereisnochangeinstaffreadingaftermovingtheeyeupanddown.

Reduced Levels

Thesystemofworkingoutthereducedlevelofthepointsfromstaffreadingtakeninthe fieldiscalledasreducedlevel(R.L)ofapointsistheelevationofthepointwithreference to the samedatum.

There are two systems of reduced levels

1) The plane of collimation system (H.I.method)
2) TheRiseandfallsystem

1) The plane of collimation system (H.I.method)

Inthissystem,theR.L.ofplaneofcollimation(H.I)isfoundoutforeveryset-upofthe level and then the reduced levels of the points are worked out with therespective planeofcollimationasdescribedbelow.

1) Determine the R.L. of plane of collimation for the first set up of the level by addingB.S.totheR.L.ofB.M.i.e(R.Lofplaneofcollimation=R.L.ofB.M.+B.S.)
2) Obtained the R.L. of the intermediate points and first change point by subtractingthestaffreadings(I.S.andF.S.fromtheR.L.ofplaneofcollimation (H.I).(R.L.ofapoint=R.LofplaneofcollimationH.I.-I.SorF.S)

collimationisdeterminedbyadditionofB.S.totheR.Lofchangepoint.Thusthe levels from two set-ups of the instruments can be correlated by means of B.S. andF.S.takenonC.P.

4) Find out the R.L.s of the successive points and the second C.P. by subtracting theirstaffreadingsfromthisplaneofcollimationR.L.

5) RepeattheprocedureuntilalltheR.Lsareworkedout.

Observation table:-

Station	Reading			R.L. of plane collimation (H.I)	Reduced Level	Remarks
	B.S	I.S	F.S			

Arithmetical check: The difference between the sum of the back sights and the sum of the fore sights should be equal to the difference between the last and first reduced levels.

i.e ∑B.S - ∑ F.S.= LAST R.L –FIRST R.L

2) TheRiseandfallsystem

In this system, there is no need to determine R.L. of plane of collimation .The difference of level between consecutive points are obtained as described below.

1) Determine the difference in staff readings between the consecutive point comparingeachpointafterthefirstwiththatimmediatelyproceedingit.

the staff reading at the point is smaller or greater than that of proceeding point.

3) Find out the reduced level of each point by adding the rise to or subtracting fall from the R.L. of a proceeding point.

Observation table:-

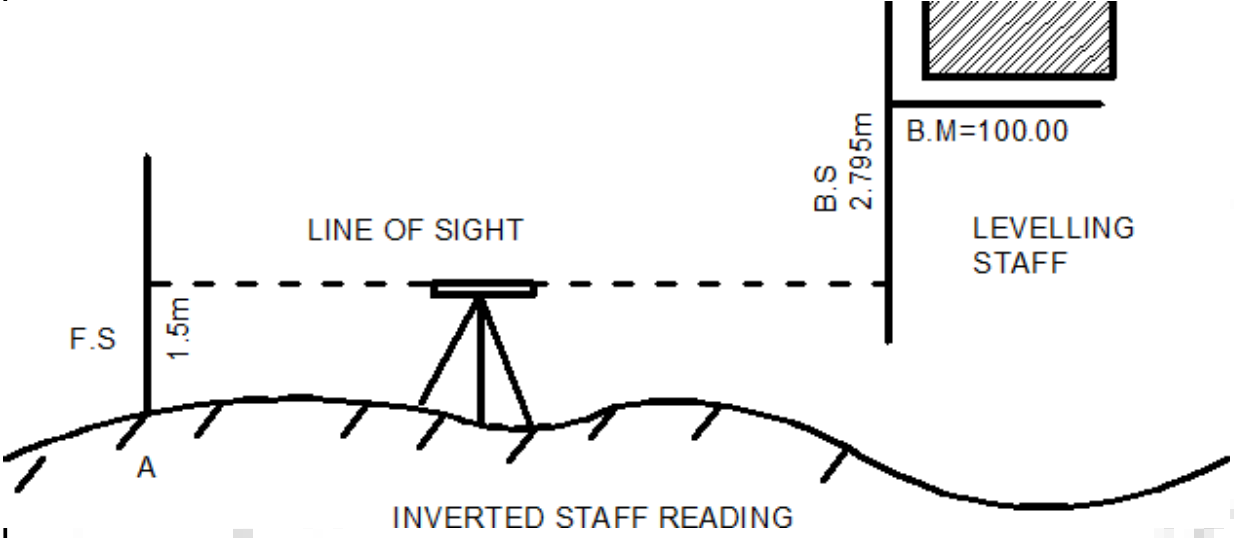
Station	Reading			Rise	Fall	Reduced Level	Remarks
	B.S	I.S	F.S				

Arithmetic check:- The difference between the sum of back sight and the sum of fore sight= difference between the sum of rise and the sum of fall = the difference between the last R.L. and the first R.L.

∑B.S-∑F.S =∑RISE -∑FALL =LAST RL- FIRST RL

Inverted staff reading

WhentheB.MofstaffstationisabovethelineofcollimationorlineofsightthestaffisheldinvertedonthepointandreadingistakenThisreadingbeingnegativeisenteredinthelevelfieldbookwithminussignortoavoidconfusionStaffinvertedshouldbewritteninthereamrkscolumnagainsttheentryofthereading.



The results are tabulated as below:

B.S.	I.S	F.S	H.I	R.L	Remarks
-2.795		1.500	97.215	100.000 95.715	B.M.Staffi nverted Point A

Whenthereadingontheinvertedstaffisaforesightorintermediatesight.itshouldalso berecordedinfieldbookwithminussign

The R.L. of such points may be worked at as:

R.L.of the point (where the inverted staff is held)

=R.L.ofH.I+F.S.orI.S.reading

RESULT:

The various reduced levels are calculated by rise and fall method and by using height or plane pf collimation method and are shown in observation table.

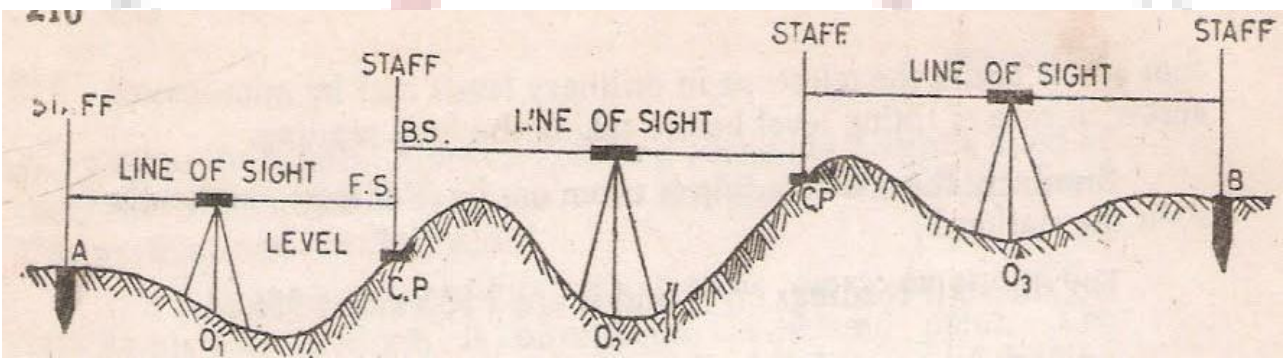
AIM :Fixingbenchmarkwithrespecttotemporarybenchmarkwith Autolevelbyfly leveling and checkleveling.

Apparatus: Auto level, leveling staff, tripod stand, arrows, pegs

Theory:

Fly leveling: - It is a very approximate from of levelling in which distances are not measuredandsightsaretakenaslargeaspossible.inthismethodalineoflevelsisrun todetermineapproximatelyreducedlevelsofthepointscarriedoutwithmorerapidly and lessprecision.

Checkleveling:Themainpurposeofthistypeoflevelingistocheckthevaluesofthe reduced levels of the bench marks already fixed. In this method only back sight and foresightaretaken.Thereisnoneedofintermediatesights.Howevergreatcarehasto be taken for selecting the change points and for taking reading on the change points becausetheaccuracyoflevelingdependsuponthese.



1) LetAandBthetwopointsasshowninfigureTheyaretooforapart.Thepositionof each set up of level should be so selected that the staff kept on the two points is visible through thetelescope.

2) LetO1,O2,O3bethepositionsoftheleveltobesetup.Choosethechangepoints 1,2 etc. on a stable ground so that the position of the level should be midway between thetwostaffreadingtoavoiderrorduetoimperfectadjustmentofthelevel.

3) Now setup the level at O1 take the reading on the staff kept vertically on A with bubblecentral.ThiswillbeabacksightandR.LoftheAisistoassumedorsayknown. Recordthesevaluesinthesamelineinthelevelbook.

4) Now select the position of C.P (1) so that the distance of it from O1 is approximately equal to thatO1A

5) With the bubble in the centre take the reading of the staff held vertically over the changepoint.Thiswillbeaforesightandbookthisvalueinthelevelbookonthenext line in the columnprovided.

6) Now shift the level to O2 and set up it there carefully, with the bubble in the centre takereadingonthestaffkeptverticallyastheforesightoverC.P(1).Thiswillbeaback sight, book it in the same line as the fore sight already recorded in the column provided.

7) Select another CP(2) on the stable ground as before so that station O2 is approximatelymidwaybetweenC.P(1)andC.P(2).

8) Withthebubblecentral,takethereadingonthestaffkeptverticallyovertheCP2.This willbeforesightandbookitinthelevelbookpageinnextline.

9) Repeattheprocessuntilthepoint B.Mreached.Thelastreadingwillbeaforesight

method.

11)Complete the remakes column also. Apply the arithmetical check

Observation table:-

Station	Readings		Heightofinstrument	Reduced Levels	Remarks
A	B.S.	F.S			
B					
C					
D					
E					

RESULT:ThedifferenceoflevelbetweenthepointbeequaltoR.LofthelastpointminustheR.L attheB.Misfoundtobe------

AIM:L-Sectionandcrosssectionoftheroad(onefullsizedrawingsheeteachforL-section and crosssection)

APPARATUS: Auto level, leveling staff, ranging rod, tape etc.

THEORY:

Profile leveling: The process of determining elevations at points at short measured intervals along a fixed line is called Longitudinal or profile leveling.

Crosssectioning:ItisamethodoflevelingtoknowthenatureofGroundoneitherside of the centerline of the proposed route. Levels are taken at right angles to the proposed Direction of the road end at suitable distances and leveling is carried out along this crossSection.

During location and construction of highways, Rail tracks sewers and canals strakesorothermarksareplacedatvariousalignedpointsandtheundulationofthe groundsurfacealongapredeterminedlineisadjoined.Thelineofsectionmaybe

A single straight lines changing directions.

Levels are taken at right angles to the proposed Direction of the road end at suitabledistancesandlevelingiscarriedoutalongthiscrosssection.Crosssectionare the sections run at right Angles to the centerline and on the either side of it for the purpose They are taken at each 10,m station on the centerline. The length of Cross section depends upon the nature of the work if cross sections are Short they are set square out by edge. If long they are set out by the Optical square, box sextant or theodolite.

simultaneouslywiththelongitudinalsectiontheymaybetakenatthehandlevel,level, abney level ortheodolite

PROCEDURE:

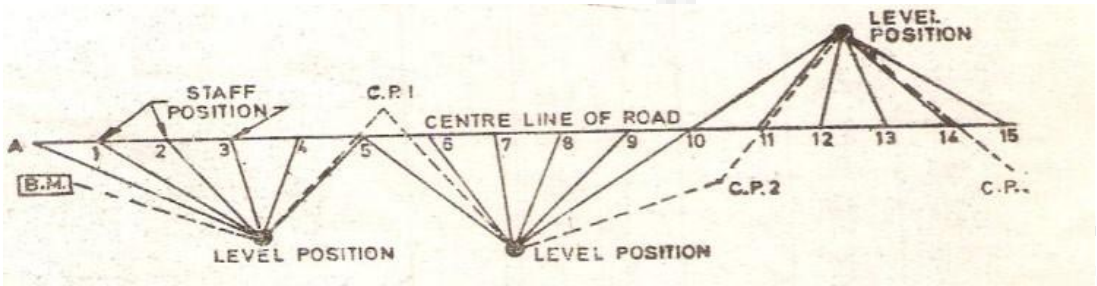
Let ABC be the line of section set out on the ground and marked with pegs driven at equalinterval(say20mto30m)asinthefigure.Thelevelissetupgenerallyononeside of the profile to avoid too short sight on the points near the instrument and care is taken to set up the level approximately midway between two change points. The levelingisstratedfromthebenchmarkofknownvalue.Fromeachsetupstaffreading are taken on pegs already fixed at the desired interval and also at significant points where abrout changes of slope etc. occur. All these readings are recorded as intermediate slight against the respective chainages along the line in the level book. Otherdataofthelevelbookisalsofilledupbeforestartingthework.Whenthelength ofsightisbeyondthepowerofthetelescope(usuallyitis100m),theforesightonthe change point is taken. The level is then isthen shifted and setup in an advanced positionandabacksightistakenonthechangepoint.Thechangepointmayormay notlieinthelineofsection.Chainingandreadingarethencontinuedasbefore,tillthe wholelineofsectioniscompleted.

Theworkistobecheckedintheprogressoflevelingbytakingreadingonotherbench marks,onthewayoronbenchmarksfixedbydifferentialleveling.

