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Tribhuvan University
Institute of Engineering
Central Campus, Pulchowk
DEPARTMENT OF CIVIL ENGINEERING
Survey Instruction Committe

Report on
Surveying Practical

Course Surveying-I
CE - 504

Combined Report on Surveying

Submitted by :-

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Submitted To :-

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DEPARTMENT OF CIVIL ENGINEERING

Survey Instruction Committee

Report on
Surveying Practical

Course Surveying-I

CE – 504

LINEAR MEASUREMENTS

Submitted by:

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PRACTICAL TASK

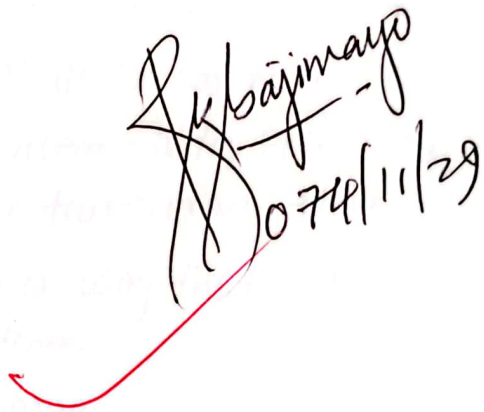
Linear measurement

OBJECTIVES

- To determine horizontal distance between two stations on plain ground by ranging.
- To determine the individual pacing factor.
- To determine horizontal and vertical distance on slopping ground by direct and indirect method.

INSTRUMENTS AND ACCESSORIES USED

- Measuring Tape 30m - 1
- Measuring Tape 3m - 1
- Ranging Rods - 3
- Abney level - 1
- Plumb Bob - 1
- marking Arrows - 4
- Wooden pegs - 2
- Hammer - 1



THEORY

Following are the principles used in linear measurment

1) Ranging :

Ranging is a process to determine the distance from one location to another location. When the line is short or its end station is clearly visible, the chain may be laid in true alignment. If the line is long or its end station is not visible due to undulating ground. It is required to mark a number of points along the chain line prior to chaining the distance. It may be done either by eye estimation or using a line ranger or theodolite.

2) Pacing factor

Pacing ~~factor~~ and q is the methodof measuring distance in the field. pacing factor is the ratio of the measured distance the number of pace made by an individual ~~to the measured distance~~.

mathematically,

$$P.F = \frac{\text{measured distance(m)}}{\text{Number of steps.}}$$

Classification of Ranging

a) i) Direct Ranging

When the end stations are intervisible, ranging is being carried out directly. The intermediate points are placed ~~carried out directly~~ at distances having interval less than one tape length. The intermediate points are found by moving a ranging rod in transverse direction and thus, points are selected in such a way that end points and intermediate points lie in a straight line.

ii) Direct method of stepping

This methode is suited when slope of ground is very steep. sloping ground is divided into number of horizontal and vertical strips like steps. so this methode is known as stepping methode.

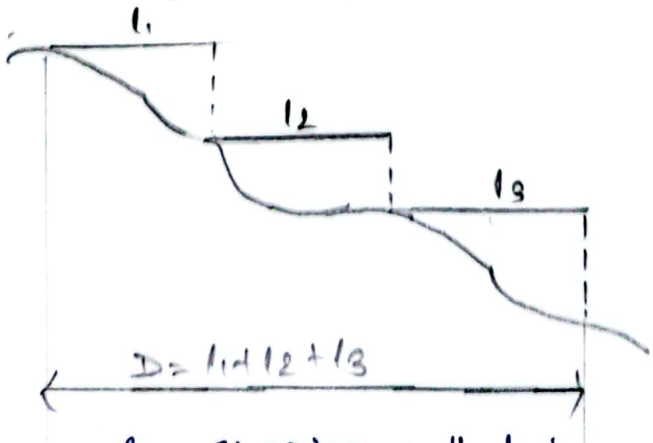


fig Stepping method

b) Indirect method by Abney level

Abney level is used to measure vertical angle. When the slope of ground surface is long and gentle stepping method is not suitable so this methode is used The precision is 1 in 500.

PROCEDURE

1) Measurement of Horizontal distance between two station on plan ground.

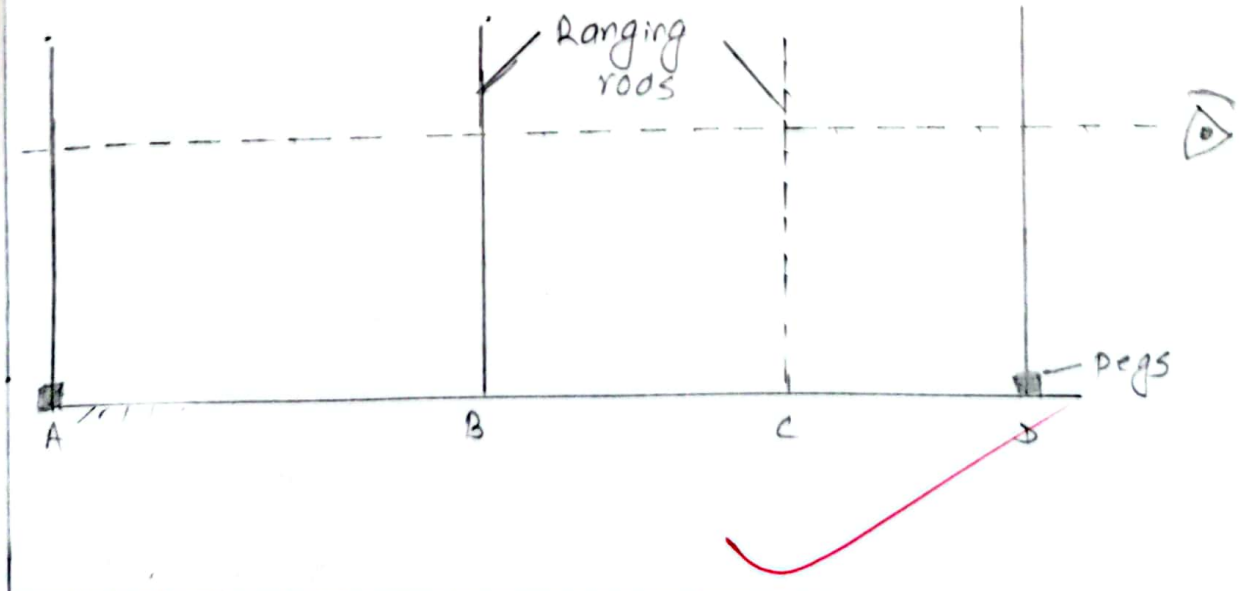
(a) Two stations were fixed at a great distance and Pegs and ranging rods were fixed.

(b) Third ranging rod was then kept in straight line with other to determine the intermediate point marking arrows planted at such points.

(c) The distance from ranging rod to marking arrows were measured using 30m measuring tape. Summing up these distances, the distance between two pegs were calculated.

(d) Ranging was done in backward distance, with using other intermediate points. The backward distance was then calculated

(e) Precision factor was calculated using the forward and backward distances.



2) Determination of pacing factor

a) Each individual of the group walked 80m distance for about four times and then number of steps to complete the walks was counted.

b) Pacing factor was then determined using the formula.

3) measorement of Horizontal and vertical Distances on sloping Ground.

a) Direct method

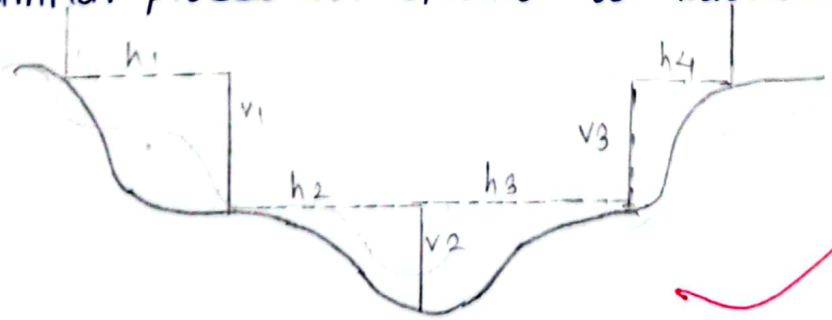
i) Two points for measuring the distances wee fixed on the slopping ground. The langing rods were tied behind the planted pegs at the two points. The ranging rods were mode vertical with the help of plumb bod.

ii) Another ranging rod was tired at the straight line joining other two it such point that it was in same sloping ground with the first rod.

iii) The horizontal distances was measured by determining the shortest distance between two rods was achieved by swigging the tape. The vertical distance was measured directly.

iv) First rod was shifted to a new position of next slope and similar method was followed to measure distances. Adding these the total horizontal and vertical distances wee determined.

(v) Similar process was repeated for baccward measurement.



Total horizontal distance = $h_1+h_2+h_3+h_4$

Total vertical distance = V_1+V_2+

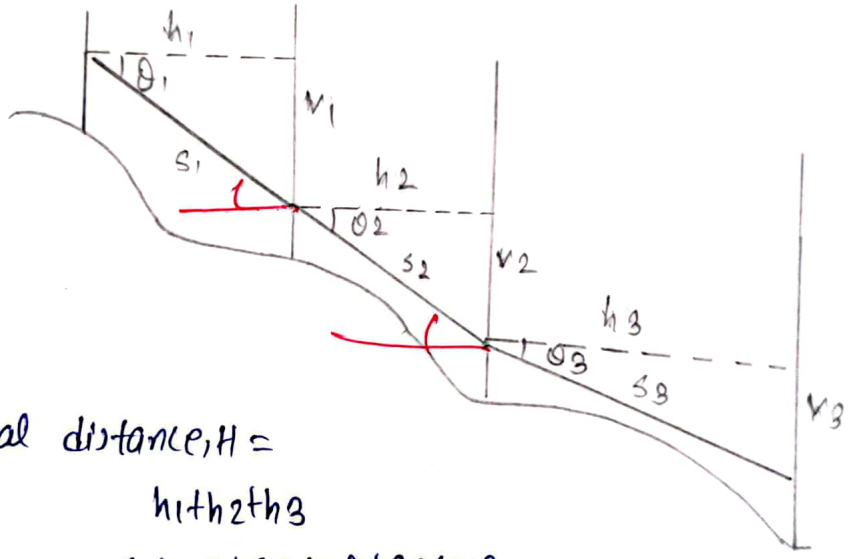
b) Indirect method

i) Two points for measurement were fixed first in the same way as above.

ii) Indetermediate points were selected such that they were in the same slope level WRT previous point.

iii) The sloping distance between two consecutive points were measured using measuring tape.

iv) Abney level was used to measure the angle between slope and horizontal. Using trignometric relations horizontal and vertical distance were calculated



Horizontal distance, H =

$$h_1 + h_2 + h_3$$

$$S_1 \cos\theta_1 + S_2 \cos\theta_2 + S_3 \cos\theta_3$$

vertical distance = $V_1 + V_2 + V_3$

$$= S_1 \sin\theta_1 + S_2 \sin\theta_2 + S_3 \sin\theta_3$$

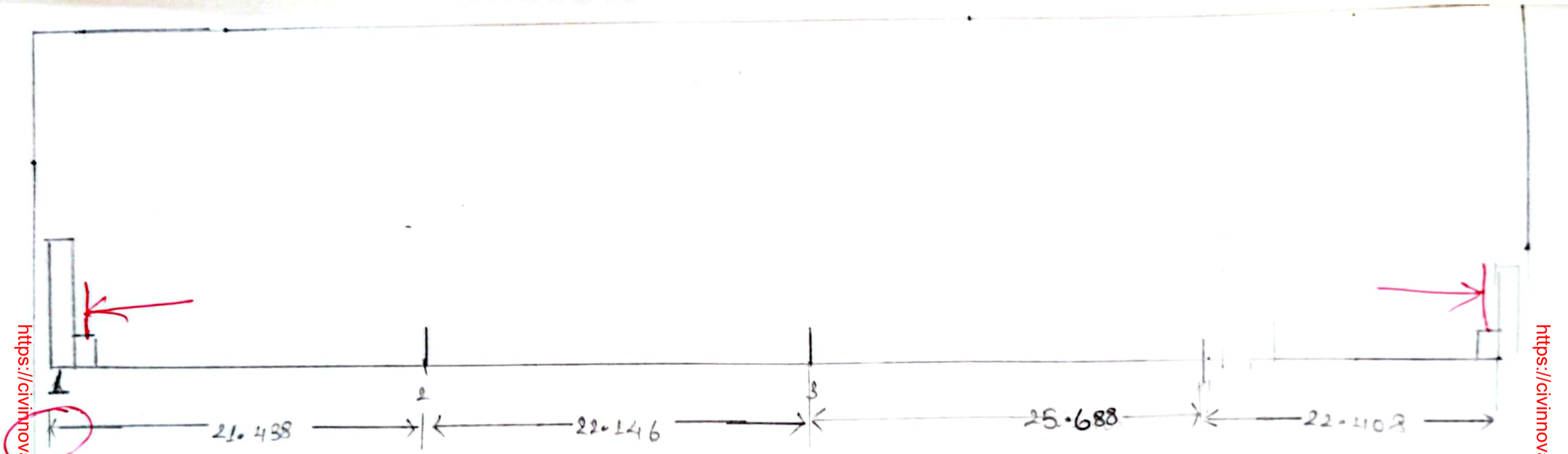


Fig measurement of horizontal on plain ground in forward direction

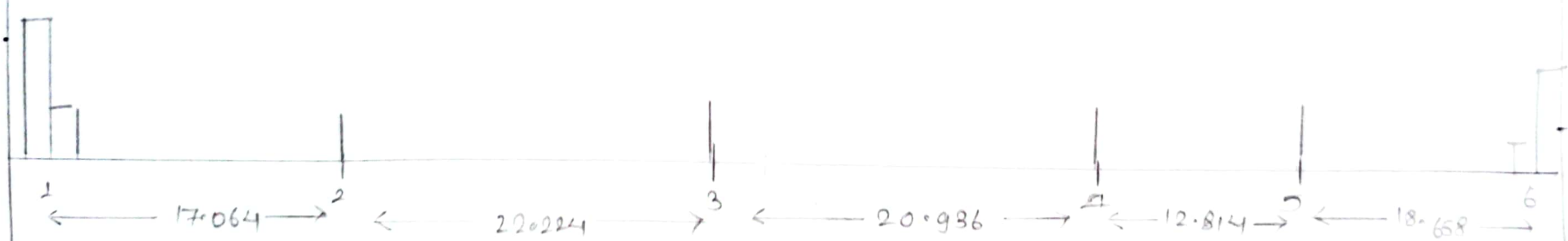


Fig measurement of Horizontal distance on plain ground in backward direction

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(1) Horizontal distance measured on plain ground

No. of reading	Distance - Horizontal (m)					Error/Average	
	Forward	Total	Backward	Total	Average	Error	Precision.
1	21.488		17.064				
2	22.146	91.680	22.224	91.696	91.688	0.016	1.5730
3	25.688		20.936				
4	24.408		12.814				
5	-		18.653				

2) Individual pacing factor

S.N	Distance (cm)	No. of steps		Average steps	Pacing factor
		Forward	Backward		
1	30	40	41		
2	30	40	41	40.625	0.738
3	30	41	41		
4	30	41	40		

For slopy ground

i) Direct method

S.N	Forward (FWD) Horizontal (m)	Forward (FWD) vertical (cm)	Backward Horizontal (m)	Backward vertical (cm)	Total Horizontal (m)	Total vertical (m)	Average Hz	Average Vz	precision Hz	precision Vz
1	3.318	69.8	8.504	81.917	HF = 13.620	VB = 8.116	13.621	8.117	1/6810	1/1558
2	8.492	81.5	5.302	112.4	HB = 13.622	~~13.622~~ VF = 8.118				
3	6.810	160.5	4.816	117.3						

HF = Horizontal forward
HB = Horizontal backward
VB = vertical backward
VF = vertical Forward.

Indirect methode

No.	sloping distance (l)	Angle θ FW	Angle θ BW	Average	Horizontal distance l cosθ	vertical distance l sinθ	Total Horizontal (m)	Total vertical (m)
1	6.460	11°50'	11°50'	11.83	6.327	1.324	13.651	3.179
2	7.558	14°30'	14°30'	14.18	7.328	1.849		

CALCULATIONS

A. For horizontal distance on plane ground

Total forward distance (F.W) = 91.68m

Total backward distance (B.W) = 91.696m

Average distance = $\frac{F.W + B.W}{2}$ = 91.688m

Error = F.W − B.W = 0.016m

Precision = $\frac{\text{Error}}{\text{Average}}$ = 1:5730

B. For pacing

Average no. of pace = 41 (40.625)

Distance = 30m

Pace factor = $\frac{\text{Distance}}{\text{Average no. of pace}}$ = $\frac{30}{40.625}$ = 0.738

c) for distance measurement on slopy ground

Direct method

Total forward horizontal distance (HF) = 13.620 M

Total back-ward horizontal distance (HB) = 13.622 M

Total forward vertical distance (VF) = 3.118m

Total back-ward vertical distance (HB) = 3.116m.

Average horizontal distance (H) = 13.621m

error = 1/500

Precision = $\frac{\text{error}}{\text{avg}}$ = 1: 6810.5

Average vertical distance (V) = 3.117m

error = 1/500

precision = 1: 15585

Also

V:H = 1: 4.37

Indirect method

Total horizontal distance (H) = 13.6507m

Total vertical distance (V) = 3.1732m

V:H = 1: 4302

Result

From the survey of linear measurment the linear distance beth two post of football ground was 91.688m. And my pacing factor was found to be 0.738 meter per pace. our precision on linear distance measurement was found to be 1:5370 Also the horizontal and vertical distance measured in slopy ground was found to be 13.6507m and 3.1732m respectively.

Conclusion

The pratical task-linear measurment taught us to measure linear distance by ranging in plane ground (area) as well as in slopy area. The use of abney level instrument was also well known. we came to know about the measurement of vertical and horizontal distance by direct and indirect method. Which gave horizontal distance quite more similar but a bit more difference in vertical distance the source of which may be due to imporper handling of abney level.

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Thribhuvan University

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Survey Instruction Committee

Report on

Surveying Practical

Course Surveying II

CE – 504

CHAIN SURVEY

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Submitted to:

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TITLE: CHAIN SURVEY (TRIANGULATION AND DETAILING)

OBJECTIVES

- TO understand the basic terminology used in chain surveying
- TO know the basic principles of surveying
- TO prepare the plane in the scale
- TO be familier with different accessories used in chain survey

INSTRUMENT AND ACCESSORIES

- Chain - (1)
- measuring Tape (30m) - 1.
- measuring steel tape (3m) - 1
- Ranging Rods - (3)
- marking Arrows - (4)
- Plumb bob - (1)
- Hammer - (1)
- Pegs (6)

THEORY AND PRINCIPLE OF CHAIN SURVEY

Among the various methods of surveying, the commonly used method is chain surveying. For less precise works chain survey is used. The principle of chain surveying is to provide skeleton framework of straight lines which can be plotted to scale. If the length of these lines are predetermined either with a chain or a tape. The frame work mostly consists of triangles.

Technical terms and their short descriptions

1) main survey stations: The point where two sides of a main traingle meet is called a main survey stations. main survey stations is a point at either end of a chain line.

2) subsidary survey station!- It is also called tie station. The stations which are selected on the survey lines for running auxiliary lines, are called subsidary lines.

3) main survey lines!- The chain line joining the two main survey stations, is known as the main surrey line

4) Auxiliary lines!- The chain line joining two subsidary surrey surrey stations is auxiliary lines.

5) Base lines!- The longest of the main surrey lines is called base lines.

6) check lines!- The line which is run in the field to check accuracy of field work is check lines.

Offsets!-

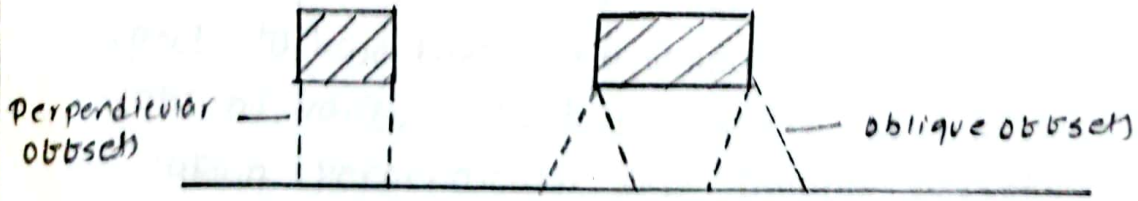
lateral measurements to chain lines for locating ground features are known as offsets. For this purpose perpendicular or oblique offsets are taken.

1) perpendicular offsets

The offsets which are taken perpendicular to chain lines are termed as perpendicular offsets.

(2) Oblique offsets

All the offsets which are not taken at right angle to Chain line is oblique offset.



field Book

The note book which chainages, offsets measurments and sketches of detail points are recorded is generally called a field book.

PROCEDURE

In chain surveying, following steps were carried out!

- Reconnaissance

The prelliminary inspection of area to be surveyed is called reconnaissance. The area to besurveyed was inspected. It was done just to place pegs and ensure the intervissibility of the survey lines.

- General or Index Sketch

After the completion of reconnaissance, theplot was roughly sketched in copy. This was done just to select exact point for stations and ensured working of survey smoothly

- marking stations.

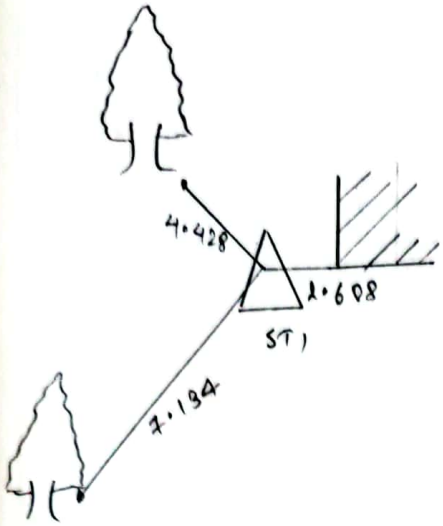
Stations were marked with ranging rods or wooden peg driving a nail or spikes if hard surface or embedding stone with cross mark.

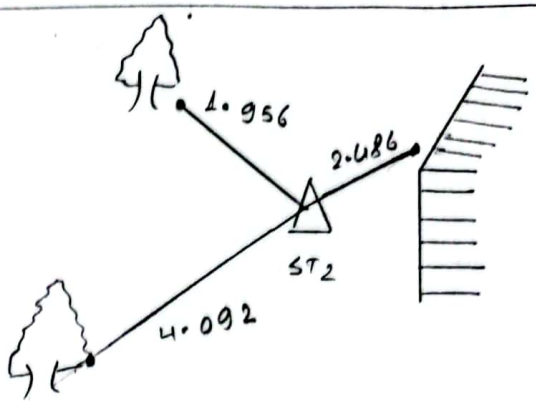
- Rebrence sketch.

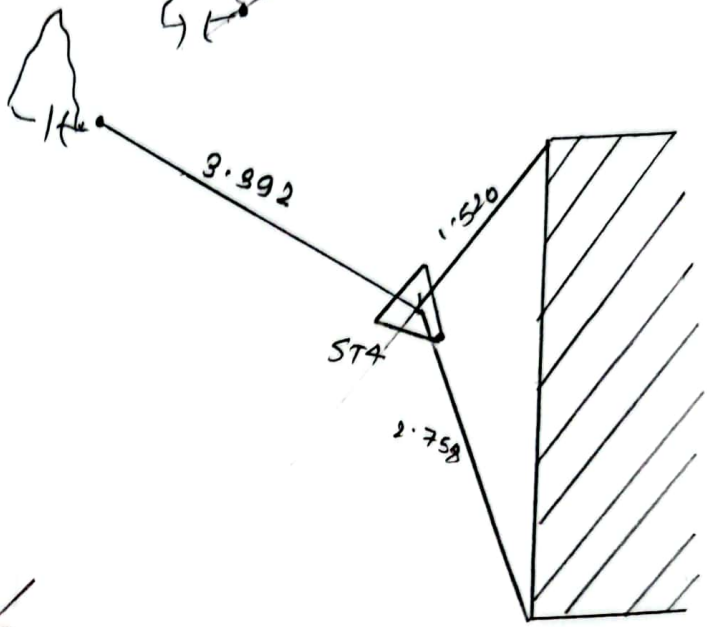
After marking, the stations were rebrenced (elocated by measurement called ties taken from 3 permenant points which were easily identified such as corner of building. Rebrence point were chosen in capital 'Y' shape.

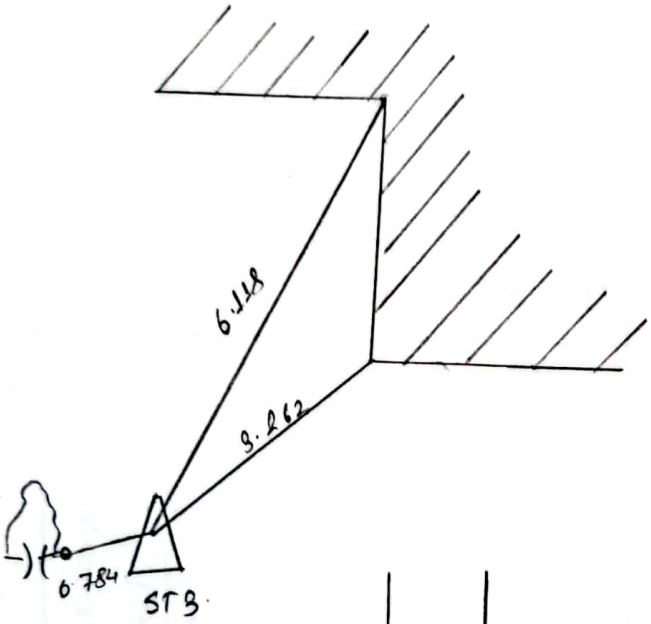
- Trangulation and Detailing

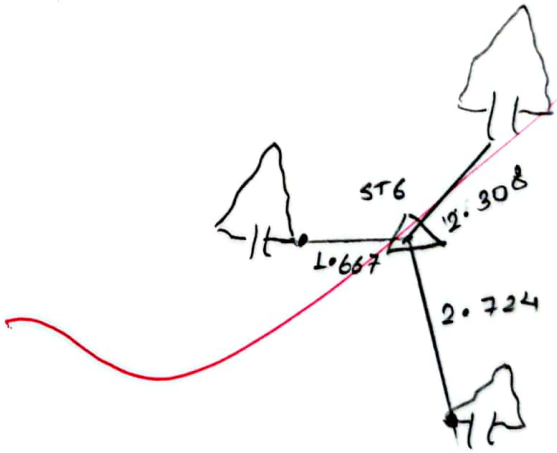
This is the last step of chain surveying. In this step first the main plot was divided into various trangles with respect to base line. Then following this we marked the details of various structures w.r.t chain or main lines. by taking perpendicular and oblique offset and also by measuring the linear distance of survey lines. In this way we can calculate area of plot.