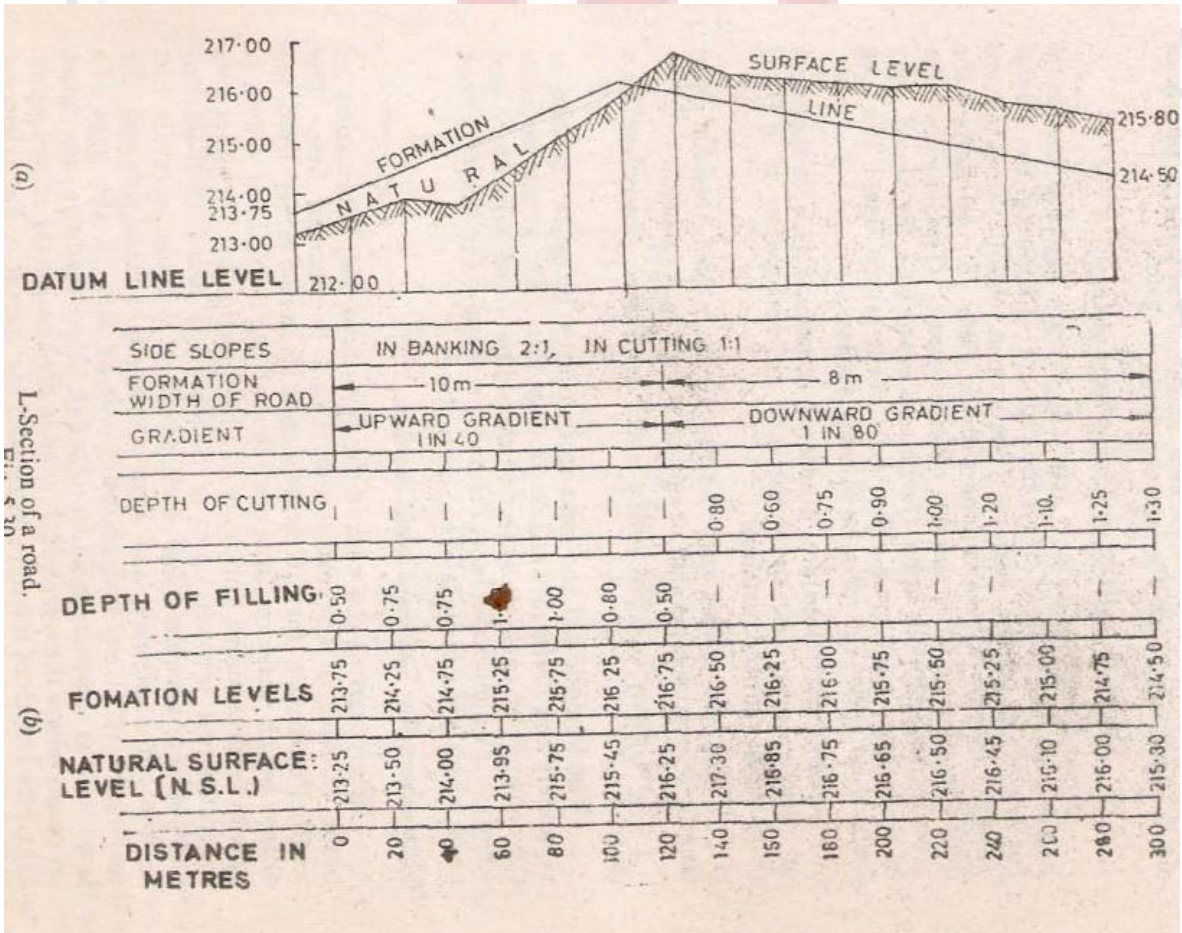
The fore and back bearing of the section line should betaken and recorded. Next sketchesofthebenchmark,changepoints,andotherfeaturesuchasnallah,aroad,

column of the level-book.

The procedure and corresponding reading and values are represented on the page ofalevel-bookforapartofroadproject.



PlottingtheLongitudinalsection

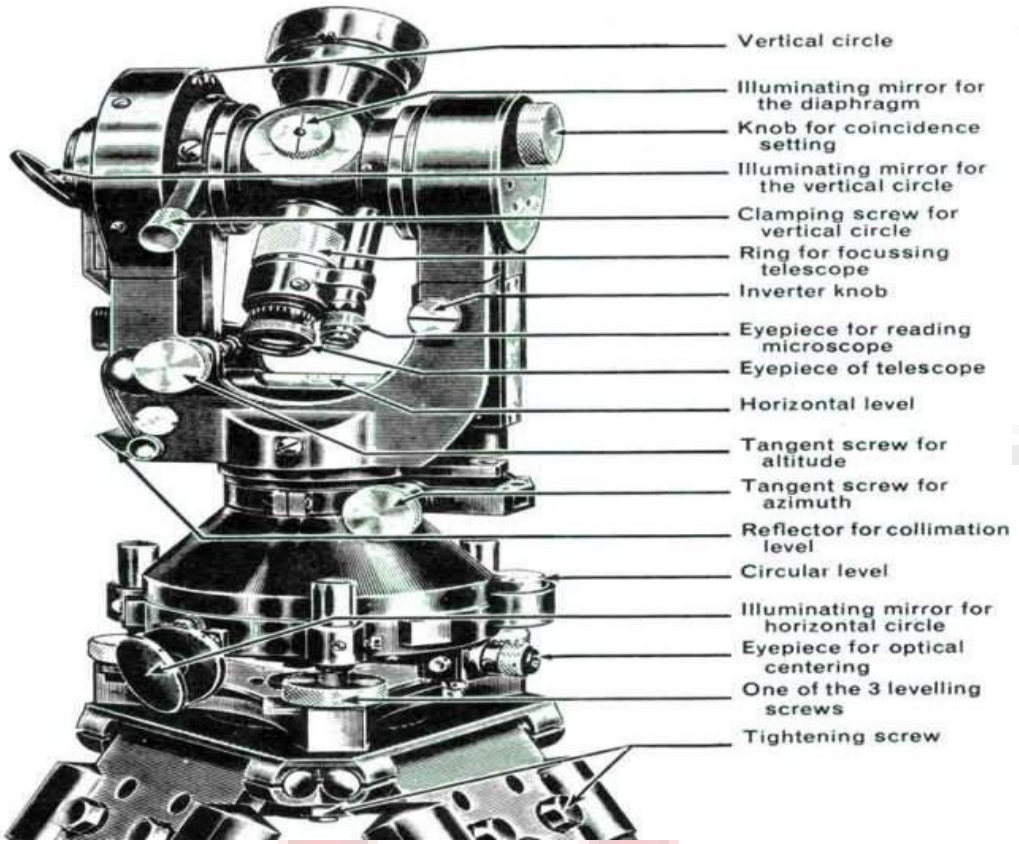


When ever leveling operation is carried out the staff reading taken in the field are enteredinthenotebookcalledaLevel-Book.Eachpageofithasthefollowing columnswhichhelpinbookingofreadingandreductionoflevels.

Page of Level-Book

Page of Level-Book										
Name of work survey for:-									Page No:-	
Levellingfrom ..... To										
InstrumentNo							Conducted by:-			
Station	Distance In meters	Bearings		Staff Reading			Height of Instrument or		Reduced Level	Remarks
		FORE	BACK	Back (B.S)	Inter (I.S)	Fore (F.S)	Rise	Fall		

AIM :Measurementofhorizontalanglestheodolitebymethodofrepetition
APPARATUS:-Theodolite,Rangingrod,pegsetc.
Figure:



TRANSIT THEODOLITE

THEORY :

Theodolite : The theodolite is the most intricate and accurate instrument used for measurement of horizontal and vertical angles. It consists of telescope by means of whichdistantobjectscanbesighted.Thetelescopehastwodistinctmotionsoninthe horizontalplaneandtheOtherintheverticalplane.Theformerbeingmeasuredona graduatedHorizontalverticalcircleoftwoverniear.

Theodolite are primarily classified as

2) Non-transit theodolite

A theodolite is called transit theodolite when its telescope can be resolved through a complete revolution about its horizontal axis. In a vertical plane. The transit type is largely used.

Various parts of transit theodolite

1) Telescope:itisanintegralpartandismountedonthespindleknownashorizontal axisorturnonaxis.Telescopeiseitherinternalorexternalfocusingtype.
2) The leveling head: It may consists of circular plates called as upper and lower Parallel plates. The lower parallel plate has a central aperture through which a plumbbobmaybesuspended.Theupperparallelplateortribranchissupportedby meansoffourorthreelevelingscrewsbywhichtheinstrumentmaybeleveled.
3) Tolowerplateorscrewplate:Itcarrieshorizontalcircleatitsleveledscrew.

It carries a lower clamp screw and tangent screw with the help of which it can be fixed accurately in any desired position.

4) Theupperplateorvernierplate:-itisattachedtoinneraxisandcarriestwovernier and at two extremities diametricallyopposite.
5) Compass: the compass box may be either of circular form or of a rough type. The former is mounted on the vernier plate between the standards while the latter is attached to the underside of the scale or lower plate or screwed to one of the standards. Modern theodolite is fitted with a compass of the tubular type and it is screwedtooneofthestandards.
6) Verticalcircle:theverticalcircleisrigidlyattachedtothetelescopeand

moves with it. It is silvered and it is usually divided into four quadrants.

vernierriestwooftheextremitiesofits horizontal arms or limbs called tthetelescopeinfrontoftheverticalaxis.Itcarhe index arm. The vertical leg called the clip or clipping screws at its lower extremity. The index arm and the clipping arm are together known asT-frame.

8)Plumbbob:Tocentretheinstrumentexactlyoverastationmark,aplumbbob issuspendedfromthehookfittedtothebottomofthecentralverticalaxis.

Repetition method of measuring Horizontal angles

Whenitisrequiredtomeasurehorizontalangleswithgreataccuracyasinthecaseof traverse,themethodofrepetitionmaybeadopted.Inthismethodthesameangleis added several times by keeping the vernier to remain clamped each time at the end ofeachmeasurementinsteadofsettingitbacktozerowhensightingatthepreviousstation. The corrected horizontal angle is then obtained by dividing the final reading by the number of repetitions. Usually six reading, three with face left and three with faceright,aretakenTheaveragehorizontalangleisthencalculated.

Procedure:-

1) LetLOMisthehorizontalangletobemeasuredasshowninfig.Oisthestationpoint fixed on the ground by a peg. Set up the theodolite over the peg 'o' and level it accurately.
2) Set the horizontal graduated circle vernier A to read zero or 360° by upper clamp screw and slow motion screw. Clamp the telescope to bisect the bottom shoe of the flag fixed at point 'L' and tighten the lower clamp. Exactly intersect the centre ofthe

theodolite should be left and the telescope in normal position.

3) Check the reading of the vernier A to see that no slip has occurred .Also see thatthe platelevelsareinthecentreoftheirrun.ReadthevernierBalso.
4) Release the upper clamp screw and turn the theodolite clockwise. Biset the flag bottom shoe fixed at point M by a telescope. Tighten the upper clamp screw and bisecttheshoeexactlybymeansofupperslowmotionscrew.
5) Notethereadingonboththeverniertogettheapproximatevalueoftheangle LOM.
6) Releasethelowerclampscrewandrotatethetheodoliteanticlockwiseaiazimuth.

Bisect again the bottom shoe of the flag at 'L' and tighten the lower clamp screw. By means of slow motion screw bisect exactly the centre of the shoe.

7) Release now the upper clamp screw and rotate the theodolite clockwise. Bisect the bottom shoe of the flag fixed at M and tighten the upper clamp screw. By means of slowmotionscrewbisectexactlythecentreoftheshoe.Thevernierreadingswillbw nowtwicetheoftheangles.
8) Repeat the process until the angle is repeated the required number of times (usually 3).Add360°foreverycompleterevaluationtothefinalreadinganddividedthetotal anglebynumberofrepetitionstogetthevalueofangleLOM.
9) Change the face of the theodolite the telescope will now be inverted. Rrpeat the wholeprocessexactlyintheabovemannerandobtainvalueofangleLOM.
10) The average horizontal angle is then obtained by taking the average of the two anglesobtainedwithfaceleftandfaceright.
11) Usuallythreerepetitionsfaceleftandthreewithfacerightshouldbetakenandthe

mean angle should becalculated.