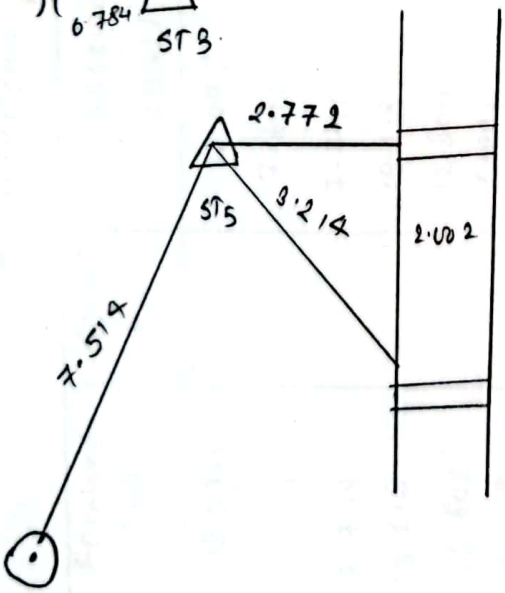


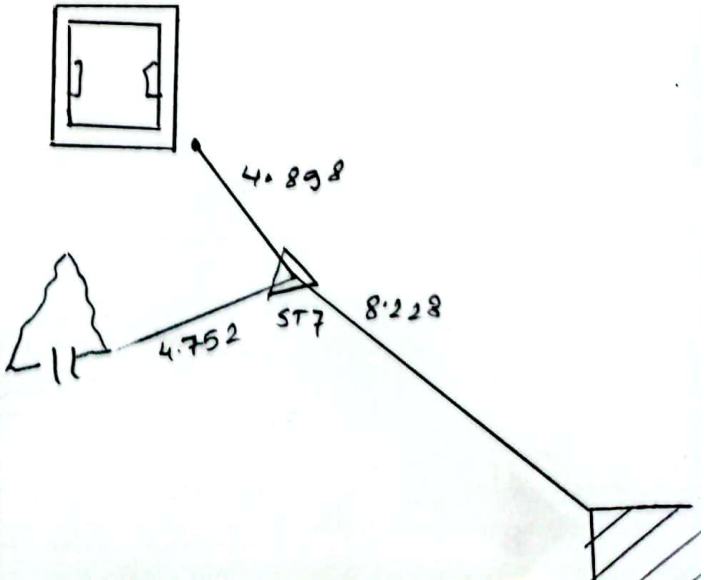












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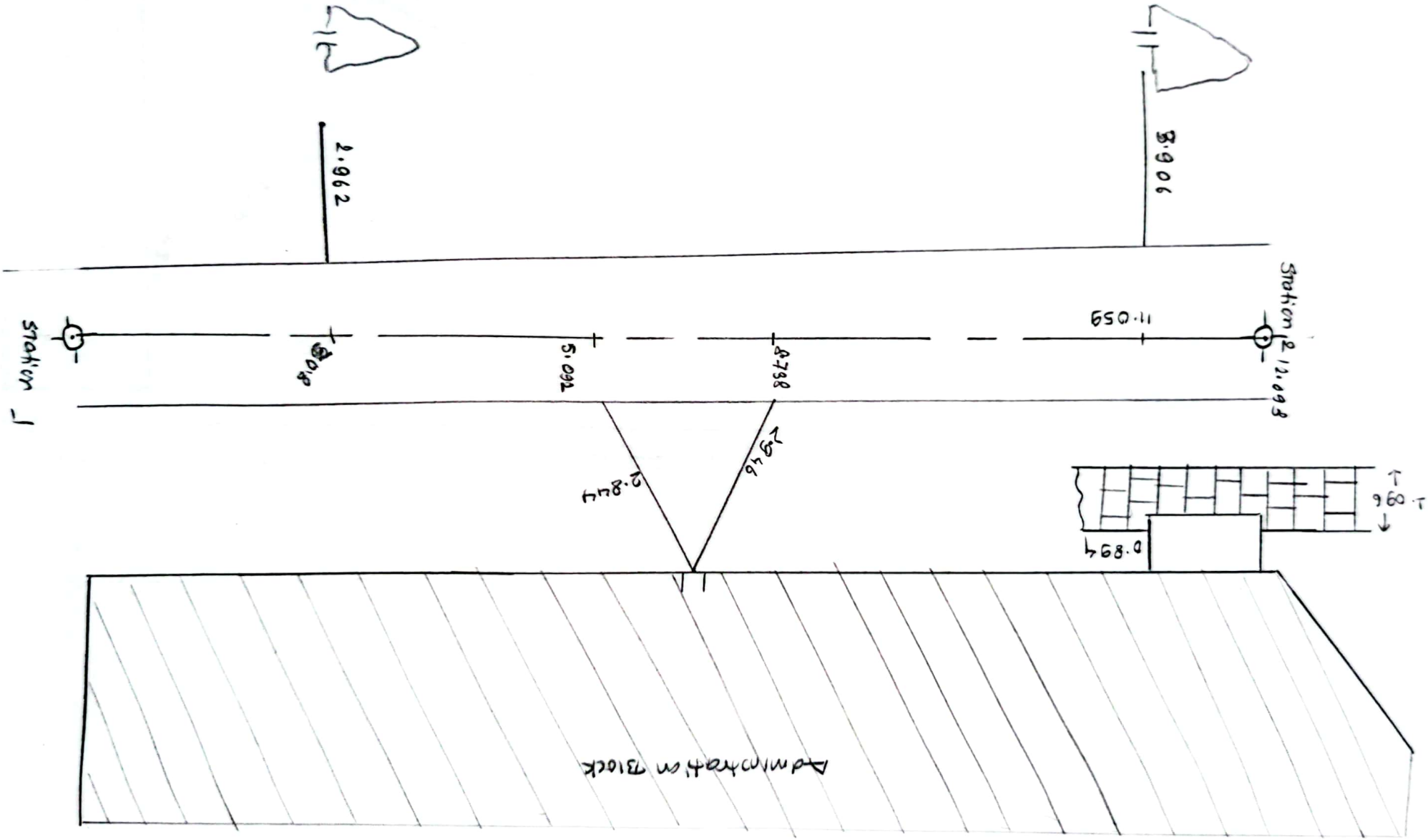
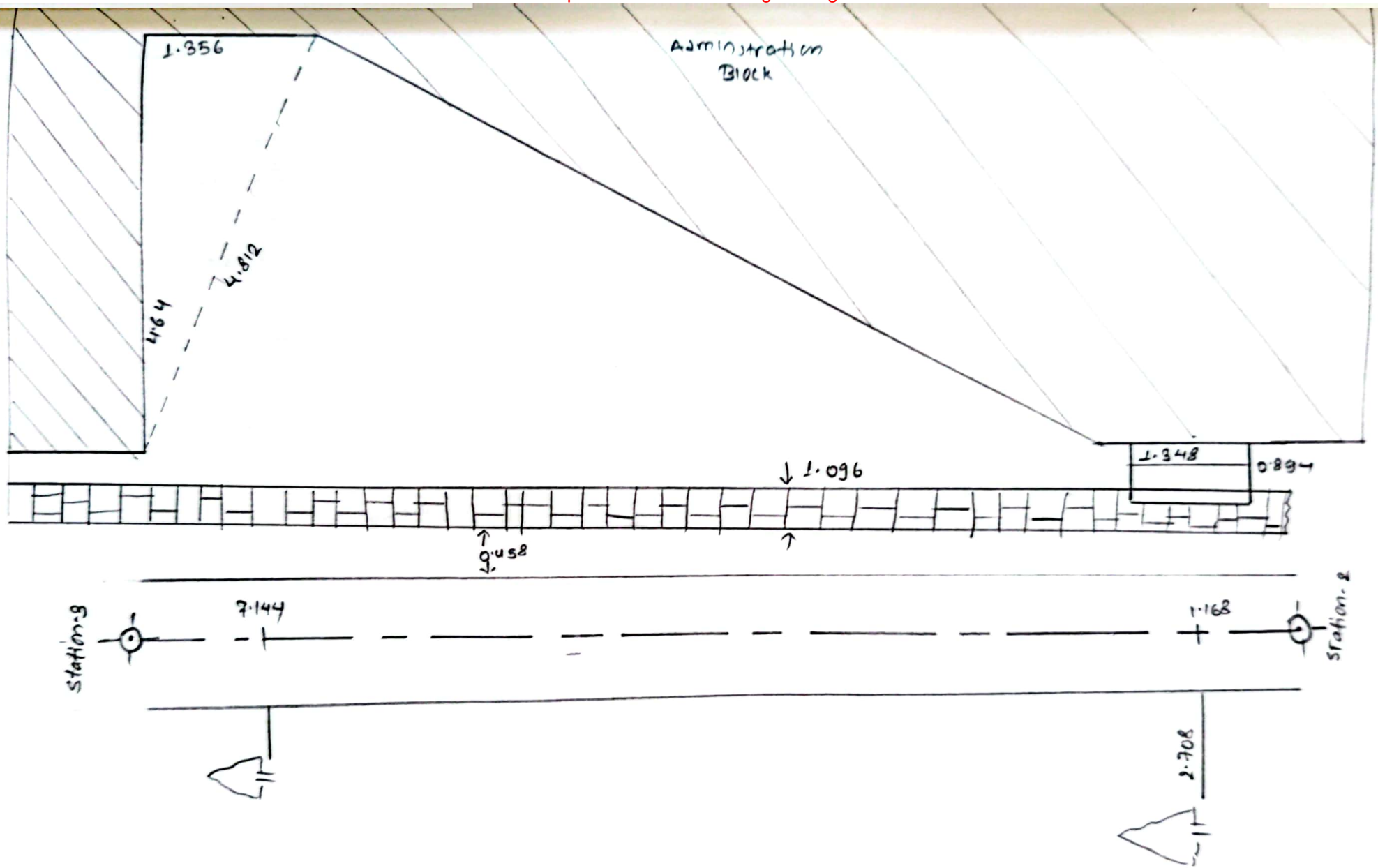
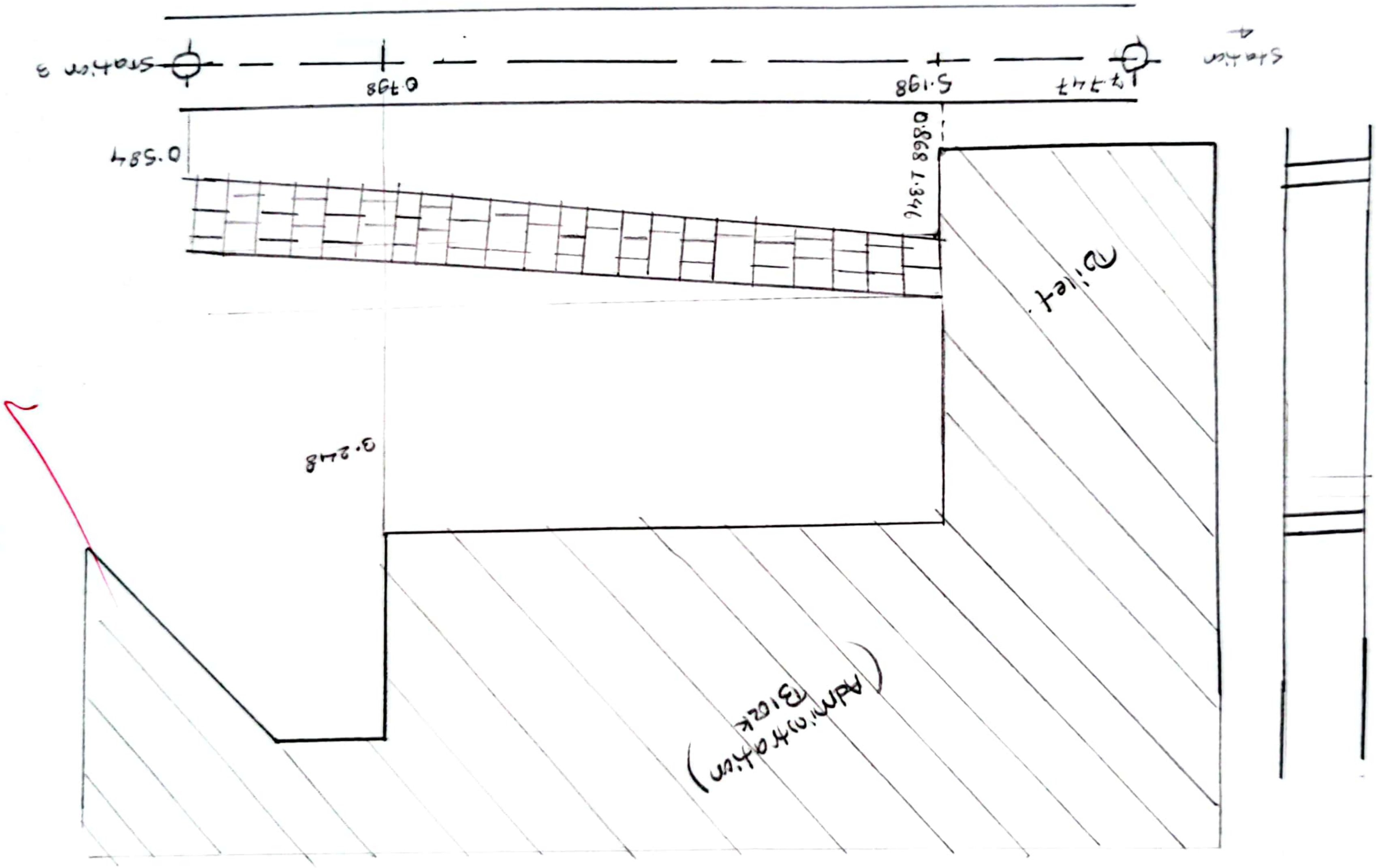
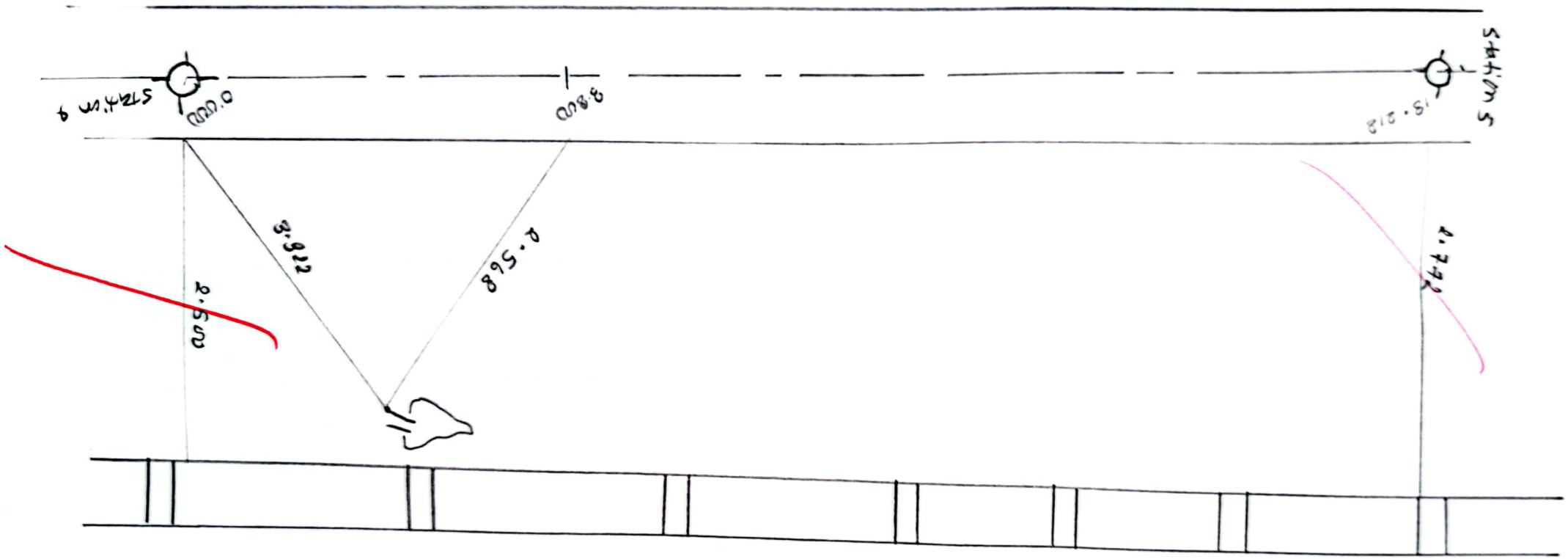
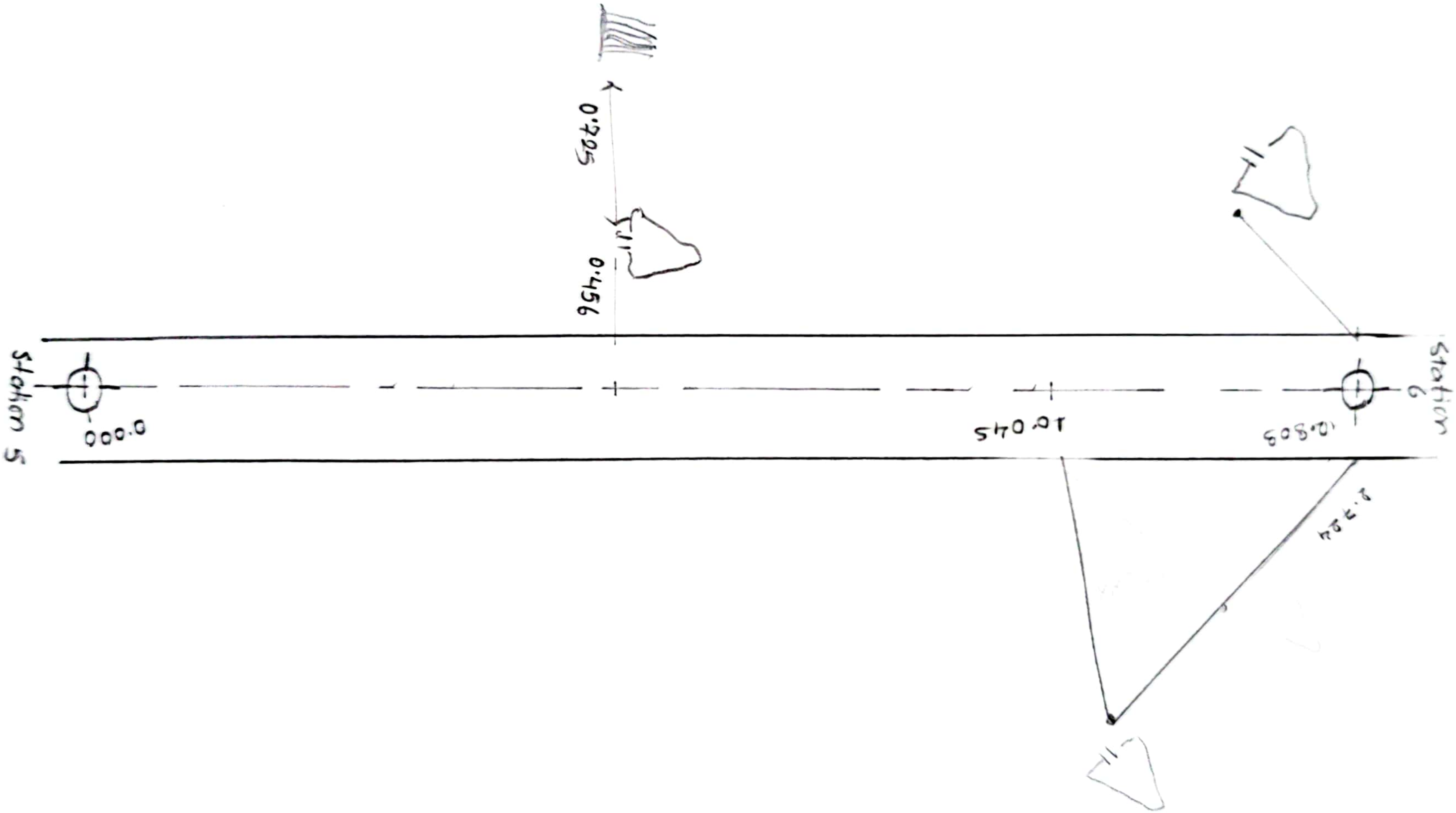
Line leg		Distance (cm)				Average (m)	Discrepancy (cm)	Precision Angle
From	TO	Forward (F.W)	Total FW	Backward (B.W)	Total (BW)			
1	2	12.094		12.092		12.093	0.002	6046:1
2	3	7.646		7.646		7.646	0.000	∞:1
3	4	7.748		7.746		7.747	0.002	3873:1
4	5	13.218		13.218		13.218	0.000	∞
5	6	12.802		12.804		12.803	0.002	6401:1
6	7	8.228		8.224		8.226	0.004	2056:1
7	1	10.590		10.592		10.591	0.002	5295:1