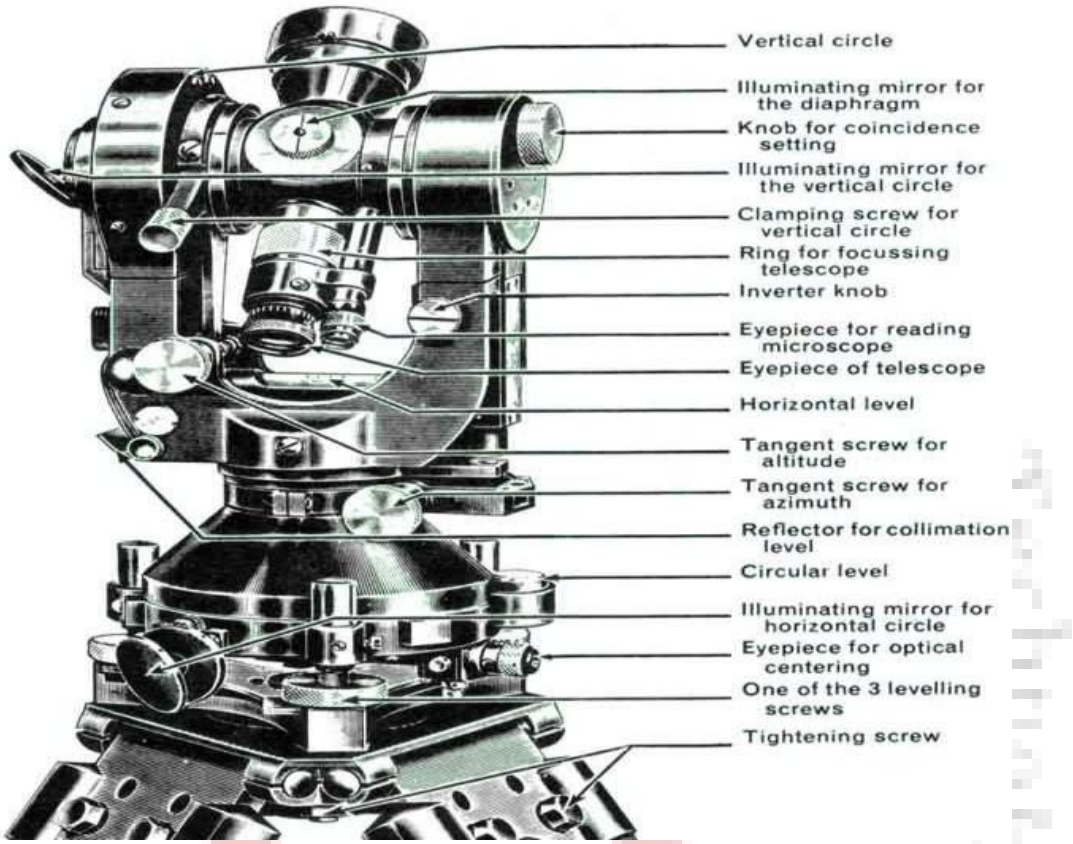
S.N.	Instrument Station	Shifted to	Face left readings			
		VenierA 0,I,II	Venier B 0,I,II	Total angle	No of Repetition	Mean horizontal angle 0,I,II
	o	L				
		M				
		L				
		M				
		L				
		M				

S.N.	Instrument Station	Shifted to	Face Right readings				
		VenierA 0,I,II	VenierB 0,I,II	Total angle 0,I,II	No of Repatition	Mean horizontal angle 0,I,II	Average horizontal angle 0,I,II
	o	L					
		M					
		L					
		M					
		L					
		M			3		

RESULT: Average horizontal angle is found to be ----------

EXPERIMENT NO- 10

AIM:MeasurementofverticalAngleswithTheodolite
APPARATUS:-Theodolite,threerangingrods,



THEORY: Theodolite is an instrument designed for the measurement of horizontal and vertical angle. It is most precise method it is also used for laying of horizontal angles Locatingpointsonlineprolongingthesurveylineestablishingthegradient,determination of difference in the elevation setting out curve .Theodolite are of two types transit and nontransit.Transittheodoliteiscommonlyusednowadays.intransittheodolitetelescope can be revolved a complete revolution about its horizontal axis in a vertical plane. a transittheodoliteconsistsofessentialpart.

tripod. The head comprises of two parts

a) Alevelingfootscrewsforlevelingtheinstrumenti.e.formarkingverticalaxistruly vertical.

b) A movable head or centering arrangement for centering the vertical axis accuratelyoverastationpoint.

2) A lower level circular horizontal metal plate: It carries a circular graduated arc . The lower plate is attached to a vertical metal spindle (outer axis) which works in vertical bearing and a form a part of leveling head. It may be graduated in degree and half degree or a degree 1/3 of degrees .the upper plate carries an index and vernier or micrometer towards fine reading on gradated horizontal circle .the upper plate carries standard use of for supporting the telescope and the spirit level used for leveling the instrument.

3) Atelescope:Thetelescopeispivotedbetweenthestandardatrightanglestothe horizontal axis .It can be rotated about its horizontal axis in a vertical plane. The telescopeisprovidedwiththefocusingscrew,Clampingscrewandtangentscrew.

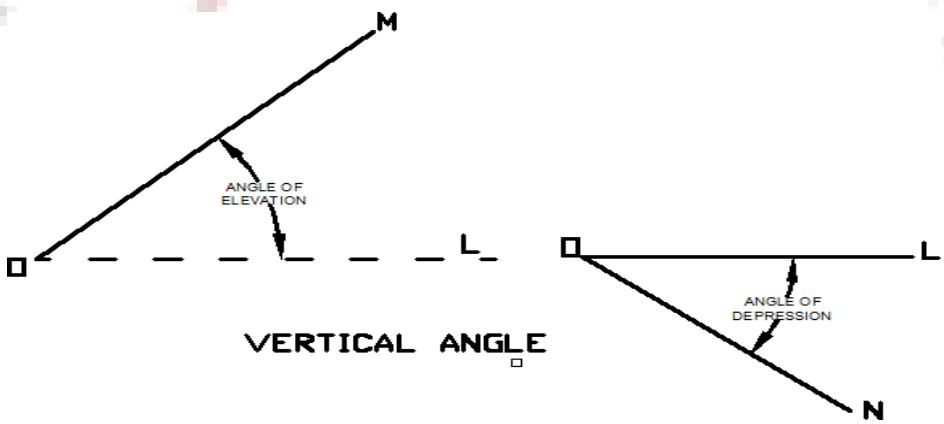
4) Acirculargraduatedarecarriedonverticalcircle:Itisattachedtothehorizontalaxis of the telescope, it is usually divided into 4 quadrants, but in some instruments it is graduatedcontinuouslyfrom0-360^0.thegraduationineachquadrantarenumberedfrom 0-90^{0}inoppositedirection.Thesubdivisionsofverticalcirclearesimilartothoseofvertical circle.

MESURMENT OF VERTICALANGLE

Averticalangleistheanglebetweentheinclinedlineofsighttoanobjectandthe horizontal.Itmaybeanangleofelevationoronangleofdepressionaccordingasthe

instrument.Tomeasureangleofelevationordepressionlomshowninfig.proceedas follows:

1) Setupthetheodoliteatstationpointoandlevelitaccuratelywithreferencetothe altitudelevel.
2) Set vertical verniers C and D exactly to zero by using the vertical circle clamp and tangentscrew,whilethealtitudelevelshouldremaininthecentreofitsrun.Alsothe faceofthetheodoliteshouldbeleft.
3) Releasetheverticalcircleclampscrewandrotatethetelescopeinverticalplaneso astobisectttheobjectM.tightenthevertical circleclampandexactlybisectthe objectbyslowmotionscrew.
4) Read both verniers C and D. the mean of the tow readings gives the value of the requiredangle.
5) Similar observation may be made with other face. The average of the tow values thus obtained gives the value of the required angle which is free from instrumental errors.
6) Similarlytheangleofdepressioncanbemeasuredfollowingtheabovesteps.



VERTICAL ANGLE

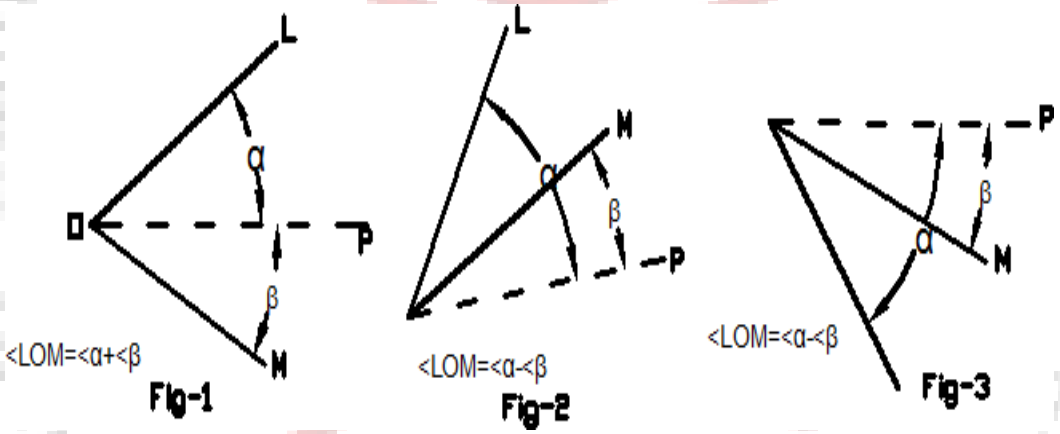
To measure the vertical angle between two points L and M

SometimesitisrequiredtomeasureverticalanglebetweentwopointsLandM.There can be threepossibilities.

(a) One point is above the line of sight and the other is below the line of sight then angleLOMasshowninfigwillbeequalto(<α+<β)

(b) Boththepointsareabovethelineofsight.ThentheangleLOM=<α-<β (Refer Fig2)

(c) Boththepointsarebelowthelineofsight,thentheangleLOM=<α-<β(ReferFig3)



To measure the angle between two points L and M proceed as follows

1) SetthetheodoliteatstationpointOandaccuratelylevelit.
2) Bisect the flag at L as explained already and take the reading on the verniers C andD.Calculatethemeanangle.
3) Bisect the flag at M as before and take the reading on the verniers C and D. Calculate the meanangle.

between points L and M as shown in the figure (4)

Observation table:-

S.N.	Instrument Station	Sighted to	Face left readings			
			VenierC 0,I,II	VenierD 0,I,II	Mean Angle	Vertical Angle
	o	P				
	(+ve)	L				
	(-ve)	M				

S.N.	Instrument Station	Sighted to	Face Right readings				Average Vertical Angle 0,I,II	Remarks
			VenierC 0,I,II	VenierD 0,I,II	Mean Angle 0,I,II	Vertical Angle 0,I,II		
	o	P						
	(+ve)	L						
	(-ve)	M						

Result:Theaveragevalueofverticalisfoundtobe ---------- --.

AIM:Determinationofhorizontaldistancebetweentwoinaccessiblepointswiththeodolite

APPARATUS:-Theodolite,threerangingrods

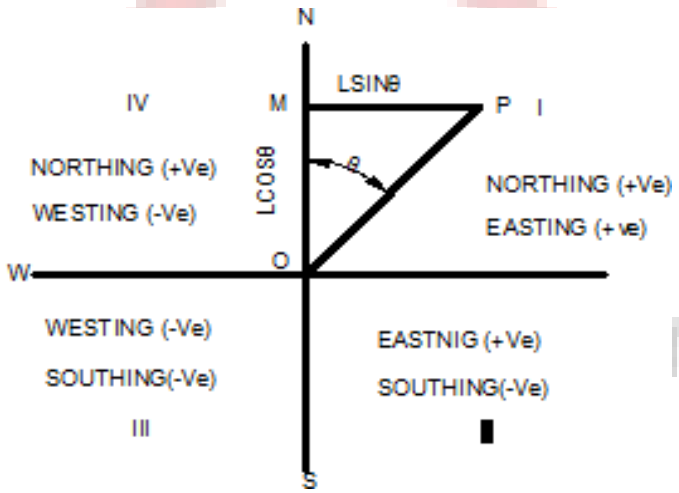
Theory: - Traversecomputation

The latitude of the line may defined as the distance measured parallel to an assumed meridian direction (i.e true meridian, magnetic meridian or any other reference direction).

The departure of a line may defined as the distance measured parallel to line perpendicular to the meridian.

The latitude (L) of a line is positive (+ve) when measured northward or upward and is termedasNorthing,thelatitudeofaline(-ve)whenmeasuredsouthwardordownwardand termed assouthing

Similarlythedeparture(D)ofalineispositive(+ve)whenmeasuredEastwardortothe right and is known as Easting. The departure of a line is negative (-ve) when measured Westward ortoleft and is knownas Westing



Refer to fig suppose the length of the line OP=L and bearing of the line θ, then

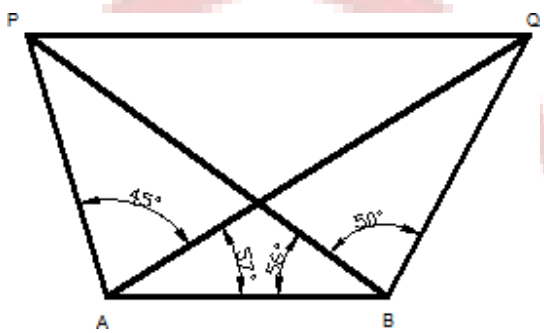
Departure of the line =lsinθ

Thus to find the latitude and departure of the line ,it is essential to convert the bearing (W.C.B)toreducebearing (R.B);becausethesignoflatitudeanddeparturedependsupon the reduced bearing i.e the first letter N or S determine the sign of the latitude and E or W determinethesignofthedeparture.

.The following table gives the sign of latitude and departure.

S.N.	Whole Circle Barings (W.C.B)	Reduced Bearing	Sign of		Quadrant
			Latitude	Departure	
1	0° to 90°	NθE	+	-	I
2	90°to180°	SθE	-	+	II
3	180° to 270°	SθW	-	-	III
4	270° to 360°	NθW	+	-	IV

Problem:-thedistancebetweentwoinaccessiblepointsPandQ,thetheodoliteissetup attwostationsA&B1000mapartandthefollowingangleswereobserved.;



<PAQ=45°;<PAQ=57°;<PBA=50°;<PBQ=50°,ThedistanceoftwoinaccessiblepointPQis calculatedby

ItisclearthatlinesPA,AB,BQ,andQPfromclosedtraverse.Thelatitudeanddepatureof linesPA,ABandBQcanbedeterminebycalculatingtheirlengthandbearingfirst.

<ABP =56°

<BPA=180°-(102°+56°) =22°

Hence, from sinerule

$$\frac{PA}{\sin PBA} = \frac{AB}{\sin BPA}$$

$$PA = \frac{1000 \times \sin 56^o}{\sin 22^o} = 2213m$$

Similarly,ΔQAB

<QAB =57°

<QBA =106°

<AQB=180°-(57°+106°) =17°

Now ,

$$\frac{BQ}{\sin 57^o} = \frac{AB}{\sin 17^o}$$

$$BQ = \frac{1000 \times \sin 57^o}{\sin 17^o} = 2869m$$

Hence.thebearingofvarioussidesarenotgivenbyassuminganyline(say,linePA)asthe reference meridian, the bearing of other lines can be calculated by the given angles as follows:

Bearing of the line =0° Add =180°
Bearing of line AP= 180°
Add<PAB =102°
BearingofthelineAB=282°
Deduct =180°
Bearing of line BA=102°
Add<QBA =106°
Bearing of line BQ =208°
R.B. of line PA= N 0° E

R.B. of line BQ= S28° W

The latitudes and departure (or consecutive coordinates) can be calculated as given below;

S.No.	Line	Length (m)	R.B.	Latitude L	Departure D
1	PA	2213	N 0° E	+2213.0	+0.0
2	AB	1000	N 78° W	+207.9	-978.1
3	BQ	2869	S28° W	-2531.0	-2325.1
			Total	-110.1	-2325.1

Result:-LengthoflinePQ= $\sqrt{(\sum L)^2+(\sum D)^2} = \sqrt{(-110.1)^2+(2325.1)^2}$

=2328m

EXPERIMENT NO- 11

AIM:Locatinggivenbuildingbytheodolitetraversing(Onefullsizedrawingsheet)

APPARATUS:-Theodolite,threerangingrods

THEORY: Theodolite Traversing:

Atraversesurveyisoneinwhichtheframeworkconsistsofaseriesofconnectedlines, the lengths and direction of which are measured with the help of tape or chain and an angle measuringinstrument.

When the lines from a circuit which ends at the starting point, the survey is termed a closed traverse, if the circuit does not close, the traverse os known as open one.

The closed traverse is suitable for wide areas and for locating the boundaries of the lakes,woodetc.,whereanopentraverseiscarriedoutintheoflongstripsofcountryasin thecaseofcanal,road,railwayetc.

In theodolite traversing, theodolite is used for measurement of angles or tape orchain, preferable,steeltapeisusedforlinearmeasurement.Thismethodisappliedforaccurate and precisesurvey.

Method of traversing

Themethodofmeasuringtheangleandbearingofatraversemaybedividedintoclasses:

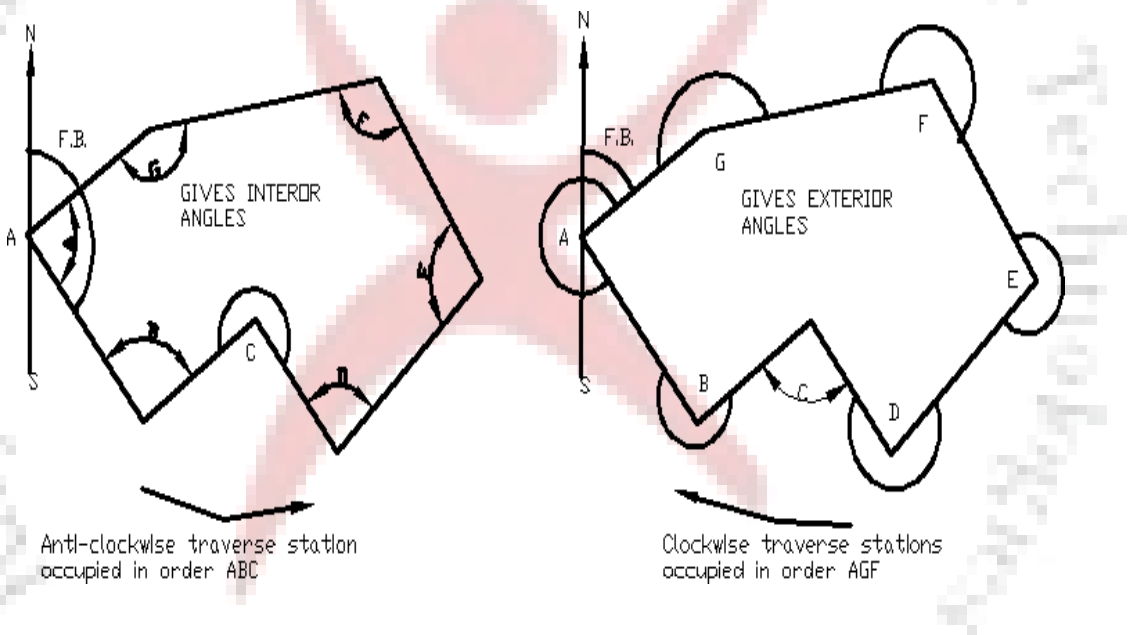
a) Those in which the angle at different stations are measured directly and the bearing subsequently calculated from the measured angles and the givenbearing of an initialline
b) Bydirectobservationofbearingofdifferentsurveylinesbyatheodolite.

A) theodoliteTraversingbyDirectObservationofAngle:-Inthismethod,horizontalangles measuredatdifferentstationsmaybeeither,

ii. Defection Angle

1) Traversingbythemethodofincludedangles:-

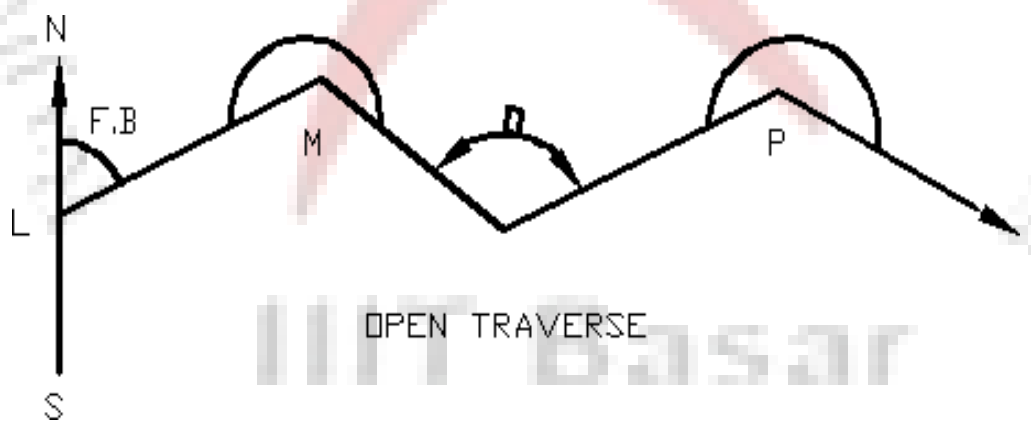
In a closed traverse included angles can be measured by running a traverse in clockwise or counterclockwise direction. The common practice is to run a closed traverse in counterclockwise direction, but it is well to adhere to a regularofroutineofmeasuringangles.Generallyinterioranglesareobtainedit the traverse is run anticlockwise and exterior ones when it is run clockwise as shown in the fig1&2.



The angle may be measured by the repetition method and the observation shouldbetakenwithboththefacesandalsobyreadingboththeverniers.Then averaging the value of each angle should be calculated. It will ensure desired degreeofaccuracyandremovalofmostoftheinstrumentalerrors.

Procedure:-InrunningatraverseABCDEFGasshowninfigure,setupthethedolite over the station A and level it accurately . Observe the magnetic bearing at the line AB and measure the included angle GAB as usual. Shift the theodolite to each of the successivestationsB,C,D,E----(inanticlockwisedirection)andrepeattheprocessto measureeachoftheangleABC,BCD,CDEetc.Alsomeasurethelengthofthelines AB, BC, CD and so on by means of a steel tape if possible and take necessary offsets to locatedifferentdetailsoneachofthesurveyline.Thewholeworkshouldberecorded carefullyinthefieldnotebook.

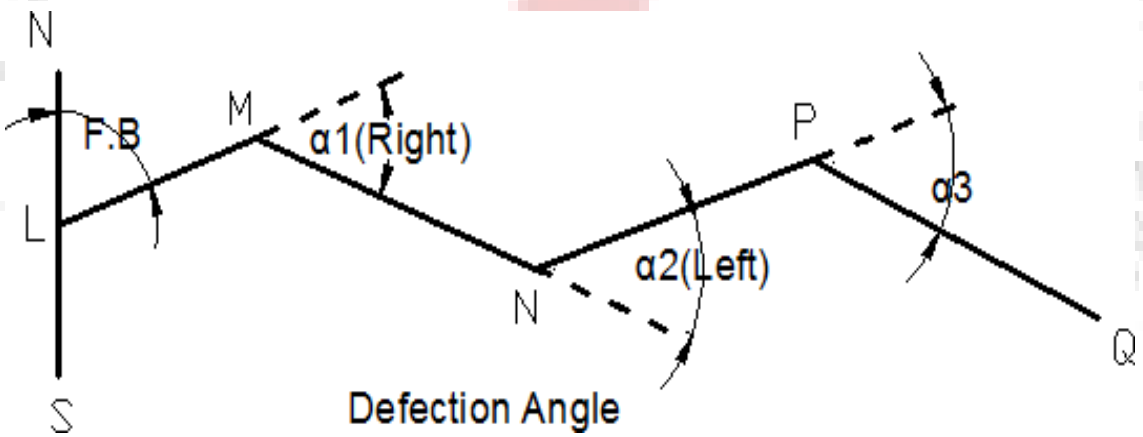
In open traverse say LMOP as shown in Fig. the theodolite is setup at strating stationLandforebearingoflineLMistaken.ThetheodoliteisthenshiftedM,Oandthe direct angles such as LMO,MOP---- are measured in the forward direction. Length of each line is measured and necessary offsets are taken to locate different details on eachofthesurveyline.



OPEN TRAVERSE

Thismethodoftraversingismoresuitableinsurveysforrailway,roads,pipeline etc.inwhichaseriesoftraverselinesmaymakesmalldeflectionangleswitheach other.

In measuring deflection angles having observed the bearing at the starting station 'L' Set the theodolite at each of station such as M,N,O,Q. Bisect the back stationsusinglowerclampanditstangentscrew.Theverniermaybesettozeroor theinitialreadingmaybetaken.Thetheodoliteistransitedandtheforwardstation is bisected with upper clamp screw and the tangent screw. The verniers areagain read, the difference between the first set of reading and the second gives the angleofdefection.Themeasurementiseitherrightorlefthandedandthisdirection must be most carefully noted in the field book. Chaining is done in the usual manner.



Traverse computation are usually are done in the tabular from the most commonly used tabular from is known as Gale's traverse table.

The steps followed are as under for computing the table.

1) Findoutthesumofalltheobserved,interiororexteriorangleitshouldbe(2n+4)right anglewheren=numberofsidesoftraverse.
2) Ifthesumisnotequalto(2n+4)rightanglesforexteriororinterioranglesapplythe necessarycorrectiontoalltheanglesothatthesumofthecorrectedanglesshould beexactlyequalto(2n±4)rightangles.
3) Findoutthewholecirclebearing(W.C.B)ofallotherlinesfromtheobservedbearing ofthefirstlineandthecorrectedincludedangles.

As a check the calculated bearing of the first line must be equal to observed bearing.

4) Convert the whole circle bearing to the reduced bearings and determine the quadrant in which theylie.
5) Calculate the latitude and departure of each line from the known length and the reducedbearingofthelines.
6) Find out the sum of all northings and also of southings similarly of eastings and westings.Determinethedifference ifanybetweennorthingsandsouthings,alsoin eastings andwestings.
7) Apply the necessary correction as per calculations to the latitudes and departures ofeachlines,sothatthesumofnorthingsmustbeequaltosumofsouthings,also eastings andwestings

ordinatesoftheline,sothattheyallarepositive,thewholeofthetraversethuslying

inthefirstquadranti.eNorth-Eastquadrant.