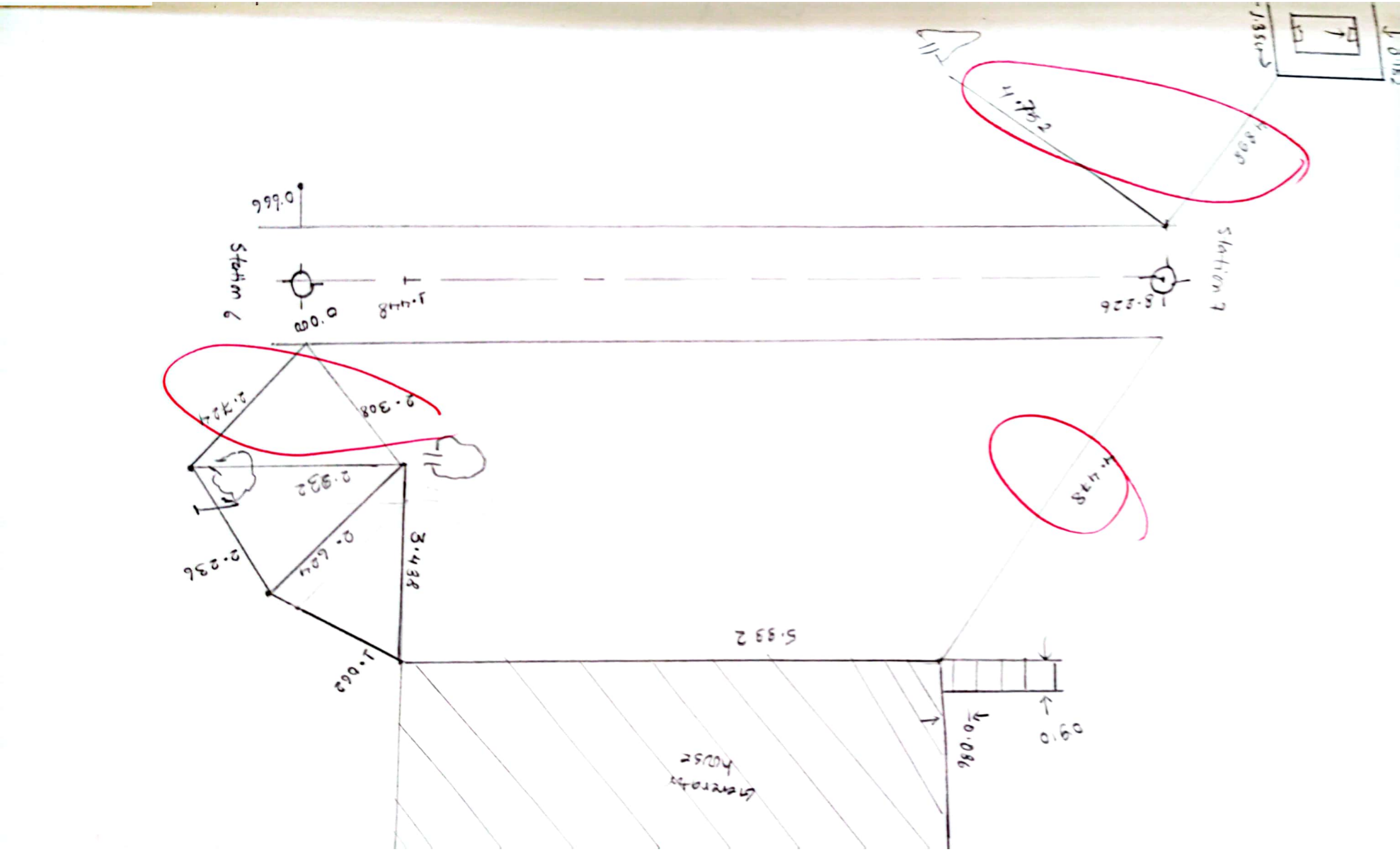


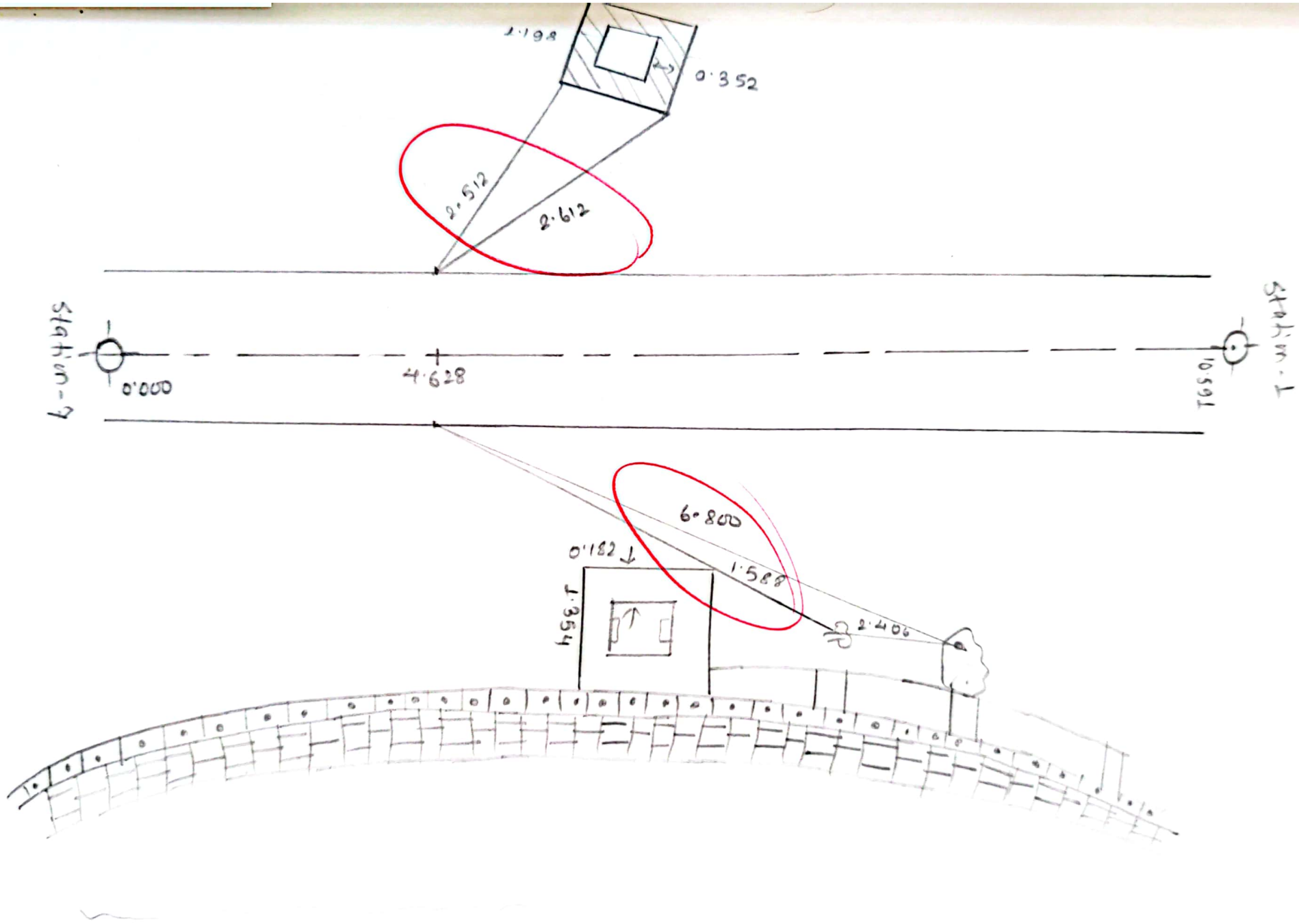


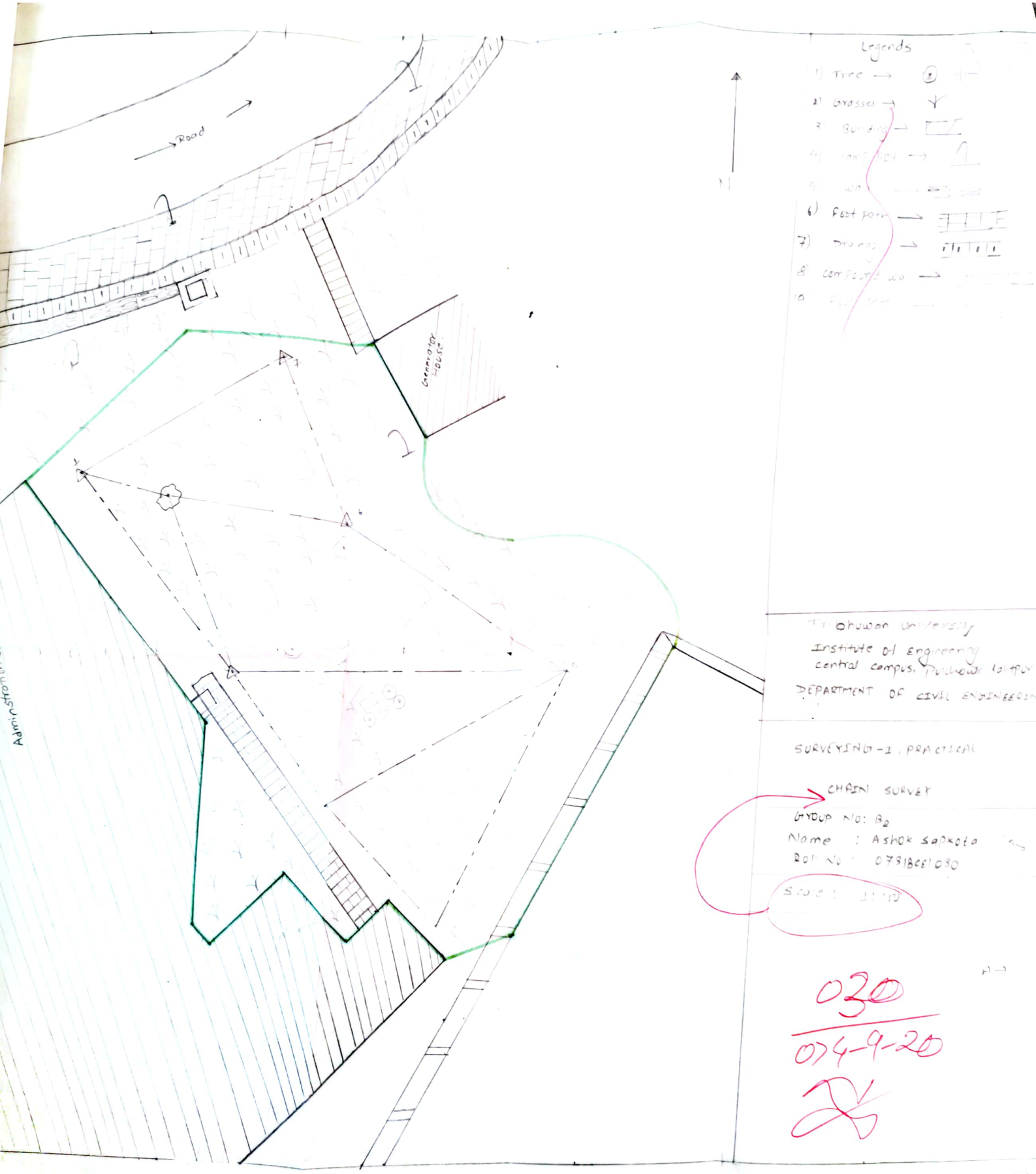




Station 5
0.000
0.456
0.725
10.045
10.808
2.724
Station 6







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Report on
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(3)

Course Surveying-I
CE - 504

Compass Surveying

11-29

Submitted by :-

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Submitted To :-

Class teacher :-

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TITLE: Compass Survey

OBJECTIVES

- To conduct traversing and detailing using Prismatic compass and by linear measurment
- To be familiar with the use and handling of prismatic compass

ACCESSORIES AND INSTRUMENTS REQUIRED

- Prismatic compass - 1
- measuring tape 30m - 1
- measuring tape 5m - 1
- ranging rod - 2
- Pole stands - 2
- Plumb bob - 1
- Wodden pegs - 4
- Hammer - 1

THEORY

Compass survey is the branch of surveying in which direction of survey lines are determined by a compass and their length by the linear measurement by chaining or taping directly on the surface of surface. In compass survey generally prismatic compass is preferred. The compass is preferred. The compass survey is mainly used for angular measurement of a large areas with rough ground having many details.

Traversing

Traversing is the framework consists of connected series of lines. The length is measured by tape or chain and the direction or angle by angle measuring instrument such as compass. Each point of tranverse line are known as traverse stations and straight line is transverse legs. Tranverse is used in anticlockwise direction for convenient.

i) Closed transverse.

It originates at a point of known position and close on another point horizontal position. This states " when a transverse originates from a known position and also terminates to known position then it is closed traverse.

a) Closed loop transverse

If the originating and terminating points are same

b) Open loop Closed transverse

A closed traverse that originates from a known point and terminates to another known point.

ii) Based on the direction

Any straight line has two dimentially opposite directions. The direction in which a survey ~~bo~~work is proceeded is forward direction & opposite direction is backward direction.

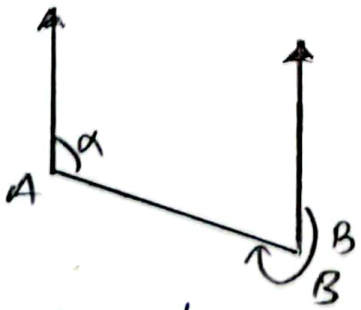
a) Fore bearing

The bearing of line measured in forward direction

b) Back bearing

The bearing measured in backward direction.

$$F.B = B.B \pm 180^\circ$$

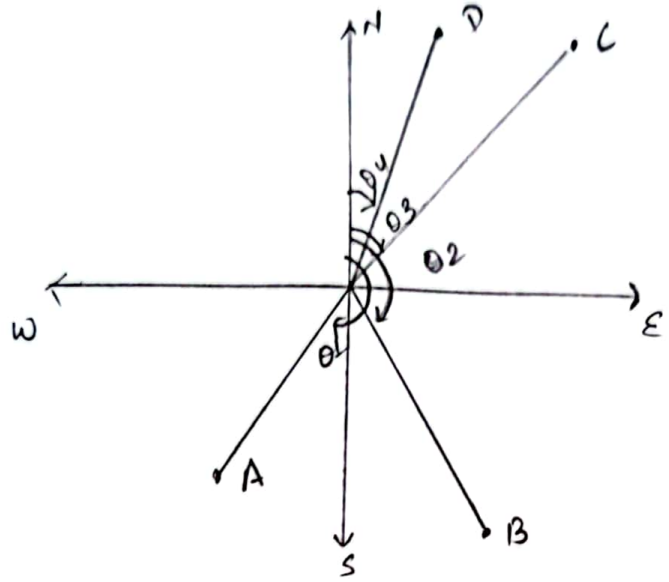


α is F.B of AB
β is BB of AB

Designation of Bearing

The angle representing bearing is designated depending on the measurment of angle either in clockwise & anticlockwise direction measured from north or south limb whichever provides minimum angle

It takes place from 0 to 360°



In the above figure

OA is WCB = θ_1

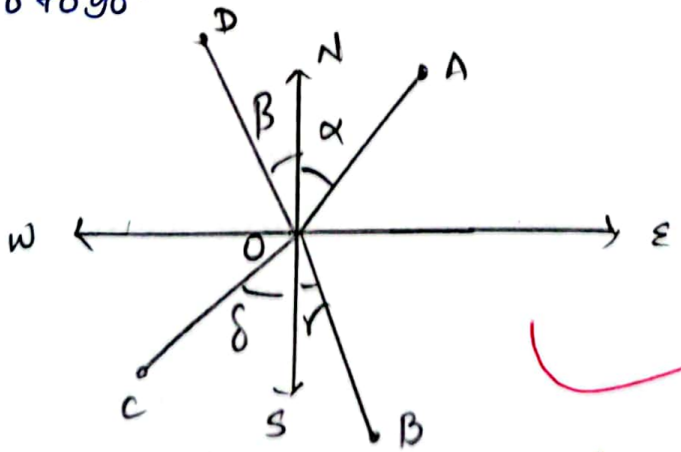
Whole circle bearing of line OB = θ_2

" " " " OC = θ_3

" " " " OD = θ_4

ii) Quadrantal or Reduced bearing

Reduced bearing of a line is defined by the acute angle which the line makes with the meridian. Thus it depends on the quadrant in which the line presents. It is measured in clockwise or anticlockwise direction either from North or from South limb of the meridian, whichever is nearer and thus provides minimum angle. It varies betn 0 to 90.



RB of OA = N α E

" " OB = S γ E

" " OC = S δ W

RB of OD = N β W.

Bearing measuring instrument

Prismatic compass is used for the measuring purpose of bearing it is a navigation and surveying instrument, which is extension used for determining direction for calculating bearing of survey lines and included angles between them. The compass is generally used to run a traverse line. The compass calculates bearing of lines with respect to magnetic north for each survey line in the traverse; we take two bearings that are F.B & B.B which should exactly differ by 180°

It is called so, because it essentially consists of Prism which is used for taking observations more accurately. The prismatic compass can read only those observations which are multiples of 30 minutes.

ii) Surveyor compass

It is an instrument for determining the horizontal direction of line with reference to the direction of magnetic needle.

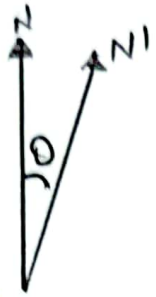
iii) Bruton compass

Unlike most modern compasses the Brunton pocket transit utilizes magnetic introduction dumping rather the fluid to damp needle oscillation. It is a specialized instrument used widely by those needing to make accurate degree of angle measurements.

Local Attraction

In presence of magnetic material such as electric poles heavy ironed material, raised windows and doors the magnetic needle deviates from the magnetic meridian and thus provides wrong directions of line. The deviation arising from such local sources is local attraction.

If the F.B and B.B of line doesn't differ by 180° then there is possibility of local attraction during observation of line.



Error due to local attraction.

PROCEDURE:

i) At first reconnaissance of the given area was done & rough sketch was prepared

ii) Station points were determined and wooden pegs were inserted.

iii) Referencing of stations was done along with the two ways taping of stations

iv) Bearing of area was done from the such stations with help of compass & measuring tape.

v) Interior & exterior angles were determined & errors were calculated correcting the bearing later.

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Calculation:-

Calculations of bearing for local attraction (included angle method)

1) Calculation of included angles and correction

S'N	Angle = BB of previous line - FB of next line	correction	Corrected angle
1)	$\angle A = 198°00'00'' - 329°30'00'$ $= -131°30'00''$ (int) $= 131°30'00''$ (int)	$0°25'00''$	$131°35'00''$
2)	$\angle B = 148°30'00'' - 288°00'00''$ $= 134°30'00''$ (int)	$0°25'00''$	$134°55'00''$
3)	$\angle C = 103°30'00'' - 191°30'00''$ $= 88°00'00''$ (int)	$0°25'00''$	$88°25'00''$
4)	$\angle D = 120°00'00'' - 109°00'00''$ $= 136°00'00''$ (int)	$0°25'00''$	$136°25'00''$
5)	$\angle E = 329°30'00'' - 89°30'00''$ $= 120$ (int)	$0°25'00''$	$120°25'00''$
6)	$\angle F = 271°30'00'' - 19°00'00''$ $= 107°30'00''$ (int)	$0°25'00''$	$107°55'00''$.
	Σ Internal angle $= 717°30'00''$	$\Sigma e = 2°30'00''$	$\Sigma\theta = 720°00'00''$

Angular misclosure (e) = Observed sum - Theoritical sum

$= 717°30'00'' - 720°00'00''$

$= -2°30'00''$

$= 2°30'00''$ (+ve error)

Correction in each angle $= \frac{2°30'00''}{6} = 0°25'00''$ (+ve correction)

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Error Adjustment

By observing it is found that CD has the least difference from 180° in its FB and BB, so first all error is distributed equally in its FB and BB

Difference = 191° 30' 00" - 12° 00' 00"

= 179° 30' 00"

error = 179° 30' 00" - 180° 00' 00" = -00° 30' 00" (-ve error)

correction must be positive.

Corrected FB of CD = 191° 30' + (0° 30')/2 = 191° 45'

And corrected BB of CD = 191° 45' - 180° 00' = 11° 45' 00"

Angular precision

$\propto c\sqrt{N}$

least count of compass = 0° 30' 00"

N = 6

Now $0° 30' 00" \times \sqrt{6} = 1° 13' 29.08" < e$.

Calculation of corrected bearing of the lines.

S.N	line	FB = corrected FB of pr line + (clockwise angle) ± 180° - 540°	BB	Difference
1	DE	(191° 45' + 136° 25') - 180° = 148° 10'	328° 10'	180°
2	EF	(148° 10' + 120° 25') - 180° = 88° 35'	268° 35'	180°
3	FA	(88° 35' + 107° 55') - 180 = 16° 30'	196° 30'	180°
4	AB	(16° 30' + 131° 55') + 180 = 328° 25'	148° 25'	180
5	BC	(328° 25' + 134° 55') - 180 = 283° 20'	103° 20'	180
6	CD	(283° 20' + 88° 25') - 180 = 191° 45	11° 45'	180°

Correction of bearing for Local attraction (FB and BB method)

In this method the correction of each station is found from the FB and BB. reading the FB of CD is adjusted such that their difference is 180°. Now there is no local attraction at both the end stations of the CD line. All the bearings taken at these stations will be free from local attraction and are therfore correct. As the FB and BB of CD are made to differ exactly by 180° the station C and D are free from local attraction.

FB of line CD = 191°30'

BB " " CD = 12° 00'

Difference = 179°30'

The difference is nearest to 180° the 30' is adjusted by distributing it in FB and BB so,

Corrected FB of line CD = 192°25'

" BB of line CD = 12°15'

As CD is considered free from local attraction, the bearings of other lines are adjusted likewise. The back bearing (BB) of line BC and fore bearing of line DE is also correct. The B.B of line DE is adjusted 149°00' + 180°00' = 329°00'. As the measured bearing of the line DE 329°30', there is an error of +30' a correction of -30' is to be applied to all the bearing taken at E.

Likewise the F.B of line BC should have been 103°30' + 180° = 283°30' where as the measured value is 283°00' There is an error of -30' at B and correction of +30' is to applied to all the bearing taken at B.

B'B of line AB = 148°30' + 30'

= 149° 00' 00"

In this way, the observed bearing are corrected by finding out the error at each station and applying correction to all the bearing taken at one station is correct.

The observed long bearing and their corrections done in the table book provided.

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Pulchowk Campus
DEPARTMENT OF CIVIL ENGINEERING
Survey Instruction Committee

Observer :
Recorder :
Instrument :

Linear/Distance measurement by Taping

Weather :
Temperature :
Date :

Line/Leg		Distance (m)				Average (m)	Discrepancy (e)	Precision (average/e)	Remarks
From	To	Forward (FW)	Total FW	Backward (BW)	Total BW				
A	B	18.192		18.182		18.186	0.009	1: 2273	
B	C	43.990		43.97		43.980	0.02	1: 2199	
C	D	29.198		29.192		29.195	0.006	1: 4866	
D	E	31.648		31.654		31.651	0.006	1: 5275	
E	F	35.208		35.214		35.211	0.006	1: 5868	
F	A	33.460		33.446		33.453	0.014	1: 2389	

3

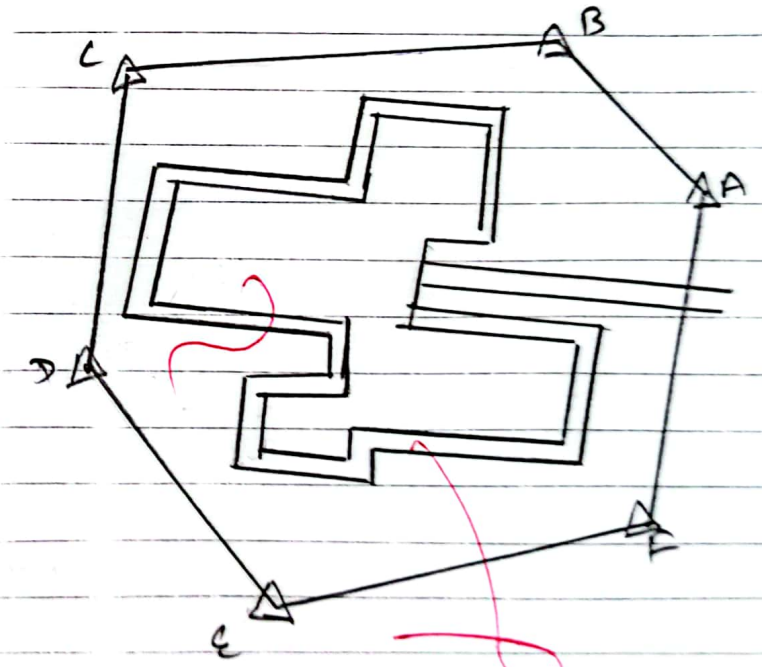
Institute of Engineering
Central Campus, Pulchowk, Lalitpur
DEPARTMENT OF CIVIL ENGINEERING
Survey Instruction Committee

Observer : _____
Recorder : _____
Instrument : _____

Weather : _____
Temperature : _____
Date :- _____

DETAILING BY PRISMATIC COMPASS

Sighted to		Distance (m)	Bearing Observation			Remarks/Detail Sketch
From	To		Fore Bearing (F.B.)			
			d	m	s	
11	12	3.540				
12	13	4.08				
13	14	12.45				
14	15	12.408				
15	16	3.560				
3	17	0.600				
18	19	3.000				
25	26	6.000				
21	22	2.880				
22	23	4.54.				



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DEPARTMENT OF CIVIL ENGINEERING
Survey Instruction Committee

07408928

Observer : .....
Recorder : .....
Instrument : .....

Weather : .....
Temperature : .....
Date :- .....

DETAILING BY PRISMATIC COMPASS

Sighted to		Distance (m)	Bearing Observation			Remarks/Detail Sketch
From	To		Fore Bearing (FB)			
			d	m	s	
C	9	11.530	179	30	00	
F	1	4.390	358	00	00	
D	10	4.274	51	30	00	
C	20	9.000	158	00	00	
E	21	2.800	70	00	00	
E	22	2600	26	30	00	
8	9	24.4				
7	8	11.30				
6	7	10.45				
5	6	16.30				
4	5	3.734				
3	4	7.34				
2	3	24.80				
1	2	14.83				
10	11	16.240				

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DEPARTMENT OF CIVIL ENGINEERING
Survey Instruction Committee

07408.28

Observer : _____
Recorder : _____
Instrument : _____

Weather : _____
Temperature : _____
Date : _____

COMPASS TRAVERSE FIELD BOOK

Trv Line/Leg		Leg Dst (m)	Bearing Observation						Discrepancy FB - BB=180			Correction			Corrected Bearings						Remarks
			Fore Bearing (FB)			Back Bearing (BB)									Fore Bearing (FB)			Back Bearing (BB)			
From	To		d	m	s	d	m	s	d	m	s	d	m	s	d	m	s	d	m	s	
A	B		329	30	00	148	30	00	181	00	00	1	00	00	329	00	00	149	00	00	
B	C		283	00	00	103	30	00	179	30	00	00	30	00	283	30	00	103	30	00	
C	D		191	30	00	12	30	00	179	30	00	1	30	00	192	15	00	12	15	00	
D	E		149	00	00	329	30	00	180	30	00	00	30	00	149	00	00	329	00	00	
E	F		89	30	00	271	30	00	182	00	00	3	00	00	89	00	00	269	00	00	
F	A		19	00	00	193	00	00	179	00	00	4	00	00	16	30	00	193	30	00	

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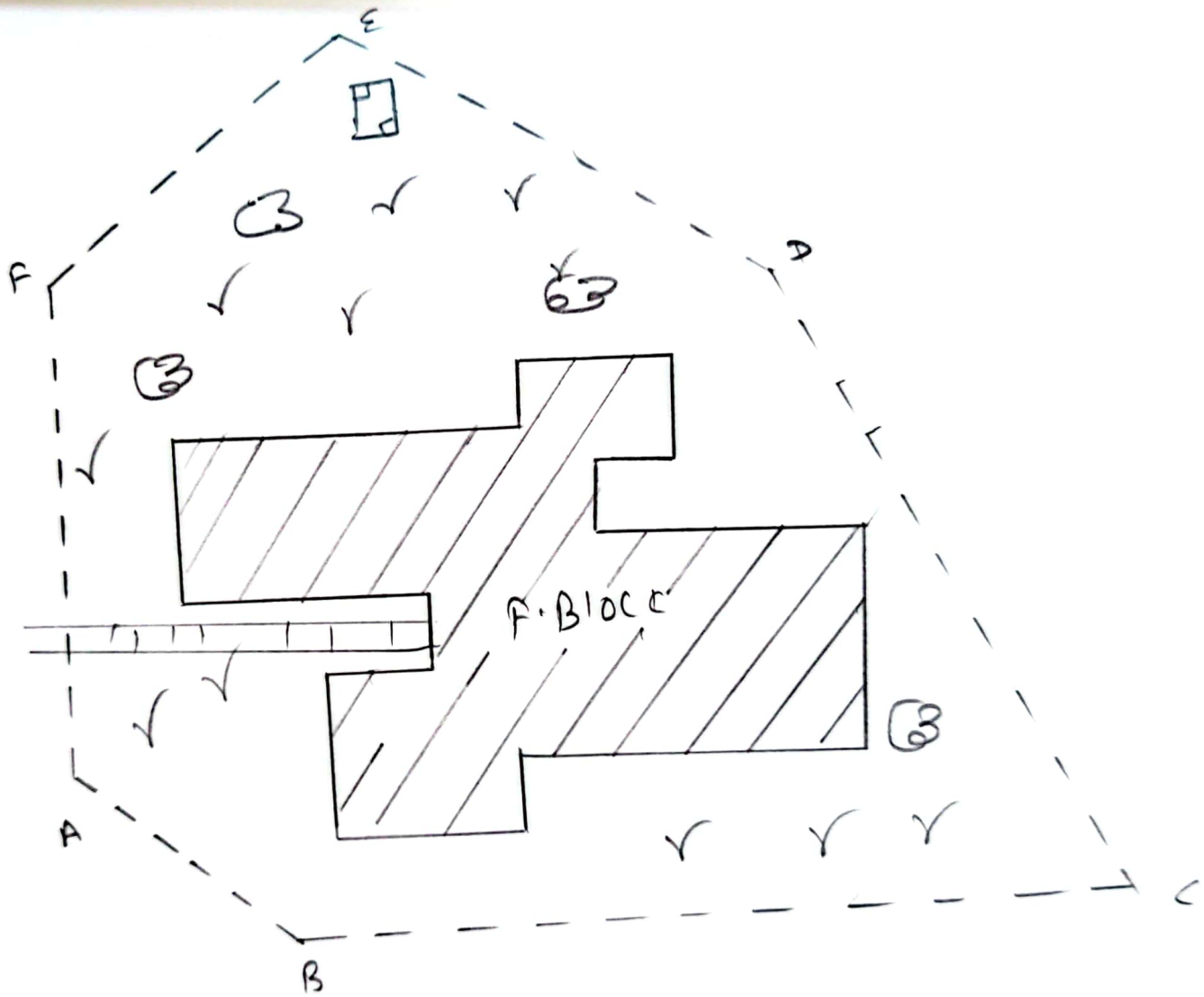

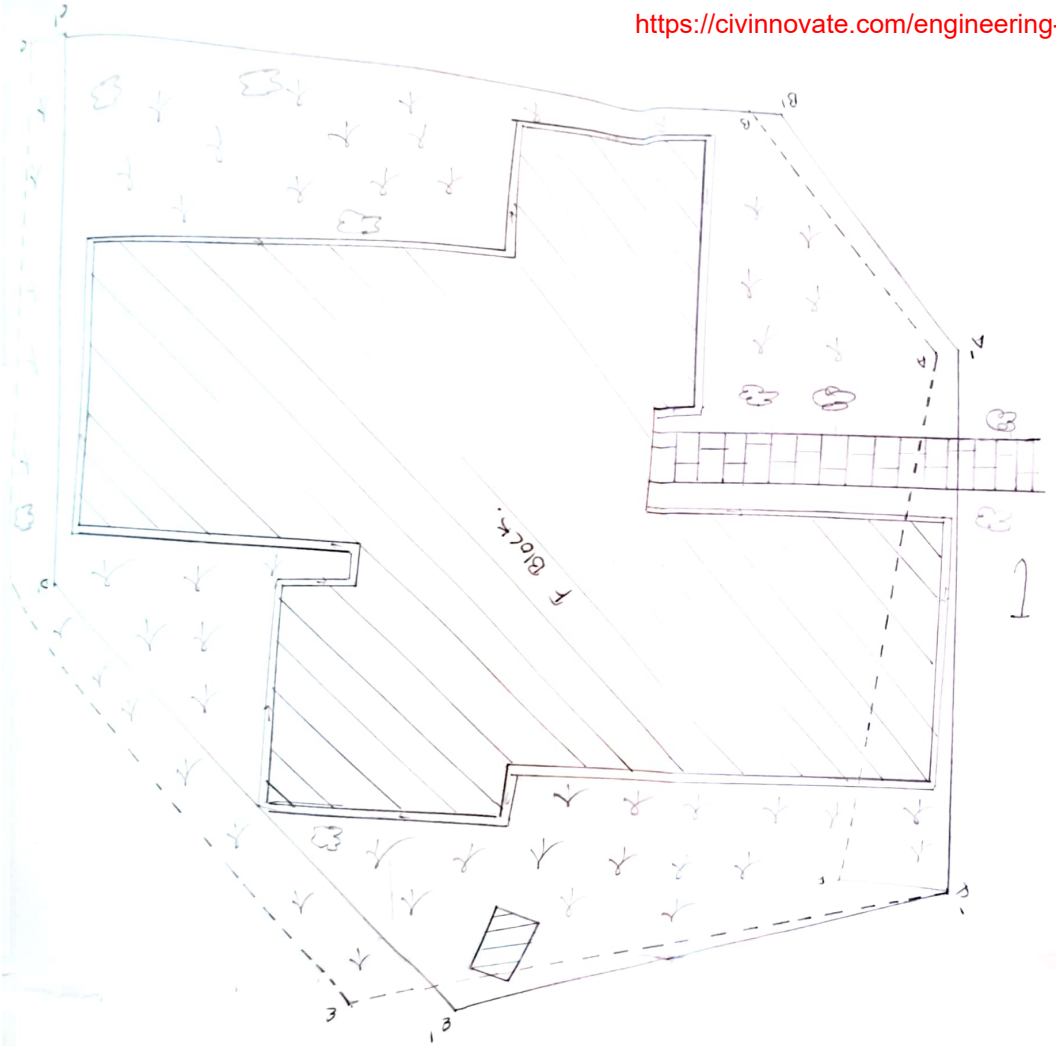

LEGENDS

Symbols	Name
	tree
	Footpath
	lamp
	Building
	Grass

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Institute of Engineering
Central campus pulchowk
Department of Civil Engineering
Survey instruction committee

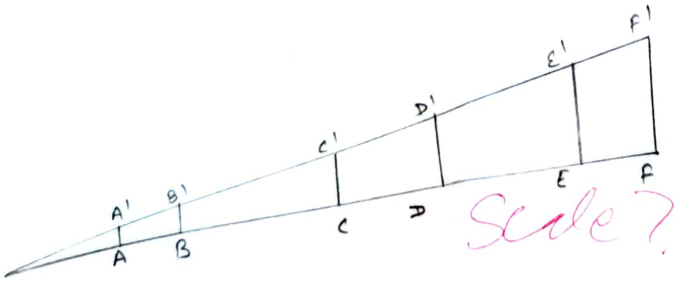
Survey - I practical

Compass Survey

Name: Ashok Sapkota Group No-B2
Roll no: 078BCE030

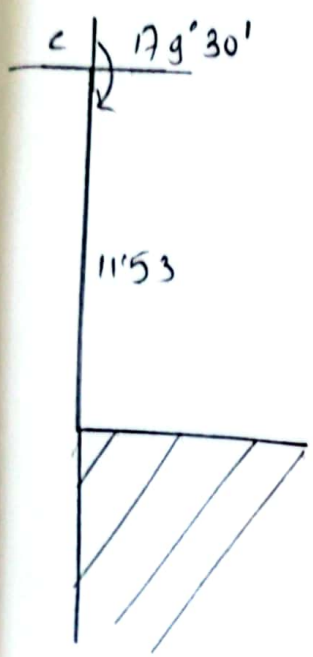
Scale : 1:200

030

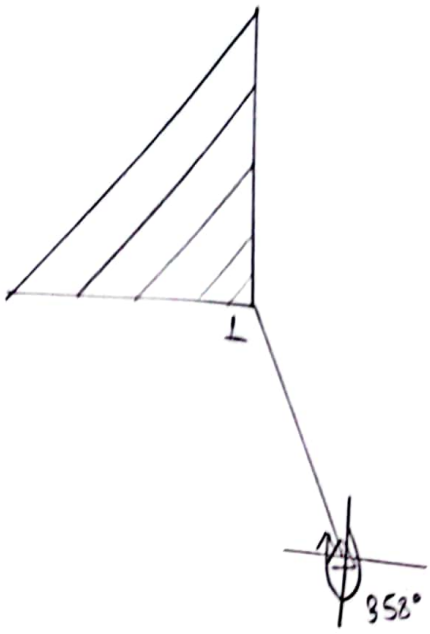


Scale?

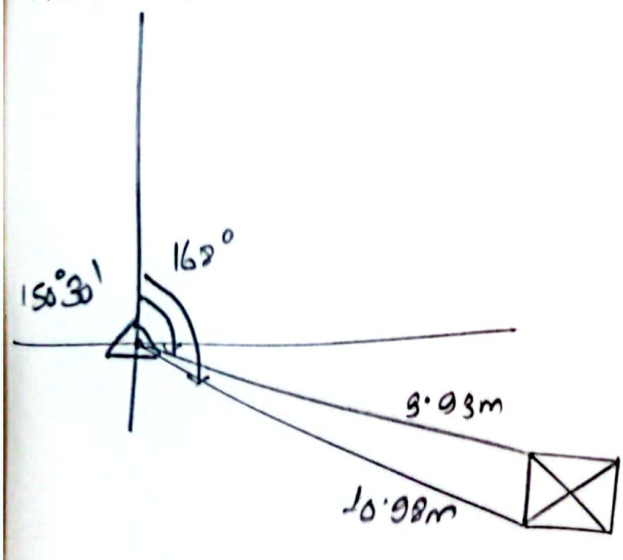
Station C



Station E



Station E.



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CONCLUSION AND DISCUSSION

Hence, from this practical we are able to plot the plan of given area using compass surveying technique using prismatic compass and tape. The distance between the stations was measured under the precision level of 1:1000 The angular precision from the data we collected was not in the precision range which may be due to mishandling and backlash error of the instrument.

Precautions:-

1) The compass should be used in places where the compass needle can rotate freely
2) The stations should be choosen such that there are no huge structures
3) Reducing should be taken carefully
4) Bearing should be corrected if necessary.

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Basic Sketch → ? (4)

XS sketch only / Chainage?

XS plot Chainage HPE

RL = ?

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Central Campus, Pulchowk

DEPARTMENT OF CIVIL ENGINEERING

Survey Instruction Committee

Report on

Surveying Practical

030

07-11-13

Course Surveying-I

CE – 504

Compiled report on

Leveling

By

Submitted by:

Group No. : B-2

Roll No : 073-BCE-030

Nam:Ashok sapkota

Submitted to:

Survey Instruction Committee

Department of Civil Engineering

Central Campus, Pulchowk

https://civinnovate.com/engineering-notes/

TRIBHUWAN UNIVERSITY

INSTITUTE OF ENGINEERING

CENTRAL CAMPUS PULCHOWK

REPORT ON

SURVEYING PRACTICAL

COURSE : SURVEYING-I

CE-504

Title:TWO PEG TEST

Submitted by:Submitted to:

Group No :B2

Roll No: 073-BCE-030

Name :Ashok Sapkota

Survey Instruction Committee

Department of Civil Engineering

Central Campus Pulchowk

TITLE:- Two Peg test and collimation check

-OBJECTIVE:-

i) To enable the proper handling of the level instruments and other necessary accessories
ii) To detect the collimation error by two peg method
iii) To adjust the collimation error

- INSTRUMENTS AND ACCESSORIES

1) level (1)
2) Tripod (1)
3) levelling staff (2)
4) Ranging Rods (2)
5) wodden Pegs (2)
6) measuring Tape (30) -1
7) Binding Rope (2)
8) Hammer (1)

TERMINOLOGIES

1. level surface: The surface which is parallel to the mean spheroidal surface of the earth, is known as level surface Everypoint on this surface is equidistant from the centre of the earth. It is also normal to the plumb line at every point. The surface of still water in a lake represents a level surface.

2. level line:- A line joing on the level surface, is known as a level line. Every point of a level line is equidistant from the centre of earth

3. Horizontal surface:- A surface tangential to the level surface is known as horizontal surface and any line present in the horizontal surface is called horizontal line. It is perpendicular to the gravity or plumb line.

4) vertical plane, vertical line and vertical angle
The plane which contains all the gravity or plumb line is called vertical plane. And the line that lie on vertical plane or the gravity or plumb line are the vertical line. The angle between an inclined line and horizontal line at a place in a verticle plane is verticle angle

5) Datum Surface: The imaginary level surface with refrence to which vertical distances of the points (above or below) are measured is called datum surface

6) Mean sea level datum:- The mean sea level datum obtained by marking hourly observations of the tides at any place over place a period of 19 years is known as MSL.

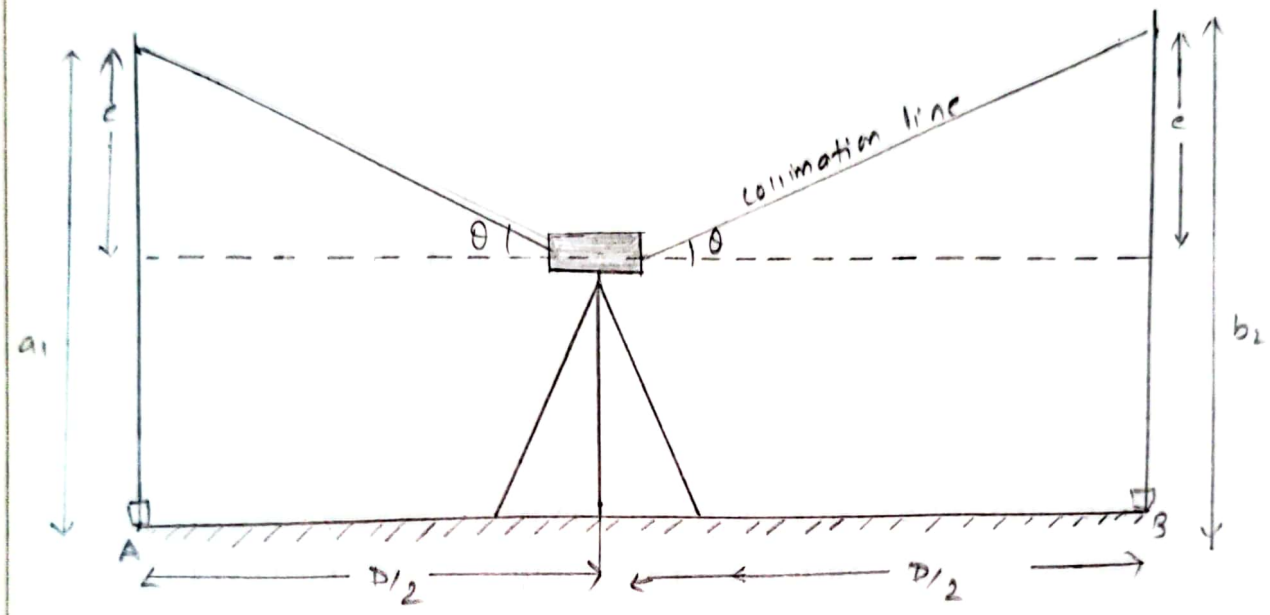
7) Reduced level (R.L) : The height or depth of a point above or below the assumed datum is called reduced level (R.L) It is also known as the elevation of the point, elevations of the points below the datum surface, are known as -ve elevation)

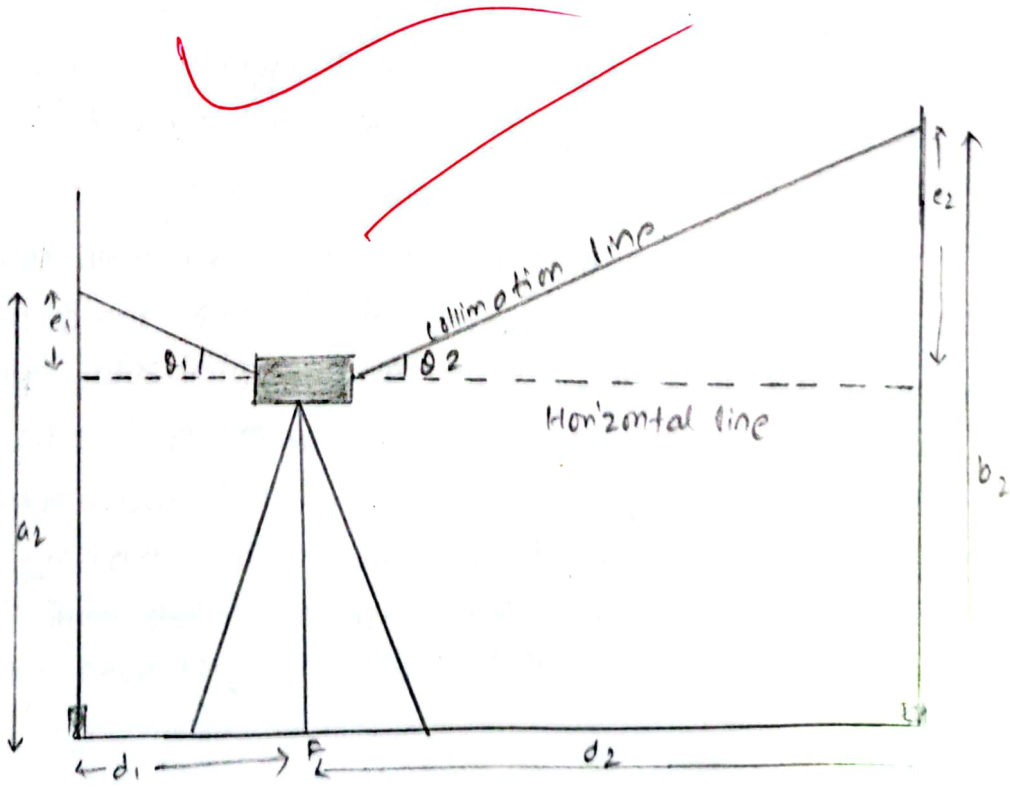
8) line of sight:- The line passing through the optical centre of the objective, traversing the eye piece and entering the eye, is known as a line of sight

9) line of collimation: The line passing through the optical centre of the objective and the point of the eye piece and its continuation, is called line of collimation. And the plane in level is rotated about its vertical axis is known as plane of collimation.