Gale's Traverse Table is shown in table

Table:- GALE'S TRAVERSE TABLE

1	2	3	4	5	6	7	8	9	10	11				12				13				14	
Inst. Stn	Angles	Correction	CorrectedAngles	Consecutive Co- ordinates W.C.Bearing	ReduceBearings	Quadrant	Line	Length	Point	Dep				Correction				Corrected Consecutive Co- ordinates				Independent Co- ordinates	
										Northings(+ve)	Southings(-ve)	Eastings(+ve)	Westings(-ve)	Northings(+ve)	Southings(-ve)	Eastings(+ve)	Westings(-ve)	Northings(+ve)	Southings(-ve)	Eastings(+ve)	Westings(-ve)	Northings(+ve)	Eastings(+ve)
Lat																							

Result: - 1) Closing Error =√(∑L)2+(∑D)2

2) Reducedbearing(θ)oftheclosingerror=Tan^{-1}∑D/∑L

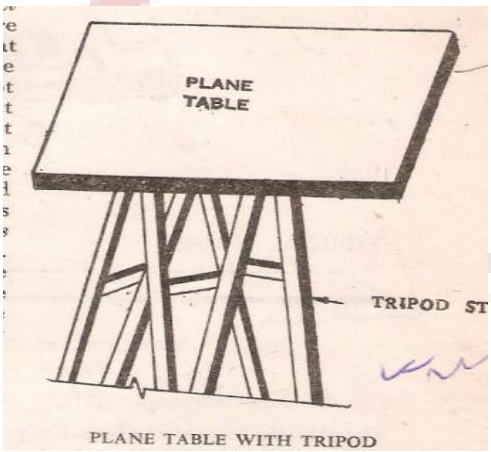
AIM: Locating given building by plane table surveying (One full size drawing sheet) .

APPARATUS: 1) ThePlanetable withtripod,2)Alidade,3)Troughcompass4)Spritlevel,5) PlumbingforkorU-frame,6)Plumbbob,7)Tape,chain,pegs,rangingrods,woodenmalletetc.

THEORY:

Planetablesurveying:thesystemofsurveyinginwhichfieldobservationandplotting worki.e.botharedonesimultaneouslyiscalledplanetablesurveying.

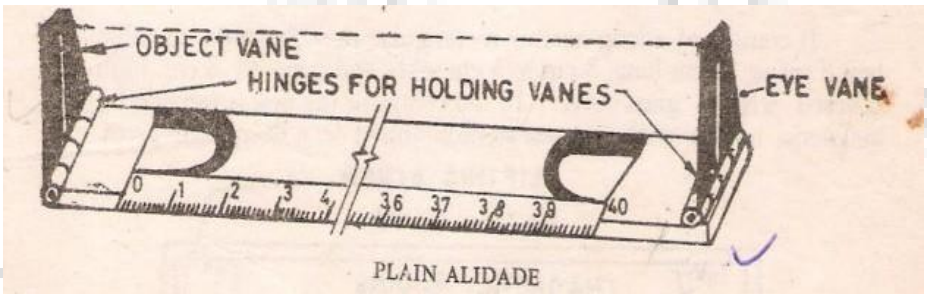
The plane Table:- The drawing board made of well seasoned wood such as teak or pinewhichisusedforthepurposeofplottingiscalledplanetable.Itisavailableinsizes 500x400x15mm,600x5000x15mm and 750x600x20mm.The top surface of board is perfectly plane and to the underneath it is fitted with a leveling head or ball and socket arrangement. The table is mounted on a tripod by means of a central screw with a wing nut or in such a manner so that the board can be revoled, leveled and clamped in anyposition.



PLANE TABLE WITH TRIPOD

seasoned) rule 40cm to 60cm long, 3cmto5cm wide and fitted with two vanes at the ends is calledan alidade.

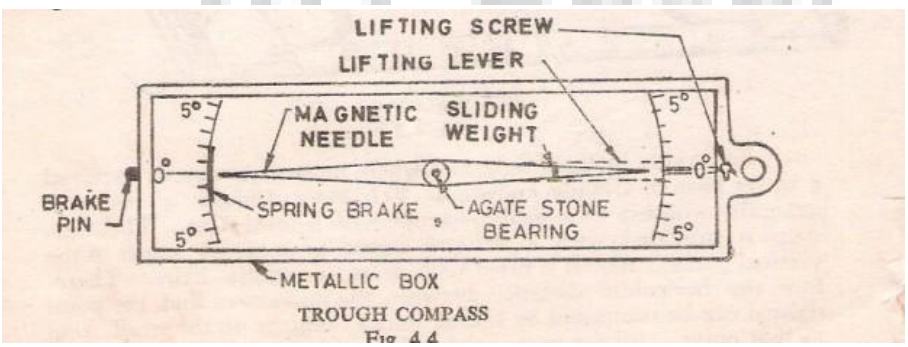
The beveled graduated edge is known as the fiducial edge. Such an alidade isknown as plainalidade.



PLAIN ALIDADE

Trough Compass:

The compass which is used to mark the direction of the magnetic meridian on the plane table is called trough compass. It consist of a long narrow rectangular non magnetic metallic box 8cm to 15cm long,3cm to 5cm wide and 2cm to 3cm high on thecoveredwithaglasscover.itthecentreoftheboxisprovidedamagneticneedle withaagatestonemountedonthesharpsteelpivot.Attheendthethroughcompass graduatedscalesarewithzerodegreeatthecentreandupto5°oneithersideofthe zeroline.AcounterweightisalsousedforNorthendoftheneedletorepresentNorth andisalsousedforbalancingthedipoftheneedle.

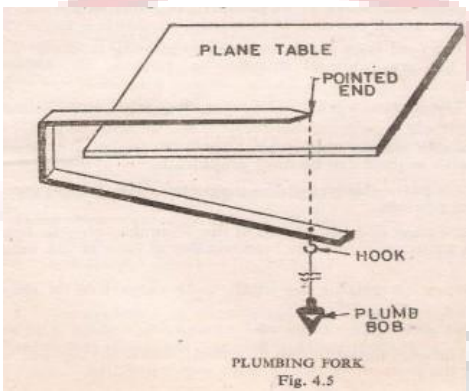


TROUGH COMPASS
Fig. 4.4

SpritLevel:-Asmallspritlevelcircularorrectangularisrequiredforseeingifthetableis properlylevel.Thelevelmusthaveflatbasesothatitcanbeplacedonthetable.

PlumbingforkorU-frame:-Theplumbingforktowhichisattachedaplumbbob,used for centering the plane table over the station occupied by the plane table. it is also meantfortransformingthegroundpointontosheetsothatboththepointsshouldbe in the same verticalline

It consists of two light metal arms as shown in fig. approximately of equal lengths.A hookforsuspendingaplumbbobisprovidedatthelowerarmimmediatelybelowthe end point of the upper arm. The upper arm is placed on the plane table while the lower arm with a plumb bob is moved below the table for centering over the ground stationmark,thusintheexactpositionthepointedendoftheupperarmwillgivethe corresponding position on thepaper.

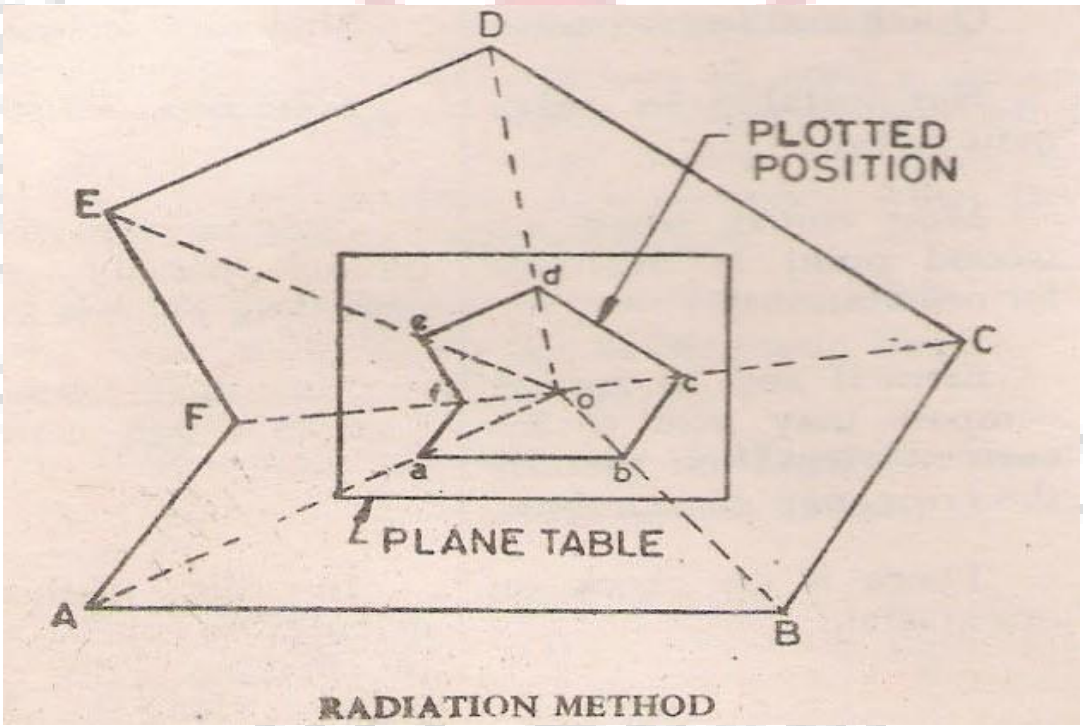


PLUMBING FORK
Fig. 4.5

details are located on the sheet, the method is known as radiation method

Inthismethodtheraysaredrawnfromtheinstrumentstationtothepointtobe located, then the distances are measured from the instruments station to the point andthepositionoftheeachpointisplottedonthesheetusingasuitablescale.

Themethodismostsuitedforsurveyingsmallareaswhichcanbecontrolledby singlesetting.Itcanalsobeusedincombinationwithothermethod.Thismethodcan be applied for locating distant points if the distances are obtained tacheometrically withthehelpofthetelescopealidade.



RADIATION METHOD

Procedure:-1)Selectthepositionofthetablewhereitisbesetsothatallthepointsto belocatedarevisiblefromit.Let'O'bethepositionofsuchapointontheground.

of sheet by means of trough compass at the table.

3) Nowtransferthepositionofthepoint‘O’onthegroundtothesheetbymeansof theaplumbingfork.Thepoint‘O’willrepresentpoint‘o’willrepresentpoint‘O’onthegro und.

4) Withthealidadetouchingthepoint‘o’(mayberepresentedbyfixingapin),sight thepointAinthefield.Drawtherayalongthefiducialedge.Measurethedistance of this point from the instrument station by means of tape and plot the point ‘a’ correspondingtopoint‘A’inthefieldtoscaleinthesheet.

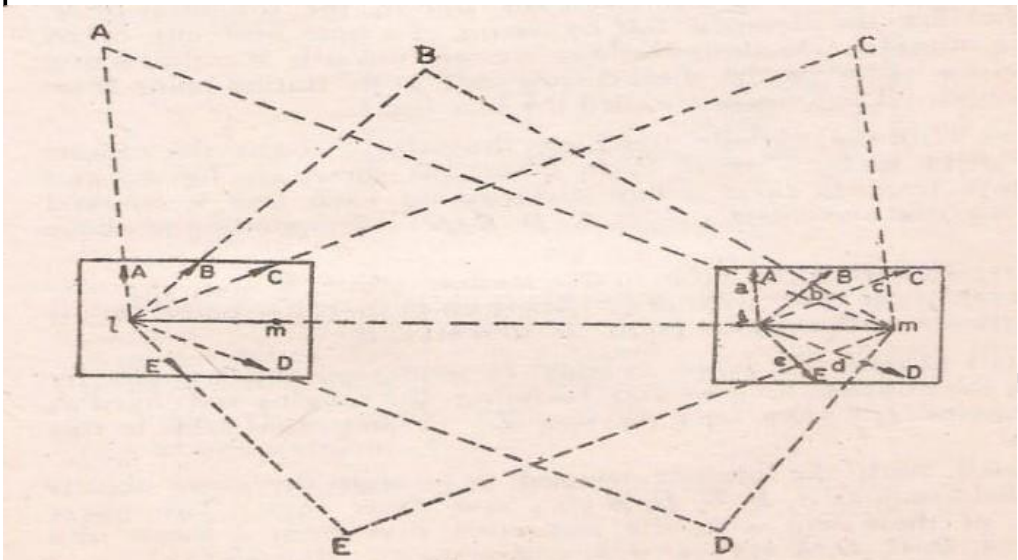
5) Similarlysightotherpointssuchas B,C,D,Eetc.andmeasuretheirdistancesfromthe instrumentstation.Plotthemtoscaletogettheirpositiononthesheetsuchasb,c,d etc. on thesheet.

Intersection method:-

Whenthelocationofanobjectisobtainedonthesheetofpaperbythe intersectionoftheraysdrawnaftersightingattheobjectfromtwoplanetablestations (previouslyplotted),itiscalledintersectionmethod.

Themethodissuitablewhenthedistancebetweenthepointandtheinstrument stationiseithertoolargeorcannotbemeasuredaccuratelyduetosomefieldconditions as in case of mountainous country. It is also employed for filling up details, locating distantandinaccessibleobject,locatingthebrokenboundariesasinthecaseofrivers etc.Themethodcanalsobeusedforcheckingofplottedpoints.

Thelinejoiningthetwoinstrumentstationsisknownasthebaseline.Nolinear measurementotherthanthebaselineismade.



INTERSECTION METHOD

Procedure :-

1) Select two points L and M in such a way so that all the points to be plotted arevisiblefromthem.Nowsetthetableatstation,pointLinsuchaposition sothatthesheetshouldcoverallthepoints.Levelthetableandclampit.
2) Drawthenorthlineinthetopcornerofsheetbymeansoftroughcompass
3) NowtransferthepositionofstationpointLonthesheetas'l'withthehelpof plumbingforksothatitisverticallyabovetheinstrumentstation.
4) Withthealidadepivotedabout'l'sighttherangingrodfixedatstationpoint M and draw the line in the direction of M. Now measure the distance LM by meansofthetapeandcutofflmtosomesuitablescalealongtheraydrawn towardM;thusfixingthepositionof'm'onthesheetcorrespondingtostation pointMontheground.Thelinelmiscalledthebaseline.
5) Withthealidadetouchingthepoint'l'sighttheobjectsinthefieldsuchas A,B,C,D,Eetc.asshowninfigureanddrawtheraystowardsthem.The

corresponding to above details.