Two Peg test

If the line of collimation and the line of sight do not coincides then error in reading of levelling staffs is occured which is called collimation error. The method of detection of this error by using two pegs on line more or less levelled ground is called two peg test.





When level is at middle of two stations,

The error in both side of observation is almost equal and is given by $e = D/2 \tan\theta$

So, true height measured on the levelling staffs are $a_1 - \frac{D}{2}\tan\theta$ and $b_1 - \frac{D\tan\theta}{2}$ so the true height between this two station is given by $H = a_1 - b_1$.

When level is near one station then,

Error in near station, $e_1 = d_1 \tan\theta_1$

" " far station, $e_2 = (D - d_1)\tan\theta_2$

Height difference of two points is given by;

$$H_2 = (a_2 - d_1\tan\theta_1) - (b_2 - (D - d_1)\tan\theta_2)$$

$$H_2 = a_2 - b_2 - d_1\tan\theta_1 + (D - d_1)\tan\theta_2$$

Actually the height difference between those two stations should be equal in both the cases but due to the collimation errors they are not equal. So, this error should be adjusted.

Procedure

- A peg was first fixed and another peg was fixed 80m away from another peg. Then a mark was made at 15m from the peg. Then two ranging rods were kept just behind the pegs vertically.
- Then the levelling staffs was kept just above the pegs and it was done by tieing with ranging rods
- Level was first set at the midway. To set the level, at first tripod was setup and was made approx horizontal by balancing the legs. Then the level was setup horizontal and bubble was balanced at the centre of the circle Then the eyepiece was focused and objective was focused at staff. Then after focusing the crosswire reading is taken And, finally necessary computation was done

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Tribhuvan University/Institute of Engineering
Central Campus, Pulchowk, Lalitpur
Department of Civil Engineering/Survey Instruction Committee

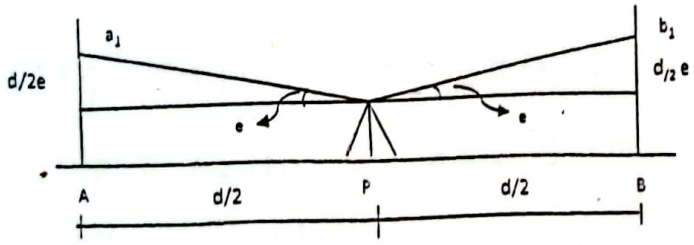
Group No.: B2 **Two Peg or Collimation Test** Date:
Observer : Location: Pulchowk Campus
Recorder : Weather : Sunny
Instrument/Code No. : 4600 Temperature :

When instrument is at midway of two pegs,

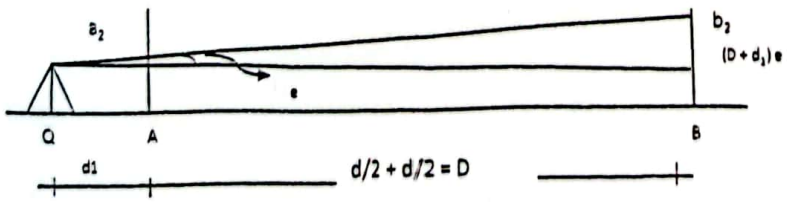
Instrument at	Sighted to	Three Wire Readings			Mean Value = (T+M+B) ÷ 3	True Difference h1 = (Mid A - Mid B)	Remarks
		Top	Mid	Bot			
P	A	1.340	1.265	1.690	1.2650	0.116	
	B	1.455	1.381	1.305	1.3803		

When instrument is at near one peg

Instrument at	Sighted to	Three Wire Readings			Mean Value = (T + M + B) ÷ 3	Apparent Difference h2 = (Mid A - Mid B)	Remarks
		Top	Mid	Bot			
Q	A	1.443	1.368	1.294	1.368	0.115	
	B	1.558	1.483	1.408	1.483		



Note: Compare Mean Value with Middle wire reading which should be within tolerance ± 1 mm.



True difference, h1 = (a1 – b1) . . . . . (1) 0.116m

Apparent difference, h2 = (a2 – b2) . . . . . (2) 0.115m

Collimation error, e = |(h1 – h2) ÷ (d/2 + d/2)| 0.001 m

Precision = 1/D/e ≥ 1 in 10,000

Obtained Precision = 1/D/e = $\left(\frac{1}{0.001}\right)$ = 1:241000

computation:

when instrument is set at one

staff reading at point A (a_1) = 1.265m

" " " " B (b_1) = 1.381 m

∴ True height difference = 1.381 - 1.265

= 0.116m

when instrument is 3m from point B

staff reading at point A, (a_2) = 1.368m

" " " " B, (b_2) = 1.483 m

Height diff (h_2) = 0.115m

As $h_1 \neq h_2$ so, collimation error is present

collimation error (e) $= h_1 - h_2$

$= 0.116 - 0.115$

$= 0.001$ m

Adjustment

~~For 24m diff tance error = 0.015m~~

$$\text{precision} = \frac{1}{d/e} = 1:24000$$

Staff correction for measurement

From data A is at rise compared to B

Taking levelline from B to A

$a_2' = b_2 + h_1 = 1.599$

error $= a_2 - a_2' = -0.231$

Correct staff reading for A $= a_2 - \frac{0.231 \times 3}{24}$

$= 1.339 = 2$

" " " " B $= b_2 - \frac{0.231 \times 27}{24}$

$= 1.223$ m $= 1$

Check $= x - y = h_1 = 1.339 - 1.223$

$= 0.116$ m

Discussion

The error in measurement of height difference was found to be 0.0057m with a precision of 1: 24600 which is quite high the permissible value. But this error is more due to the observation error than the instrumental error This error is due to inverticality of levelling staff as the ranging rod are not perfectly fixed with ground. Swinging of staff occur due to the air velocity So, collimation error is found to be very large than permissible error. But if in real field the precision is such low, then check should be repeated by maintaining above mentioned things and checked again

Conclusion:-

After this field work, we are able to detect collimation error of the instrument by two peg test. This experiment also enables us to familier to level instrument.

TRIBHUWAN UNIVERSITY

INSTITUTE OF ENGINEERING

CENTRAL CAMPUS PULCHOWK

REPORT ON

SURVEYING PRACTICAL

COURSE : SURVEYING-I

CE-504

Title:FLY LEVELING

Submitted by:Submitted to:

Group No : B2

Roll No: 073-BCE-030

Name :Ashok Sapkota

Survey Instruction Committee

Department of Civil Engineering

Central Campus Pulchowk

PRACTICAL TASK: Level Transfer (fly level)

OBJECTIVES

→ To determine the height difference of two points on the ground
→ To determine the reduced level (R.L) of a point when the RL of next point is known.

INSTRUMENTS AND ACCESSORIES USED

→ TRIPOD - 1
→ Levelling staff - 2
→ Auto level - 1
→ Foot plate - 2

THEORY

Fly levelling is used to determine the level difference between two points on a ground approximately with low precision.

Height of instrument (H.I)

It is the elevation of the level instrument above the mean sea level. HI is calculated for every setting of the instrument which then helps to determine RL of different stations. The HI of first setting is calculated by adding RL of first benchmark with its BS reading.

Rise and Fall system

The level reading taken on different stations are compared with the readings from the proceeding stations, the differences of which gives rise or fall. The rise is added and fall is subtracted from RL of a station to obtain RL of next station. The arithmetic check of booking a)

$$\Sigma BS - \Sigma F.S = \Sigma Rise - \Sigma Fall = \Sigma last\ RL - \Sigma first\ RL$$

PROCEDURE

→ Level was set up and the backsight reading of TBM-1 was noted on the staff kept on the bench mark.

→ The turning point was determined by pacing so as to keep the tripod and level mid-way between TBM1 and TP-1

→ F.S reading of TP1 was noted

→ This process was continued till the FS reading of TBM-2 finally, height difference was calculated and was checked if it was under permissible value of error.

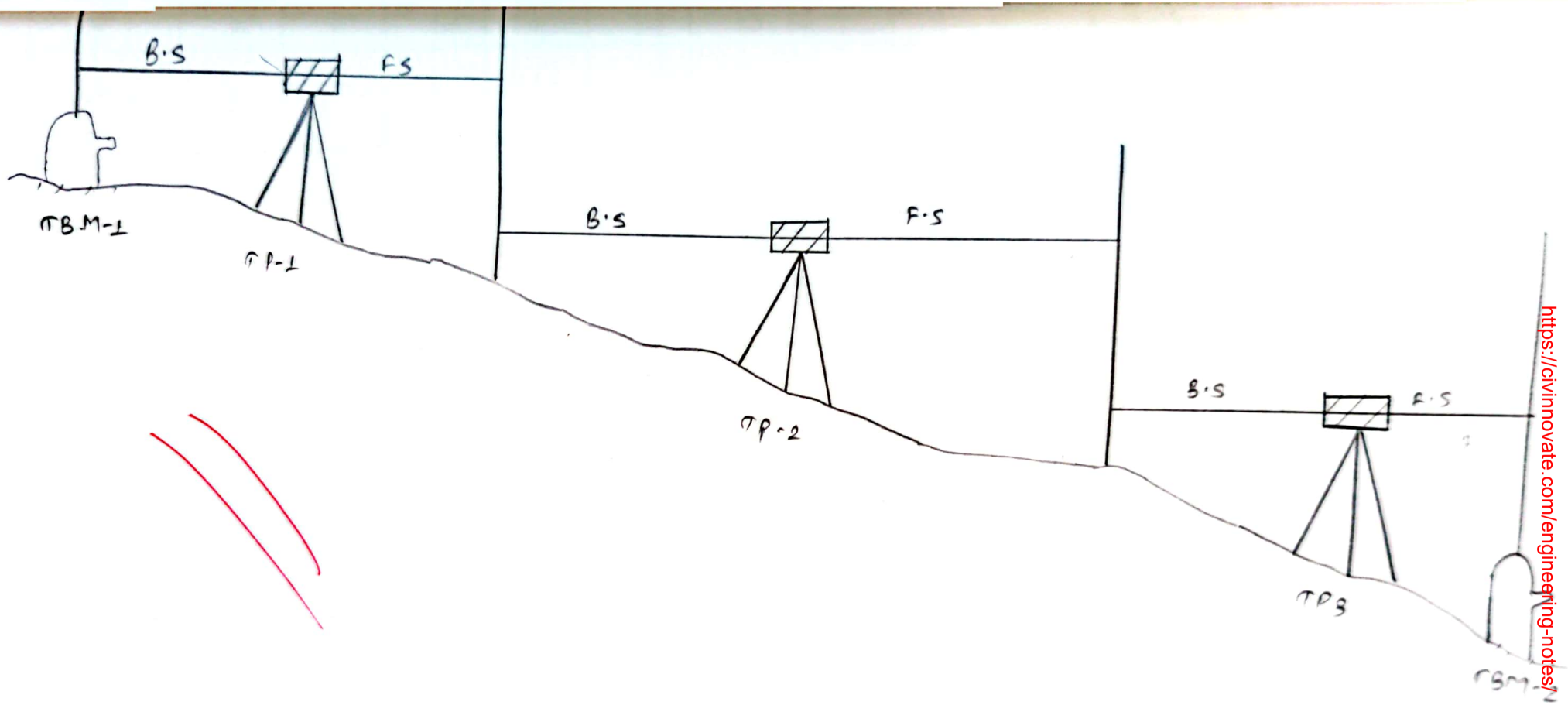


Fig Dly level

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Trial

6

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erver :
rder :
ument :

Trail (dry level)

Weather : Sunny
Temperature : 12°C
Date :

Level Field Book for L-Section and X-Section

nts	Left Offset	Center Line Chainage	Right Offset	BS	IS	FS	HI	Elevation (m) RL	Remarks
				Foward				1330.765	
M1				0.465		-	1331.230	1330.765	
1				0.886		1.633	1330.483	1329.597	
2				0.794		1.554	1329.723	1328.929	
3				0.488		1.850	1328.361	1327.873	
M2						1.795		1326.566	
m				2.633		6.832			
thmetic check =			ΣBS - ΣFS			last RL - 1st RL			
			= -4.199			=	-4.119m	(OK).	
				Backward					
M2				1.934		-	1328.500	1326.566	
1				1.874		0.399	1329.975	1328.101	
2				1.825		0.883	1330.917	1329.092 1328.983	
3				1.474		1.063	1331.328	1329.854 1329.394	
M1						0.357		1330.771	
1				7.107m		2.902			
thmetic check.			ΣBS - ΣFS				last RL - 1st RL		
			= 4.205m				= 4.205 (OK)		

Observer : Parwaiz

Recorder :

Instrument :

Weather :

Temperature :

Date :

Differential Leveling (Three Wire) R F

Stations Chainage	Back Sight BS			Mean BS	S_1 (T-B)	Fore Sight FS			Mean FS	S_2 (T-B)	Rise +	Fall -	Elevation (m)	Stadia interval $S=S_1+S_2$	Hz Dist (m) $S\times100$	Remarks
	Top	Mid	Bot			Top	Mid	Bot								
TBM-1	0·217	0·138	0·059	0·138	0·158								1330·765			
TP1	0·623	0·564	0506	0·564	0·117	1·891	1·969	2·050	1·970	0·159		1·832	1328·933	0·317	31·7	
TP2	0·677	0·628	0·577	0·627	0·100	2·202	2·144	2·086	2·144	0·116		1·580	1327·353	0·233	23·3	
TP3	0·924	0·832	0·740	0·832	0·184	2·064	2·018	1·964	2·015	0·100		1·388	1325·965	0·250	20·0	
TP4	0·971	0·799	0·629	0·799	0342	1·757	1·671	1·583	1·670	0·174		0·838	1325·127	0358	35·8	
TP5	1·527	1·364	1·201	1·364	0·326	1·765	1·590	1·417	1·590	0348		0·791	1324·336	0·690	69·0	
TBM2						0·953	0·780	0·610	0·781	0343	0·583		1324·919	0·669	66·9	
			ΣBS = 4·324							ΣRise = 0·583				ΣH2 = 246·7		
								ΣFS = 10·170		ΣFall = 6·429						
Arithmatic Check																
	ΣBS − ΣFS							ΣRise − ΣFall					Last RL − First RL			
	= 4·324 − 10·170							= 0·583 − 6·429					= 1324·919 − 1330·765			
	= −5·846m							= −5·846m					= −5·846 m			

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.2

Forward.

Weather :
Temperature :
Date :

Leveling Field Book (HI method)

Distance Chainage	BS	IS	FS	Height of Instrument HI (m)	Elevation (m)	Remarks
	0·138		-	1330·903	1330·765	
	0·564		1·970	1329·497	1328·933	
	0·627		2·144	1327·98	1327·353	
	0·832		2·015	1326·797	1325·965	
	0·799		1·670	1325·926	1325·127	
	1·364		1·590	1325·700	1324·336	
	-		0·781		1324·919	
ΣBS =	4·324	ΣFS =	10·170			
Arithmetic Check						
ΣBS - ΣFS			last RL -	first RL		
= -5·846			= -5·846	m.		

Observer : Backward

Recorder :

Instrument :

Weather :

Temperature :

Date :

Differential Leveling (Three Wire) R F

Stations Chainage	Back Sight BS			Mean BS	S_1 (T-B)	Fore Sight FS			Mean FS	S_2 (T-B)	Rise +	Fall -	Elevation (m)	Stadia Interval $S=S_1+S_2$	Hz. Dist (m) Sx100	Remarks
	Top	Mid	Bot			Top	Mid	Bot								
TBM 2	0.907	0.769	0.632	0.769	0.275								1324.919	0.572	57.2	
TP1	1.424	1.317	1.202	1.314	0.222	1.465	1.316	1.168	1.316	0.297		0.547	1324.372	0.444	44.4	
TP2	1.955	1.820	1.684	1.819	0.271	1.259	1.145	1.037	1.147	0.222	0.167		1324.539	0.527	52.7	
TP3	1.714	1.660	1.606	1.660	0.108	1.051	0.924	0.795	0.923	0.256	0.896		1325.435	0.219	21.9	
TP4	2.199	2.143	2.142	2.142	0.113	0.775	0.720	0.664	0.719	0.111	0.941		1326.376	0.217	21.7	
TP5	2.006	1.953	1.953	1.953	0.104	0.619	0.564	0.515	0.566	0.104	1.576		1327.952	0.202	20.2	
TP6	1.898	1.772	1.774	1.774	0.126	0.820	0.775	0.772	0.772	0.098	1.181		1329.133	0.259	25.9	
TBM1						0.217	0.149	0.150	0.150	0.133	1.624		1330.757	Σ HZ = 244m		
		$\Sigma BS = 11.493$														
							$\Sigma FS = 5.593$		$\Sigma Rise =$		6.385					
	Arithmetic Check										$\Sigma Fall = 0.547$					
	$\Sigma BS - \Sigma FS$						$\Sigma Rise - \Sigma Fall$						Last RL - First RL			
	$= 5.838$						$= 5.838$					=	$1330.757 - 1324.919$			
													$= 5.838$			

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4 .2

erver : Backward
rder :
ument :

Weather :
Temperature :
Date :

Leveling Field Book (HI method)

oints	Distance Chainage	BS	IS	FS	Height of Instrument HI (m)	Elevation (m)	Remarks
M 2		0·769		-	1325·688	1324·919	
1		1·314		1·316	1325·686	1324·372	
2		1·879		1·147	1326·540	1324·539	
P3		1·660		1·923	1326·277	1325·435	
4		2·142		0·719	1327·700	1326·376	
5		1·953		~~0·719~~ 0·566	1329·087	1327·952	
P6		1·774		0·772	1330·089	1329·133	
BM1		-		0·150		1330·~~757~~	
	ΣBS =	11·431					
			ΣFS =	5·593			
	Arithmetic Check				Last RL - First RL		
	ΣBS - ΣFS				= 5·838 m		
	= 5·838 m						

ERROR CALCULATION FOR FLY LEVELLING

Elevation diff during toward (h_1) = 5.846 m

Elevation diff during backward (h_2) = 5.838 m

ERROR, $e = |h_1 - h_2| = 8$ mm

Total chainage = $S = 246.7 + 200 = 446.7$ m

$S = 446.7 \times 10^{-3}$

Permissible error $= 24\sqrt{k} = 24\sqrt{446.7 \times 10^{-3}} = 16.8$ mm

But the error is 8mm. So the data is within permissible error.

The average elevation difference $H_{avg} = \frac{h_1 + h_2}{2}$

$= \frac{5.846 + 5.838}{2}$

$= 5.842$ m

FOR FLY LEVELLING (TRAIL)

Elevation diff for forward (h_1) = 4.199

Elevation diff for backward (h_2) = 4.205

Error = $|(h_2 - h_1)| = 4.205 - 4.199 = 6$ mm

Total chainge along the footpath $S = 94.74 + 94.94$

$= 189.73$ m

Permissible error $e = 24\sqrt{k}$ $= 24\sqrt{189.73 \times 10^{-3}}$

$= 10.45$ mm

Since the obtained error during the measurement of elevation difference is 6mm and permissible error is upto 14 lies within the permissible error.

discussion

The elevation difference between the bench marks was found to be 5.842 in average. The error of 8mm was observed but the error range was upto 30, the computed error was within range. The small error which was occured due to the collimation error of the device and parallel as well. This error was minimized by placing the auto level nearly betn 2 turning points to cancel out the collimation error.

conclusion:

Hence from the field work, we can conclude that the elevation differences between two bench marks can be established with the help of by levelling Also, the collimation error of the instrument can be reduced by keeping the level nearly centre to 2 stations

~~Prec~~ Precautions:-

1) Foresight and backsight distance should be measured with the help of pacing
2) staff reading shouldnot be greater than 2m or smaller than 0.6m
3) The distance betn the instrument and corresponding stations should be equal.

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CENTRAL CAMPUS PULCHOWK

REPORT ON

SURVEYING PRACTICAL

COURSE : SURVEYING-I

CE-504

Title:PROFILE LEVELLING

Submitted by:Submitted to:

Group No : B2

Roll No: 073-BCE-030

Name :Ashok Sapkota

Survey Instruction Committee

Department of Civil Engineering

Central Campus Pulchowk

TITLE : PROFILE LEVELLING

OBJECTIVES

- To know about the method (field procedure) of profile levelling and cross-section levelling
- To know about the methods of plotting of longitudinal and cross-section in standard scale
- To know about RL adjustments

Instruments and Accessories used

1) Auto level (1)
2) Tripod (1)
3) Levelling staff (1)
4) Foot plate (1)
5) marking arrows (5)
6) measuring tape 30m (1)
7) plumb bob (1)

Theory

→ profile levelling (longitudinal profile)

The operation of levelling carried out to determine the elevations of various points at the regular interval of the distances, and also the salient features along a given straight line of rods, railway, pipe. The elevations are plotted as ordinates and the horizontal distances are plotted as abscca. Thus, the graph obtained gives the profile of the surface of the ground.

cross-sectoning

In many projects, we need to determine the terrain information along with longitudinal section like for highways railways, canals etc. so cross-sectoning is a type of survey which is carried out right angled to centreline generally at regular interval.

standard scale of plotting

For the plotting of longitudinal profile, L section the standard horizontal scale is 1:1000 and in vertical 1:100

For cross-sectioning

H= 1:100

V=1:100

PROCEDURE

- The reconisence survey of given alignment was done.
- From the starting point along alignment. Since the distance was taken at the regular interval of 30m interval was marked
- Instrument was setup and back sight reading was taken at TBM1.
- After that various chainage reading was taken and noted as intermidiate points
- Then a turning point was decided according to the clarity of reading & instrument was moved accordingly
- The foresight reading was taken and after that backsight at TP1 was taken
- After this in the same process intermediate sights were taken
- At point 0+010, 0+110 etc the rough sketch of the either side of ground was made
- The distance from center line was measured where ground's nature changes and marking arrows wer kept.
- The elevation of the respective points were read by keeping the staff at these positions

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Weather :
Temperature :
Date :

Leveling Field Book (R F method)

nts	Distance Chainage	BS	IS	FS	Rise +	Fall -	Elevation (m)	Remarks
1-1		3.261					1330.765	
		0.657		2.539	0.722		1331.487	
2		0.591		2.889		2.232	1329.255	
3		0.520		3.409		2.811	1326.444	
4		1.602		2.299		1.779	1324.665	
5		1.254		1.302		0.3	1324.365	
M-2		—		0.710	0.544		1324.909	
	ΣBS = 7.285		Σ FS = 13.141					
				Σ Rise = 1.266				
					Σ Fall = 7.122			
	Arithmetic Check							
	ΣBS - Σ FS			Σ Rise - Σ Fall			Last RL - First RL	
	= -5.856			= -5.856		=	1324.909 - 1330.765	
							= -5.856 (OK).	

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Weather : .....
Temperature : .....
Date : .....

Level Field Book for L-Section and X-Section

ints	Center Chainage & Left/Right offsets	BS	IS	FS	HI	Elevation (m)	Remarks
M-1		8.261		-	1334.026	1330.765	
1		0.657		2.539	1332.144	1331.487	
2		0.591		2.889	1329.846	1329.255	
3		0.520		3.402	1326.964	1326.444	
4		1.002		2.299	1325.667	1324.665	
5		1.254		1.302	1325.619	1324.365	
BM2		-		0.710		1324.909	
	ΣBS=	7.285	ΣFS=	13.141			
	Arithmetic check						
	ΣBS-ΣFS			last RI - first RI			
	= -5.856			= 1324.909-1330.765			
				=	-5.856 (O.K)		

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Dealt by : Error = 0.014 m
Instrument used : correction = -0.0014 m

Adjustment of Elevations

Project :

Date :

Stations	Partial Distance	Chainage	Observed Elevation	(error/Σd)x cumu d or (error/ΣNs of Stns)x cumu Stns	Correction + or -	Adjusted R. L.	Remarks
TBM-1			1330.765	$\frac{0.014}{6} \times 0 = 0$	- 0.000	1330.765	
TP1			1331.487	$11 \times 1 = 0.0023$	- 0.0023	1331.4847	
TP2			1329.255	$11 \times 2 = 0.0046$	- 0.0046	1329.2504	
TP3			1326.444	$11 \times 3 = 0.0070$	- 0.0070	1326.437	
TP4			1324.665	$11 \times 4 = 0.0093$	- 0.0093	1324.6557	
TP5			1324.365	$11 \times 5 = 0.0116$	- 0.0116	1324.3534	
TBM-2			1324.909	$11 \times 6 = 0.014$	- 0.014	1324.895	

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Level Field Book for L-Section and X-Section

s	Left Offset	Center Line Chainage	Right Offset	BS	IS	FS	HI	Elevation (m)	Remarks
1				3.261			1334.026	1330.765	
		0+000			1.075		"	1332.951	
		0+010			1.207		"	1332.819	
		0+020			1.800		"	1332.226	
	0.512				2.169		"	1331.857	
	3.372				2.048		"	1331.978	
	10.000				2.779		"	1331.247	
			3.580		2.064		"	1331.962	
			7.520		2.040		"	1331.986	
			7.520		1.839		"	1332.187	
			10.772		1.838		"	1332.188	
			10.772		1.690		"	1332.336	
			10.772		0.384		"	1333.642	
			14.052		1.671		"	1332.355	
			15.902		0.412		"	1333.614	
		+030			2.666		"	1331.360	
21				0.657		2.539	1332.104	1331.487	
		+040			1.587		"	1330.557	
	4.454				0.511		"	1332.655	
	0.214				0.832		"	1332.334	
	7.856				0.954		"	1332.212	

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Weather : .....
Temperature : .....
Date : .....

Level Field Book for L-Section and X-Section

nts	Left Offset	Center Line Chainage	Right Offset	BS	IS	FS	HI	Elevation (m)	Remarks
			8.416		0.954		"	1332.212	
			7.528		0.658		"	1332.508	
			7.528		0.513		"	1332.653	
			11.074		0.460		"	1332.706	
			11.074		0.817		"	1332.349	
		0+050			2.180		"	1330.986	
		0+060			2.545		"	1330.621	
		0+070			2.833		"	1330.333	
P2				0.591		2.889	1329.846	1330.277	
		0+080			0.956		"	1329.912	
	1.050				1.530		"	1329.338	
	1.050				1.315		"	1329.553	
	1.550				1.343		"	1329.525	
			2.991		1.370		"	1329.498	
			6.750		1.369		"	1329.499	
			6.750		1.281		"	1329.587	
			9.862		1.220		"	1329.648	
		0+090			1.621		"	1329.242	
		0+100			2.314		"	1328.554	
		0+110			3.022		"	1327.846	
		0+120			3.721		"	1327.147	

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Weather :
Temperature :
Date :

Level Field Book for L-Section and X-Section

hts	Left Offset	Center Line Chainage	Right Offset	BS	IS	FS	HI	Elevation (m)	Remarks
3				0·520		3·402	1326·964	1327·466	437
		0+130			1·337		"	1326·649	
		0+140			1·561		"	1326·425	
		0+150			1·730		"	1326·256	
		0+160			1·930		"	1326·056	
	2·428				1·646		"	1326·34	
	2·878				1·582		"	1326·404	
			1·722		1·701		"	1326·285	
			5·872		1·794		"	1326·192	
			5·872		1·582		"	1326·404	
			8·220		1·562		"	1326·424	
			8·670		1·561		"	1326·425	
		0+170			2·11		"	1325·876	
	2·818				1·353		"	1326·633	
	3·268				1·364		"	1326·622	
			3·422		1·450		"	1326·536	
			6·322		1·519		"	1326·467	
			6·322		1·375		"	1326·611	
			8·670		1·318		"	1326·668	
			9·120		1·288		"	1326·698	

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Server : _____ Weather : _____
Recorder : _____ Temperature : _____
Instrument : _____ Date : _____

Level Field Book for L-Section and X-Section

Points	Left Offset	Center Line Chainage	Right Offset	BS	IS	FS	HI	Elevation (m)	Remarks
		0+180			2.299		"	1325.687	
		0+190			2.242		"	1325.744	
	9.480				1.655		"	1326.331	
	4.798				0.902		"	1327.084	
			0.526		0.646		"	1326.34	
			4.526		1.719		"	1326.267	
			4.526		1.604		"	1326.382	
			6.846		1.560		"	1326.426	
			9.382		1.191		"	1326.795	
			11.966		1.416		"	1326.57	
TP4				1.602		2.299	1325.667	1325.687	656
		0+200			1.317		"	1325.372	
		0+210			1.339		"	1325.35	
		0+220			1.363		"	1325.326	
		0+230			1.342		"	1325.347	
TP5				1.254		1.302	1325.619	1325.387	
		0+240			1.324		1325.619	1325.317	
TBM2						0.710		1325.931	895