6) NowshiftthetabletothestationpointMandapproximatelysetitintheline withML.Setitupsothatthepoint‘m’isverticallyabovethestationpoint‘M’ and levelit.
7) Orient the table roughly by compass, then finally by placing the alidade along ml and bisecting the ranging rod fixed at station point ‘L’ i.eby back sighting‘L’.Clampthetableinthisposition.
8) Withthealidadecenteredatmsightthesameobjectinthefieldsuchas A, B,C,D,Eetc;anddrawrays.Theintersectionoftheserayswiththe respectiveraysfromllocatetheobjectA,B,C,D,Eetc;asa,b,c,d,eetc;on thesheet.

AIM :Threepointprobleminplanetablesurveying.

APPARATUS:Planetablealidade,plumbingfork,plumbbob,Rangingrod,drawing sheetetc.

THEORY:It is finding the location of the station occupied by a plane table on the sheet, bymeansofsightingtothreewell-definedpointsofknownlocationonthesheet The principle of this method lies in the fact that if the plane table is correctly oriented, the three resectors through a ,b,&c, shown in fig. meet at a point p whichisthelocationoftheplane-tablestationonthesheet,providedthepoints A,B,C& P do not lie on the circumference of a circle. By solving three- point problem,thus,theorientation&resectionareaccomplishedsimultaneously.

Thesolutionofthree-pointproblemisfurtherillustratedgraphicallyin fig.thestationsA,B,&CareofknownpositionandpisofunknownpositionIfthe angle a is observed between PB, & PA, the position of P is indeterminate, because P can be anywhere on the circle circumscribing the triangle PAB. Additionalinformationis neededtomaketheproblemdeterminate.Iftheangle B,whichistheanglesubtendedbyACatP,isalsoobservedthenthesolutionis unique since P, A &C lie on the circle that circumscribe triangle PAC, & P isone ofthetwointersectionpointsofthecircles&Aistheotherintersectionpoint.This solutionbecomesindeterminateofA,B,C,&PfallonthecircumferenceofoneIf the two circles tend to merge into one circle, the problem will be less stable & finally becomes indeterminate again when the two circles coincide.

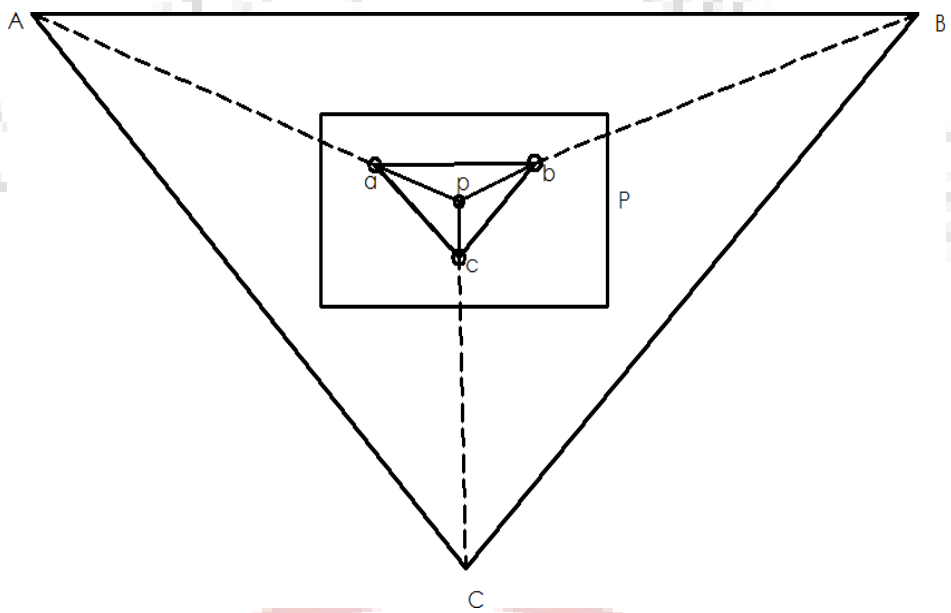
Points should be selected in the field so as to avoid this situation.

methods applicable to the plane table discussed.

a. mechanicalmethod(tracingpapermethod)

b. graphicalmethod

c. trial&errormethod(Lehmann'smethod)



PROCEDURE:-

The three point problem consists in locating on the plan the position of the instrumentstationonthegroundbymeansofobservationtothreewelldefined pointswhosepositionshavebeenalreadyplottedontheplan.SupposeA,B,&C are the three points which have been plotted as a, b, & c on the plan & the t ableissetupatTfromwhichA,B,&Carevisible.Itisrequiredtoplotonthe planthepositiontoftheinstrumentstationT.

Theproblemmaybesolvedby(1)Mechanically(2)Graphically(Bessel's method)&(3)bytrial&errormethod

i. Aftersetting&levelingthetable,thealidadeisplacedalongthelineca & the board turned until A is sighted being towards A. the table isthen clamped. With the alidade centered on C, B is sighted & a ray CB is drawnalongtheedgeofthealidade.

ii. When the alidade placed along ac, the board is turned until the line of sight bisects c, c being towards C & then clamped. With the alidade touchinga,Bissighted&arayaBisdrawnthrougha;intersectingthe raypreviouslydrawnthroughinthepointd.

iii. With the alidade along bd, the table is turned until B is bisected &then clamped. The table is now oriented & t must lie on db& also on Aa & Cc. with the alidade centered on a, A is bisected & a lay is drawn through a, intersecting the ray bdin t, which represent the instrument stationT.

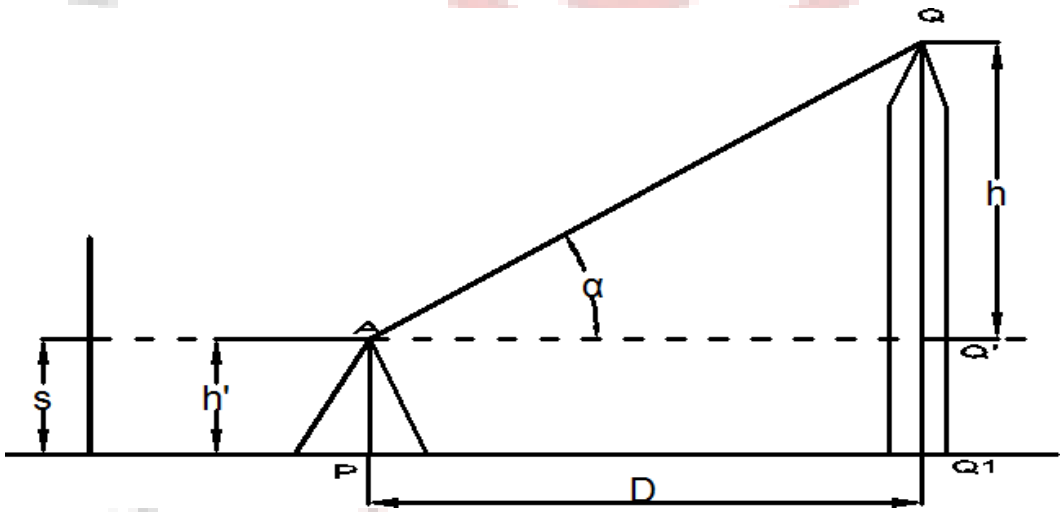
To check the orientation, the alidade is pivoted on c &C is bisected.TherayCcshouldnowpassthrought,iftheworkiscorrect.

RESULT: The location of the station on given point is found on sheet.

AIM:-Determinationofelevationofpointbytrigonometriclevelling.

Theory:- Trigonometrical leveling is the process of determining the difference of elevation of station from observed vertical angles and known distances, which are assumed to be either horizontal or geodetic length at mean sea level. The vertical angles may be measured by means of an accurate theodolite and the horizontal distancesmayeitherbemeasured(incaseofplanesurveying)orcomputed(incase of geodeticobservation)

Base of the object accessible:-



Height and Distances

1) Baseoftheobjectaccessible.:-Thehorizontaldistancebetweentheinstrumentand theobjectcanbemeasuredaccurately.

Let P= instrumentstation.

Q=Point to be observed

A=centreofthe instrument

D= AQ'=horizontal distance between P&Q

h'=height of the instrument at P

h=QQ'

S=ReadingonstaffkeptatB.M,Withlineofsighthorizontal.α=angleofelevationfromA toQ

From triangle AQQ',h=Dtanα

R.LofQ=R.Lofinstrumentaxis+Dtanα

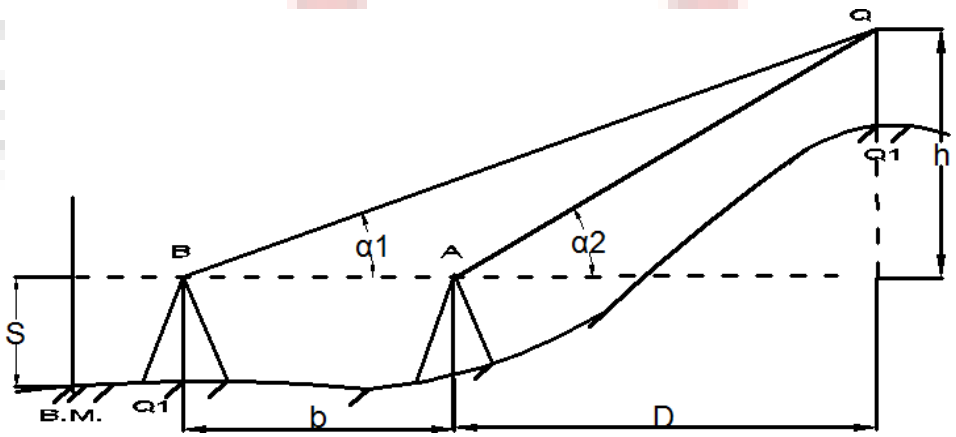
IftheR.L.ofPisknown,

R.L. of Q=R.L of P+h'+Dtanα

If the reading on the staff kept at the B.M. is S with the line of sight horizontal.

R.L of Q=R.L. of B.M+S+Dtanα

2) Baseoftheobjectinaccessible:-ifthehorizontaldistancebetweentheinstrument andtheobjectcanbemeasuredduetoobstraclesetc.,twostationsareusedsothattheyareinthesameverticalplaneastheelevatedobject.



a) Instrumentaxesatthesamelevel:-

Leth=QQ',α1=angleofelevationfromAtoQ,α2=angleofelevationfromBtoQ

S=staffreadingonB.MtakenfrombothAandB,thereadingbeingthesameinthe

boththecases.b=horizontaldistancebetweentheinstrumentstations,

D= horizontal distance betweenP&Q

FromtriangleAQQ',h=Dtanα1 ----------(1)

FromtriangleBQQ',h=(b+D)tanα2 ----------(2)

Equating (1) and (2), we get,

Dtanα1=(b+D) tanα2

D(tanα1-tanα2)=btanα2

$D = \frac{b\tan\alpha_2}{\tan\alpha_1 - \tan\alpha_2}$

h=Dtanα2

$= \frac{b\tan\alpha_1 \tan\alpha_2}{\tan\alpha_1 - \tan\alpha_2}$

$= \frac{b\sin\alpha_1 \sin\alpha_2}{\sin(\alpha_1 - \alpha_2)}$

R.L. of Q= R.L of B.M.+S+h

Procedure:-

1) SetupthetheodoliteatPandlevelitaccuratelywithrespecttothealtitude bubble.
2) DirectthetelescopetowardQandbisectitaccurately.Clampboththeplanes.

Read the vertical angleα1.

stationRontheground.MeasuredthedistanceRPaccurately.Repeatsteps(2) and(3)forbothfaceobservation.Themeanvaluesshouldbeadopted.

4) Withtheverticalverniersettozeroreading,andthealtitudebubbleinthecentreof therun,takethereadingonthestaffkeptatnearbyB.M.
5) ShifttheinstrumenttoRandsetupthetheodolitethere.Measuredthevertical angleα2toQwithbothfaceobservations.
6) Withtheverticalverniersettozeroreading,andthealtitudebubbleinthecentreof therun,takethereadingonthestaffkeptatthenearbyB.M.

Observation table:-

Instrument Station	R.L@ B.M	Reading on staff keptat B.M.	Vertical angle (α)	Horizontal distance between instrument station and object	R.L o f the object

Result:-theelevationoftheobjectfromtheB.Misfoundtobe ---------- m

AIM : Counter plan of given area (Oe full size drawing sheet)

APPARATUS:Autolevel,prismaticcompass,chain20m,30m,metallic Tape, ranging road Leveling staff, pegs line.

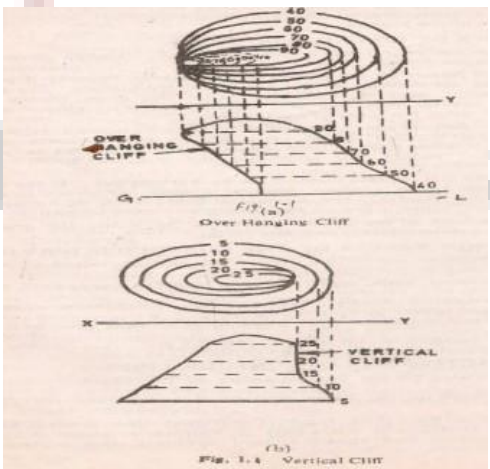
THEORY:

CONTOURING: The elevation and depression the undulations of the surface of the ground are shown as map by interaction of level surface with by means of contour line. a contour may be defined as the line of intersection of a level surfacewiththesurfaceoftheground.

Characteristics of CounterLines

The following are the Characteristics of the contours/ contour lines.

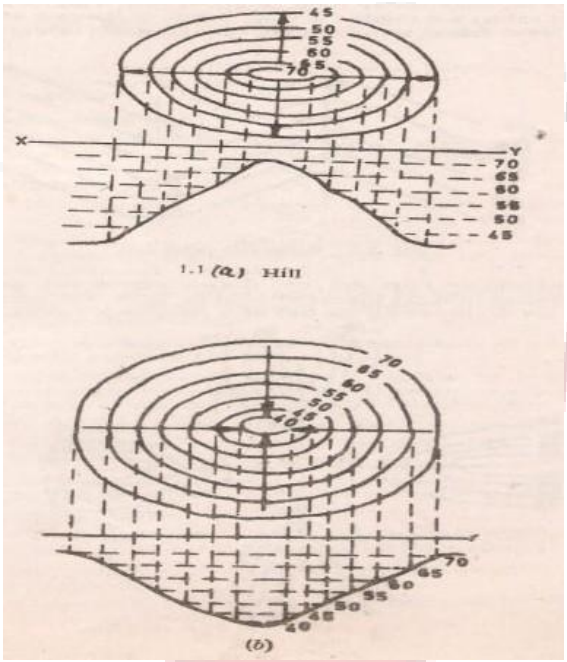
1) Allpointsonthesamecontourlinewillhavethesameelevation.
2) Contourlinesclosetogetherrepresentsteepground,whileuniformslopeisindicated when they are uniformly spaced. A series of straight, parallel and equally spaced contoursshowaplaneorflatsurface.
3) Contourlinesofdifferentelevationcannotmergeorcrossoneanotheronthemap, expectinthecaseofanoverhangingcliff.Averticalcliffisindicatedwhenseveral contourscoincide[seefig1.1(a)and(b)]



Over Hanging Cliff

Vertical Cliff

5) Series of closed contour lines on the map either represent a hill or a depression accordingasthehigherorlowervaluesareinsidethemasshowninfigs[1.2(a)and (b)



6) Acontourwillnotstopinthemiddleoftheplan.Itwilleithercloseorgooutofthe plan.

7) Ridgeorwatershadandvalleylinesarethelinesjoiningthetopmostorthebottom mostpointsofhillandvalleyrespectively,crossthecontoursatrightangles.Aridge lineisshownwhenthehighervaluesareinsidetheloop,whileinthecaseofavalley line,thelowervaluesareinsidetheloopasshowninfig(1.3)

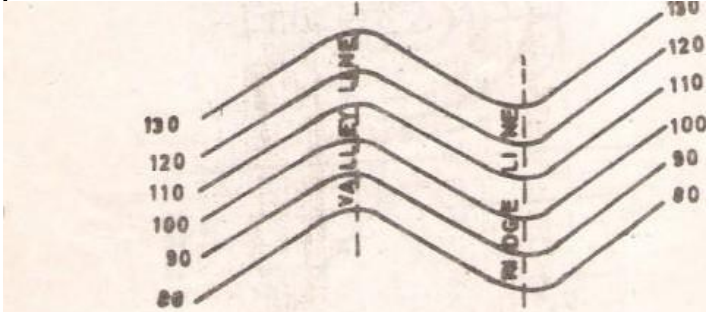


Fig. 1.3. Ridge and valley line

8) Contour lines are not drawn across the water in the stream or river because the water level in the it is not constant; but contours are drawn along the bed of a river or a stream.

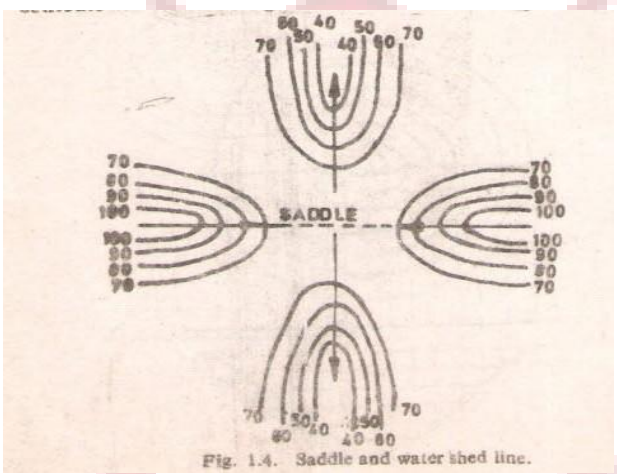


Fig. 1.4. Saddle and water shed line.

Uses of contour map

1) For preparing contour map in order to select the most economical or a suitable site.

2) For getting the importance about ground whether it is undulating or mountainous

construction will be economical and will command maximum irrigated area.

4) Tomakethealignmentfortheroad,railwaysothatthequantityofearthwork bothincuttingandfillingshouldbeminimum.

5) To find out the capacity of the reservoir or a volume of earthwork especially in the Mountainousregion.

6) Forpreparingcontourmapinordertoselectthemosteconomicalorsuitable site.

7) Asitsdefinitionitselfindicatesthelinejoiningthepointsofsameelevationthat Meansitnaturallyprefersthecondition ofnatureofgrounditself.

8) Itisalsousedforirrigationpurposeasfromitcapacityofreservoirisshown.

LOCATING CONTOURS:

a) By cross-sectionmethod:

Thismethodiscommonlyusedinroughsurvey,crosssectionsareruntraverseto the contour line of road, and railway as canal and the point of change of slope (representations) are located. The cross-section line may be inclined at any angleTo the centerline if necessary. The spacing of the cross sections depends upon the characteristics of theground.

By interpolation of contour is meant the process of spacing the contour proportioning between the plotted ground points. Contour may be interpolated by

1) Estimation

2) Arithmeticalcalculations

3) Graphicalmethod.inallthesemethods

uniform.

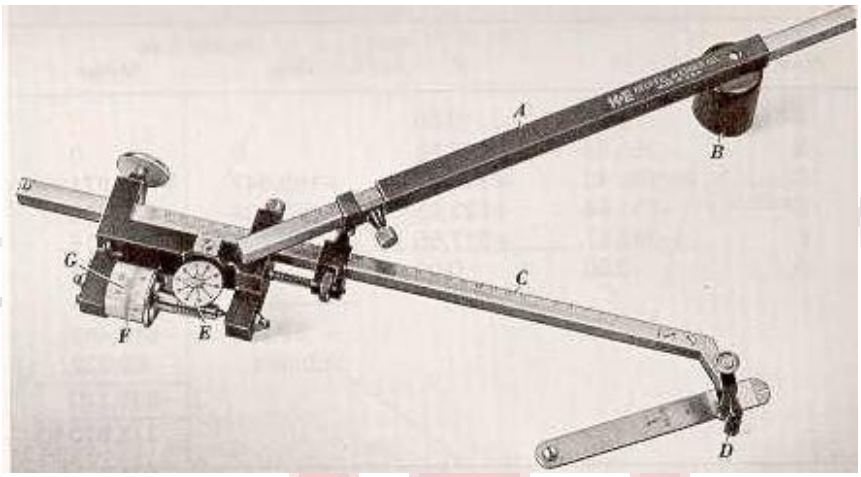
RESULT: The contour of given land is drawn in the sheet.

EXPERIMENT NO- 17

AIM :StudyofPlanimeterA

PPARATUS :Planimeter

FIGURE :



Planimeter : A Planimeteris a mechanical integrator is used by engineer for measuring areaoffigurewhichisbeenplottedscaleparticularlywhentheboundariesare irregulararecurvedmathematicallyitisdifficulttofindtheareaofsuchirregular figures.Planimeterislargelyusedforfindingtheareasofcontourindetermining the capacity of storageserver.

Construction:TheseareseveraltypesofPlanimeterbuttheamplerpolarPlanimeterisin mostcommonuse&isdescribedas-

It consists of two arms hinged at a point one is known is anchor arm &it is at fixedlength.Ithasaneedlepointcalledtheanchorpointwhichisfixedinpaper&hold inpositionbydetachablesmallweightheotherarmiscalledtrussingarm.itcarriesa tracing point which is moved along the periphery of the figure of which the area is to befoundout.Tracingarmisadjustableislengththetracingarmissettopositiongiven by the manufacturer according to scale used the total normal displacement is

measured b rolling wheel. The rolling wheel carries graduated drum divided into 100

connected by gears is the counting disc. The counting disc measure one revolution at every10turnsoftherollingwheeleachcompletereadingisafigureoffourdigits.The zeroofrollingwheelisappositetothezeroatveriner.Actuallythemarksofriseshould beoppositetoindexmarkduetoimperfectionofthewheelgear.

Instrumentisequippedwithmagnifyinglancetoreadvernier&acheckbarorflatbar for testing thePlanimeter.

Reading on Planimeter:

Each complete reading on Planimeteris a figure of digits. Let the reading be 4.375 thefirstdigit4 isreadonthedisctheseconddigit3isreadontherollingwheel(main scale)thethirddigit7isreadonthefallingwheel(mainscale)&thelastisfourthdigit5 isreadonthevernierscalebesidethemainscaleofrollingwheelpositionofmeasuring unit(settingoftracingarm)thepositionoftracingarmisadjustableaccordingtogiven positionbythemanufactureforthedifferentscalar.Thepositionofmeasuringunitwill be vary from instrument to the index mark on the beveled edge of the tracing arm of thefiguremaybeobtaineddirectlyinm^2orhectorsbymarkinguseofmultiplyingscale factor.

Method of usingPlanimeter:

The Planimeter is used in determining the areas of the figure in 2 ways.

1) Byplacingtheanchorpointoutsidethefigure.
2) Byplacingtheanchorpointinsidethefigure.

Procedure: 1) Set out the index arm on the tracing arm to the given scale as per manufacturesinstructionexactlybusingclamp&finemotionscrew.Stretchthesheet makingfreefromwrinkleness.

Mark the points on the boundaries of the figure & set tracing arm exactly over it.

3) Nowtaketheinitialreadingi.e.thereadingondial&wheel&vernier.

4) Movethetracingpointalongtheperipheryofthefigure&stopatthestartingpoint.

5) While tracing point is moved note the number of times the zero index mark in clockwise & anticlockwise direction. Again take the reading of on dial wheel &vernier that will be finalreading.

6) Thecalculatedarea(A)=m(FR-IR+10N+C)

Where, M=multiplying constant which is different scales

N=numberoftimesthezeroofdialpassesthefixedindexmarkusethe+vesignwhen movesclockwise&-vesignmovesanticlockwise.

C=constantofinstrumentsuppliedbymanufacture&differentfordifferentscales&itis offsetwhenanchorpointiskeptinsideotherwiseitistakenzeroifitiskeptoutside.

FR=Final reading.

IB=Initialreading.

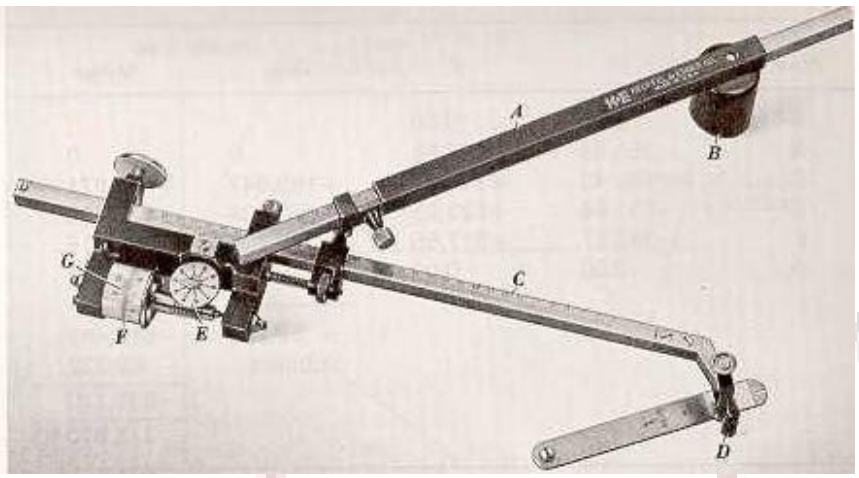
Area of the zero circles i.e. Mc is defined as the correction circle which is defined as a circle found the circumference at which if the tracing point is moved wheel will slide without rotation in a reading. This is possible when tracing arm is placed in such a position relative to the anchor of arm that the plane of the roller passes thought the anchored point the multiply constant of Planimeter is equal to the number of unit of area per revolution of the roller.

RESULT: - Planimeter has been used to measured irregular figure.

AIM :Determinationofareaofirregularfigurebyusingplanimeter

APPARATUS :Planimeter

FIGURE :



Planimeter : A Planimeteris a mechanical integrator is used by engineer for measuring area of figure which is been plotted scale particularly when the boundaries are irregular are curved mathematically it is difficult to find the area of such irregular figures.Planimeterislargelyusedforfindingtheareasofcontourindetermining the capacity of storageserver.

Method of using planimeter

The planimeter is used in determining the area of the figure in two ways.

1) Byplacingtheanchorpointoutsidethefigureand
2) Byplacingtheanchorpointinsidethefigure.

Ifthefigureislargetheanchorpointmaybekeptinsidewhileifitsmallthesamemay be placed outside. The larger figure may be divided into parts and the area of each partismeasuredseparatelyandtheresultssoobtainedareaddedtogethertoget required area.

The procedure is common for both the above cases.

1) Setouttheindexarmonthetracingarm(positionofmeasuringunit),togivenscale aspermanufacturesinstruction,exactlybyusingtheclampandfinemotionscrew.
2) Stretchthemapsheetuntilitisflatandfreefromwrinkles.
3) Fixtheanchorpointfirmlyinthepaperoutsideorinsidethefigureaccordingasthe figureissmallorlarge.
4) Markapointontheboundaryofthefigureandsetthetracingpointexactlyoverit.
5) Now take initial reading (I.R) as described previously, reading the dial, wheel and vernier.Itisnotnecessarytosetthedialandwheeltozero.
6) Move the tracing point exactly around the boundary, always in clockwise direction usingonehandtokeepthepointexactlyon theboundaryandthe otherhandtokeep theanchorpointfrommoving,stopexactlyatthestartingpoint.
7) While tracing point is moved along the boundary of the figure, note the number of times the zero mark in clockwise or anticlockwise direction. Again take the reading of dial,wheelandvernierrecording itasthefinalreading(F.R).Theareaofthefigureis then calculated by using the followingformula.

The calculated area (A) = m (FR-IR +10N+C)

Where,M=multiplyingconstantwhichisdifferentfordifferentscalesandsuppliedinthe instructionsheetbythemanufacture.Itisequaltotheareaofonerevaluationofthe wheel i.eunitarea.

F.R.=thefinalreading I.R=

the initial reading

moves clockwise & -ve sign moves anticlockwise.

C=constantofinstrumentsuppliedbymanufacture&differentfordifferentscales&itis offsetwhenanchorpointiskeptinsideotherwiseitistakenzeroifitiskeptoutside.

Area of the zero circles i.e. Mc is defined as the correction circle which is defined as a circle found the circumference at which if the tracing point is moved wheel will slide without rotation in a reading. This is possible when tracing arm is placed in such a position relative to the anchor of arm that the plane of the roller passes thought the anchored point the multiply constant of Planimeter is equal to the number of unit of area per revolution of the roller.

Observation table:-

Position of anchor point	Initial Reading	Final Reading	Value of N	Remark

Result:Theareaofirregularfigureisfoundtobe---------- Sq-m

AIM :ToStudyofAbneylevel,Boxsextant

APPARATUS:Abneylevel,Boxsextant

FIGURE :

Abney level:-

Abney level is a light compact bond instrument of low elevation. It is widely used for-

Measuring the angle of elevation or depression.

1) Takingaloneofthegroundwhenchainingalongtheunevenground.
2) Tracingagreatcontouroraalignmentofaroad.

Abney level consist of-

1) A square lighting tube fitted with an eye piece or small telescope at one endat theotherendthemirrorisplacedatanangleof45^{0}insidethetubethewireislanced acrossthetubebehindthemirrorbywhichobjectcanbebisected.
2) A small bubble tube is attached to the mirror arm which can be rotated by means of wormwheel.
3) Asemicircularquadratearchismarkedzeroatthemiddlepoint.Thegraduation are made from 0^0 –6^0

Measurement of vertical angle

Directtheinstrumenttowardstheobject&bisectitwithcrosswire&atthe same times the middle wheel until the crass wire bisect the reflection of therequired angle in the arc by means of the vernierit may be noted that the bubbletubeisalwayshorizontal&theverticalarmvertical,whatevermaybethe inclination of telescope.

Theobserverstandsatoneendoftheslope&directtheinstrumentontothe markallvanefixedontherangingrodatthesameheightastheobserverwheeluntil thereflectedimageofthebubbleisbroughttothecentreofitsrun&intersectedby thecrosswirethebubbletubeisnowhorizontalwhiletheteleScopeisparalleltothe slopeoftheground.Theanglereadontheareagivestheslopeoftheground.

To trace the grade contour:-

Withthehelpofthevernierthe rollinggradientcanbeobtainedmarktheheight of the observer on the ranging rod. Direct the instrument towards the mark on the rangingrodheldattheconvenientdistanceray30-50metertherangingrodisthen moved upward downward until the observer bisect the vane with cross hair & simultaneously over the bubbled centered is the instrument station to the point on whichrangingrodisheldparalleltothispoint&repeattheprocesstoestablishthe nextpointtheprocessiscontinueduntilthelastpointisestablished.

Iftheabneylevelisnotgivingcorrectvaluesofangleofinclinationofthereis difference of two observations then adjust the instrument to the mean value. i.e. (T1+T2/2)lighttheobject&centrethebubblebymeansofadjustingscrewofthe bubbletube.

Itisreflectedtypeofinstrumentcapableofmeasuringangleupto120^0& reads to oneminute.

Construction: - it consist of –

ii. Aboxabout7.5cmindia&4cmindepth

iii. Acoverwhichserverasahandlewhenoccurredtothebottom.

iv. Ahorizontalglasshavingthelowerhalf&thenipperhalf.

v. An index glasswhplly.

vi. AOliverallgraduatedfrom0^{0}to140^{0}degrees&halfdegrees.

vii. Anindexarmcarriesavernierwhichreadstosingleminute.

viii. An adjustable magnifyingglass.

ix. Amilledhandlescrewtorotatetheindexglass&indexarm.

x. Aneyeholeinaslidingarm.

xi. A pair of colored glasses for use when observations are taken on the brought objectorthesun.

xiii. Aslotinthesideoftheboxthroughwhichentreestheraysfromtheobjectsighted.

xiv. Abayforadjustingtheinstrument.

Uses:-Theboxsextantisacompacthandinstrumentbysettingthevernierto90itmay be used as a optical square & therefore after included in the instrument (equipment)Forachainsurveyitisveryusefulformeasuringchainangles.

Locating inaccessible point at measuring angles for checking purpose.

PROCEDURE:-

Whenmeasuringanglesbetweenthetwoobjectsatastationholdtheinstrument stherighthandoverthestation&lookthroughtheeyelensesatthelefthandobject through the lower position of the horizontal angle. The middle headed screw slowly untiltheimageoftherighthandobjectseenistheuppersilveredhalfofthehorizon glassiswithlefthand.

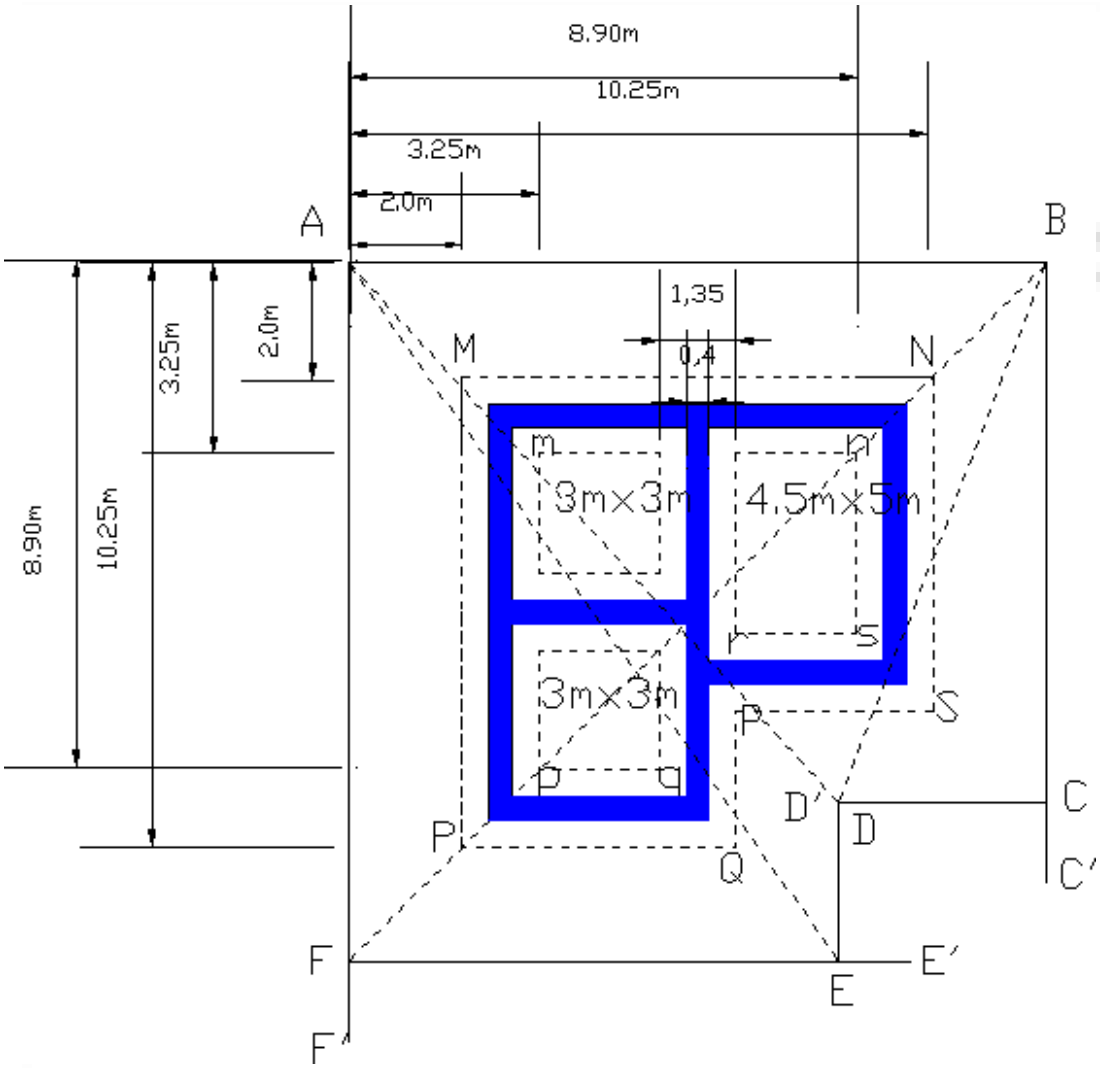
Note- the reading of vernires which gives the value of the required angle.

RESULT:- Abney level, Box sextant isstudied.

EXPERIMENT NO -20

AIM :TogiveLayoutforgivenplanofbuilding.

Equipment: Pegs, Nails ,Lime, Wooden Mallet



Theory: - When plans are ready for the works, the works are robe executed .To startwithanystructurefirstofall,trenchesforthefoundationaretoexcavated.To excavate these trenches, the outline of excavation are defined on the ground,the processofdefiningtheoutlinesoftheexcavationonthegroundisknownassetting outofworksorliningoutofworks.

line,theplanshowingthewidthofthefoundationtrench,forvariouswalls,distance of the corners from some definite line etc. is required. This plan called foundation plan (Fig) .The distances and they are with reference to lines AB and AF. PROCEDURE:-

Tostartwiththesettingoutofbuilding,firstofallapointAisfixedandthenline AB is oriented in the required direction .Thus having fixed the direction of the line AB, two pegs A and B are driven at distance of 12.25m,apart (This distance calculated from the plan). Wire nails are driven at the centers of the pegs. Again the distance between the wire nails is checked and which should be equal to 12.25m. A cord is stretched along AB and ends are secured to these wire nails at Aand B, perpendicular AF' and BC' are setout. Perpendicular may be set with a tapeby3-4-5methodortheodolitemaybeusediftheworkisimportant.AlongAF' andBC',pointFandCarefixedat12.80mand10.30m,fromA&Brespectively.Theperpendicular are then set at C and F and point D and E are fixed along CD' and FE' at a calculated distance from C and F respectively . The stakes are driven at thesepointC,D,E,andFandwirenailsaredrivenatthecentersofthesestakes.A cordisstretchedallalongABCDEF.

To check up the work, the diagonal AE, AD, bF, and Bd are actuallymeasured and these measured values should agree with their corresponding calculated lengths. Otherwise the setting out work should be repeated and stakes should be refixed at their correct positions.

AfterfixingupallthepegsandstretchingthecordthecornersM,N,Petcand m,n,p etc. are to be located . The point A is considered as the origin and thelines

etc., and m, n, p, etc. are calculated with reference to A as origin .

ForexampleCo-ordinatesofM.N.Pare(2,2),(2,10.25)and(10.25,2)respectivelyand thoseform,n,pare(3.35,3.35),(3.35,8.90)and(8.90,3.35)repectively.Withtheseco-ordinates,pointM,N,P,m,n,petc.,aresetandpegsaredrivenatthesepoints.The cord are stretched around the wire nails at M,N,P,Q,R,S and m,n,p,r,s indicating peripheries.Theoutlineoftheperipheriesaremarkedwithlimespread.

Nowthelimelinesonthegroundindicatethetrenchesforthevariouswallsandthe excavationmaybestarted.ifduringtheprogressofthework,thelinesmarkedare disturbed,itmaybecheckedorresetwithhelpofreferencelineABCDEF.