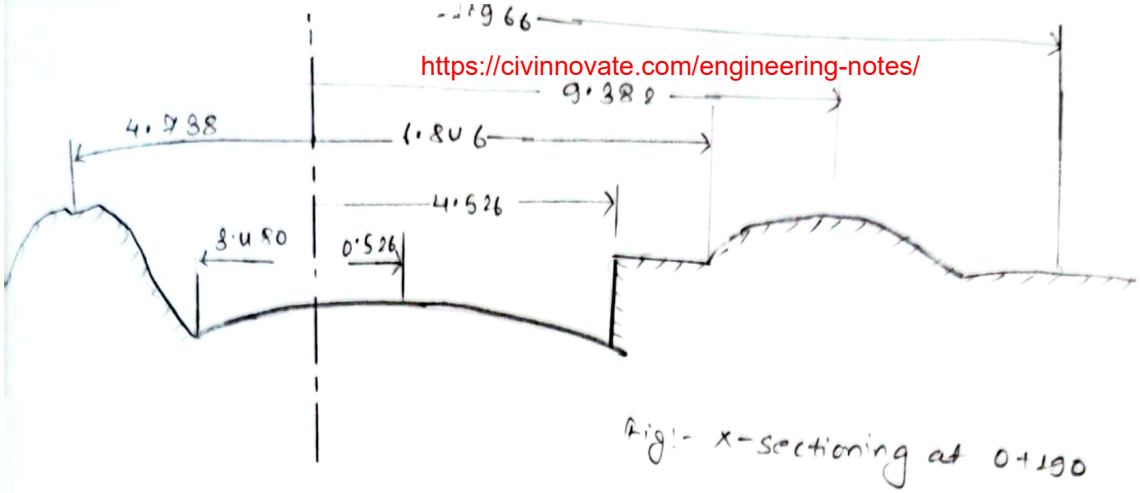


fig:- x-sectioning at 0+190

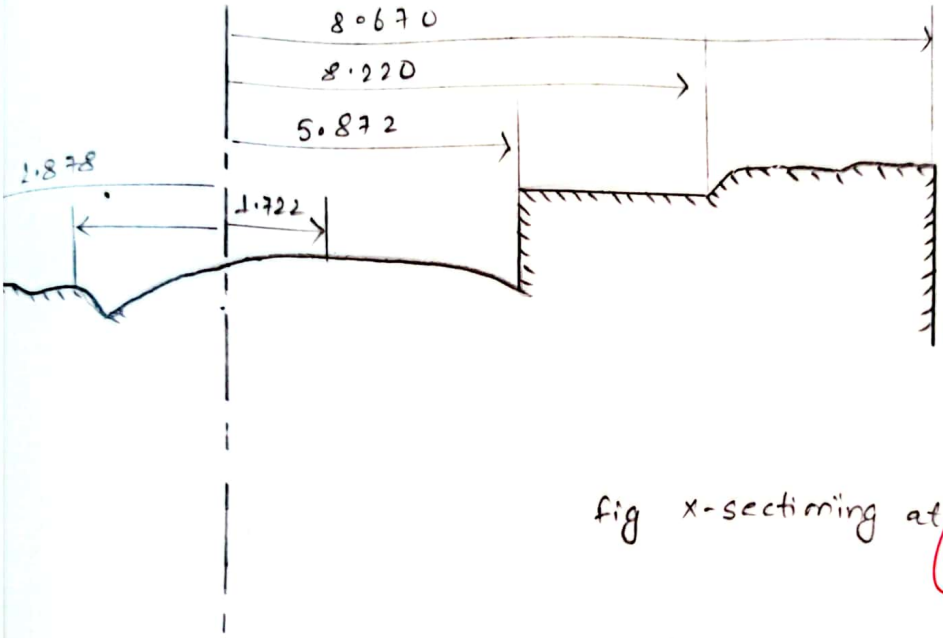


fig x-sectioning at 0+160 170

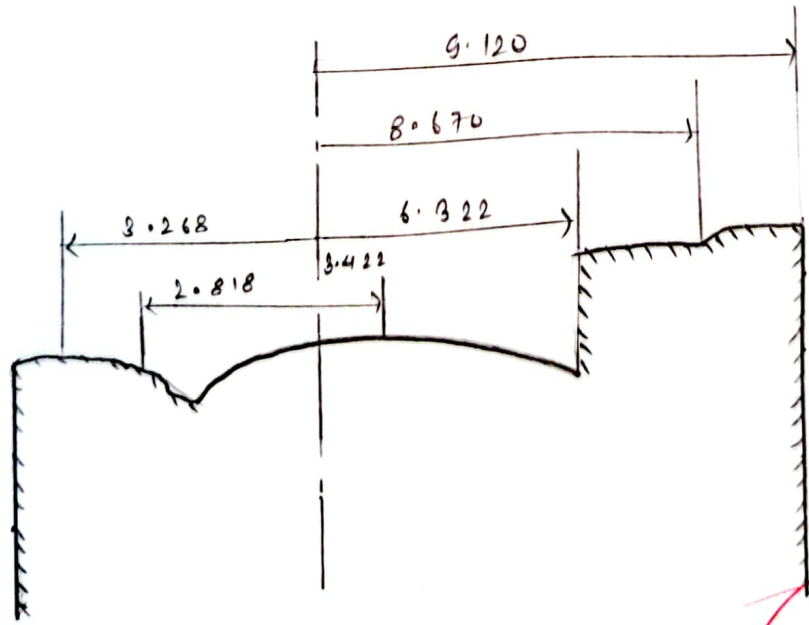
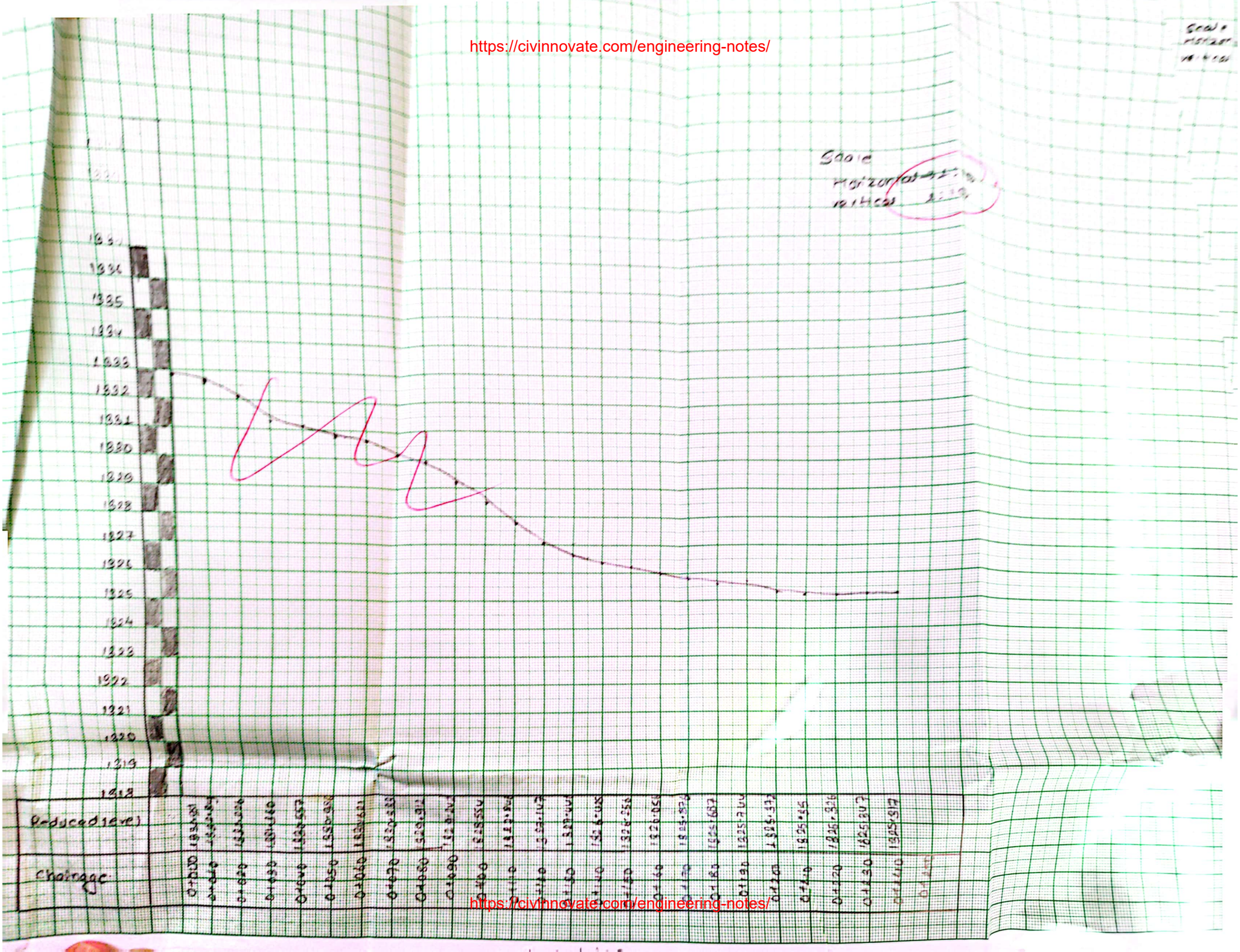
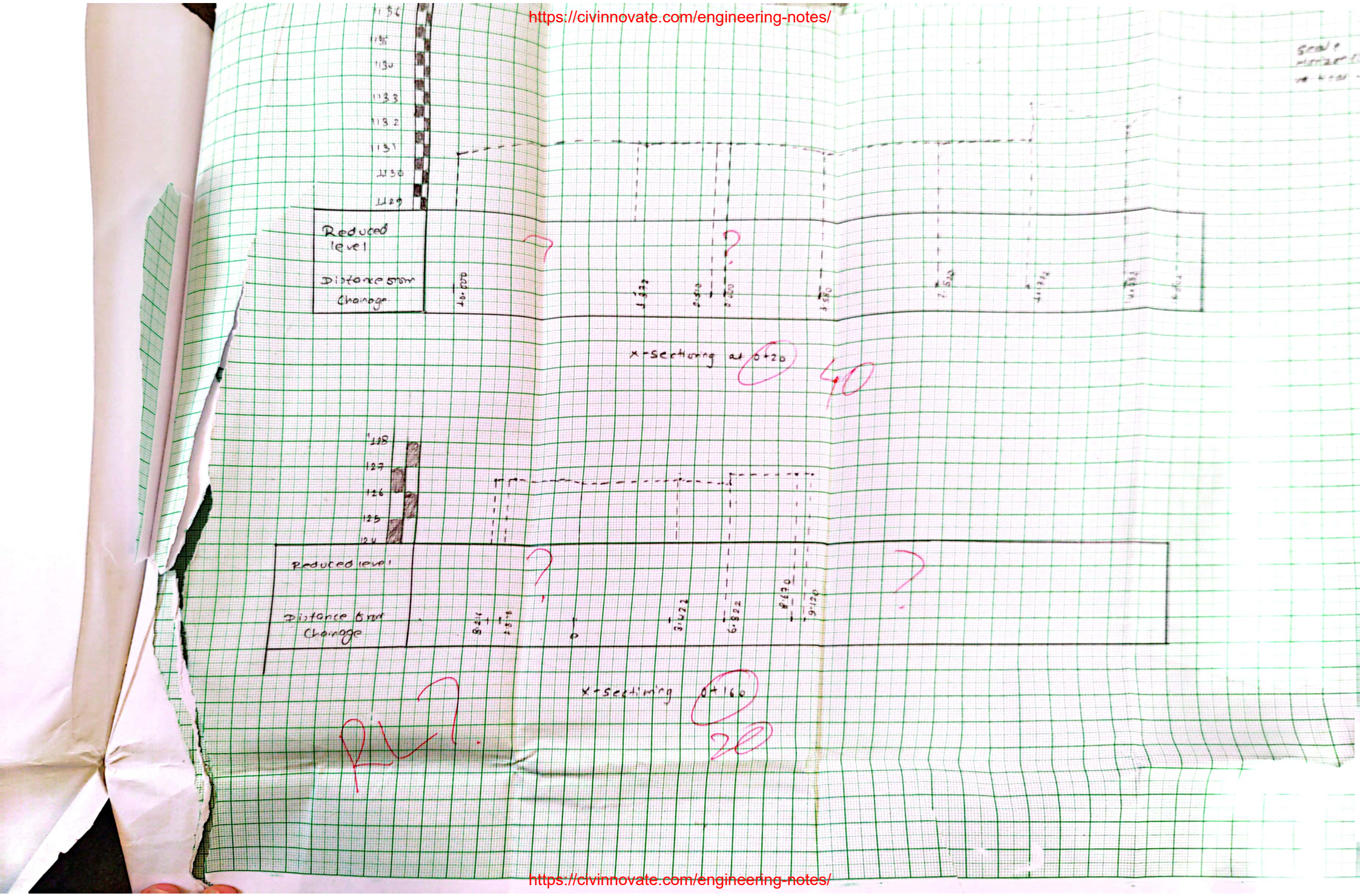
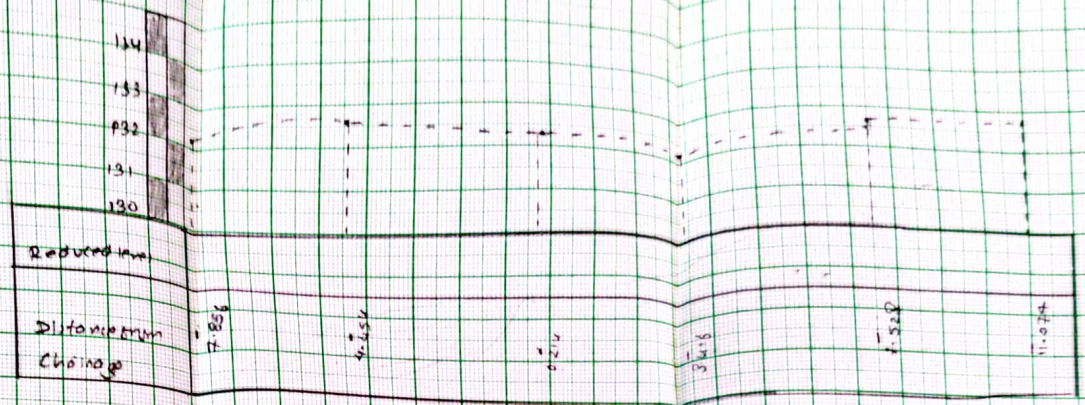


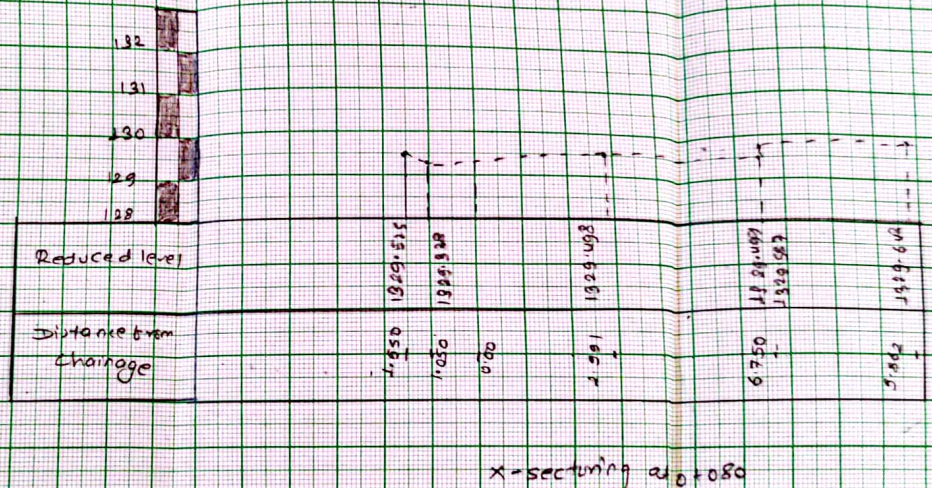
fig: x-sectioning at 0+170 160

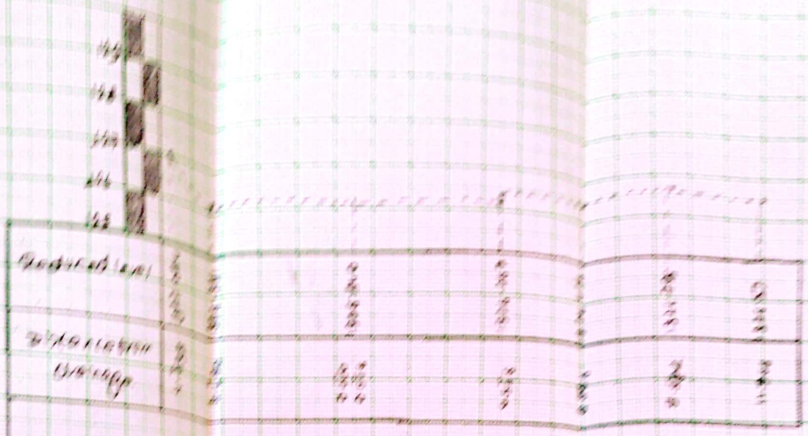
Scale
Horizontal 1:10
Vertical 1:10

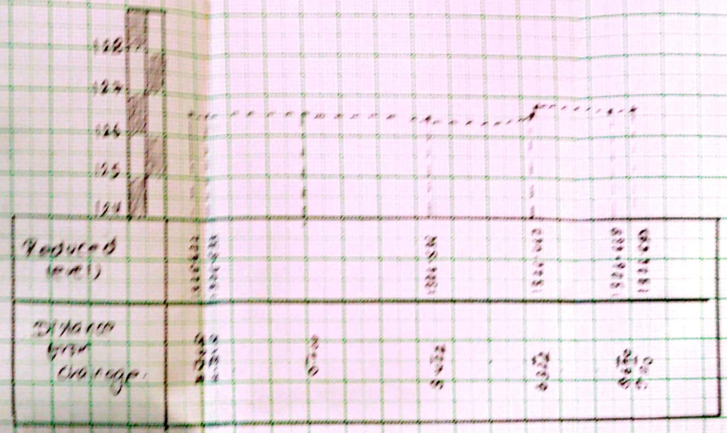












cussion

from this field work, fundamental principles and methods of profile levelling was practised. The elevation difference between two points is found to be 5.856m which 0.010m higher than the height difference found in fly levelling. The error occurs due to collimation error of instrument as perfect balance of foresight and backsight is not possible in some stations. The readings are taken for away point due to which error is occured in staff reading so, elevation difference of fly level is taken as standard value and RL of various points was adjusted.

CONCLUSIONS

From this field work, we can conclude that profile levelling is done for the drawing of profile of various points along the project alignment for calculation and estimation of earth work. profile levelling can be done for both in longitudinal direction as well as in cross-sectional direction.

Precautions:-

- levels should be perfectly horizontal and should handeled carefully
- cross section should be taken perpendicular to the central chain line
- Foresight and backsight should be balanced

If work is to be continued in next day then referencing of chainage and TBM should be done atleast from a fixed point

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Report on
Surveying Practical

5

Course Surveying-I
CE - 504

Area Computation

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Submitted by :-

Group No. :- B2

Roll No. :- 073BCE1030

Name :- Ashok Sapkota.

Submitted To :-

Class teacher :-

Survey Instruction Committee
Department of CivilEngineering
Central Campus, Pulchowk

TITLE: COMPUTATION OF AREA

THEORY:

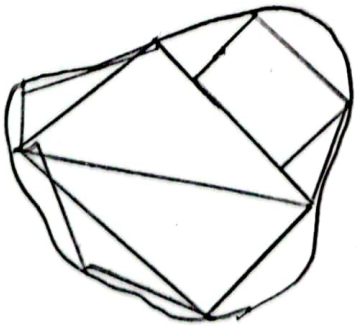
One of the primary objective of most land survey is to determine the area of the tract of volume of earth works. Area are considered in the first since the computation of areas is involved in the calculation of the volume and the following heading are involved

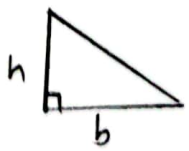
i) mechanical integration
ii) Area enclosed by irregular figures
iii) Area enclosed by regular figures
iv) Area enclosed by straight lines.

PROCEDURES:

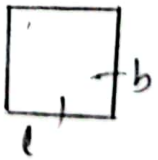
1) Area by division into simple figures.

If the area is bound by straight edges, it can be sub-divided in a set of convenient figures and area calculated. But in most of the cases the the boundary may be have irregural shape In such case the boundary may have irregular shape. In such cases it may be sub-divided into regular shape as square, rectangular. etc and area is computed. The smaller area near the boundry is formed from taking offset from survey line.





$A = \frac{1}{2} \times b \times h.$



$A = l \times b$

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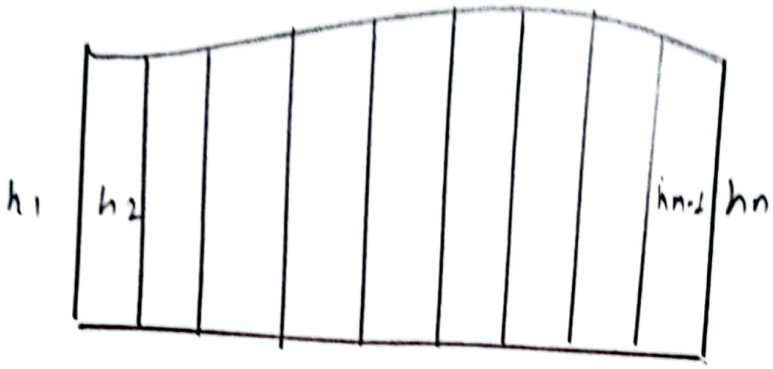
iii) Area enclosed by irregular offset

Trapezoidal and simpson's $\frac{1}{3}$ rule can be used to find area of the irregular figures.



$$\text{Area} = d\left[\frac{h_1+h_n}{2} + h_2+h_3+\cdots h_{n-1}\right]$$

Simpson's $\frac{1}{3}$ rule

$$\text{Area}(A) = \frac{d}{3}\left[(h_1+h_n) + 4(\text{sum of even offset}) + 2(\text{sum of odd offset})\right]$$

value of n should be odd for using this rule.

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, calculation).

Area computation by analytical methode

	Geometrical shape	Dimension	Area
1	Rectangle	a = 26.3 b = 10	= 263
2	Triangle	h = 6 b = 6	$\frac{1}{2} \times b \times h = 18$
3	Rectangle	a = 1.5 b = 6	A = a × b = 15 × 6 = 9
4	Rectangle	a = 4.3 b = 1.5	A = 6.45
5	Triangle	b = 8.6 h = 3.7	15.91
6	Triangle.	a = 9.2 b = 3.4 c = 7.3 s = 9.95	$A = \sqrt{s(s-a)(s-b)(s-c)}$ = 11.38 1
7	Triangle.	a = 7.5 b = 9 a = 15.1 s = 15.8	$A = \sqrt{s(s-a)(s-b)(s-c)}$ = 24.985
A8	Triangle	h = 6.3 b = 5.9	$A = \frac{1}{2} \times b \times h$ = 18.585
9	Rectangle	a = 5.2 b = 5.5	A = 28.6
10	Triangle	a = 1 b = 5.1	A = 2.55.
11	~~Curved~~ Triangle	b = 15.5 h = 8.7	A = 67.42
12	Triangle	h = 3.8 b = 7.1	A = 13.49
A13	Triangle	h = 0.7 b = 1	A = 0.35
A14	Triangle	h = 4 b = 7.3	A = 14.60

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S.N	Geometrical shape	Dimension	Area
A15	curved surface	A. height = 1.0625 distance = 7.2	7.65
A16	curved surface.	AH = 1.375 distance = 7	7.9625
			ΣArea = 505.93 cm²

Area computation by Graphical methode

Total area = Area due to rectangles + Area due to small boxes from graph

$= 479 + 2090 \times 10^{-2}$

$= 499.9 \text{ cm}^2$

The difference in area = 505.93 - 499.9

$= 6.03 \text{ cm}^2$

CONCLUSIONS:

In this way the area of field was calculated to be 499m² and the calculation of area from graphical methode is more precise than analytical methode.

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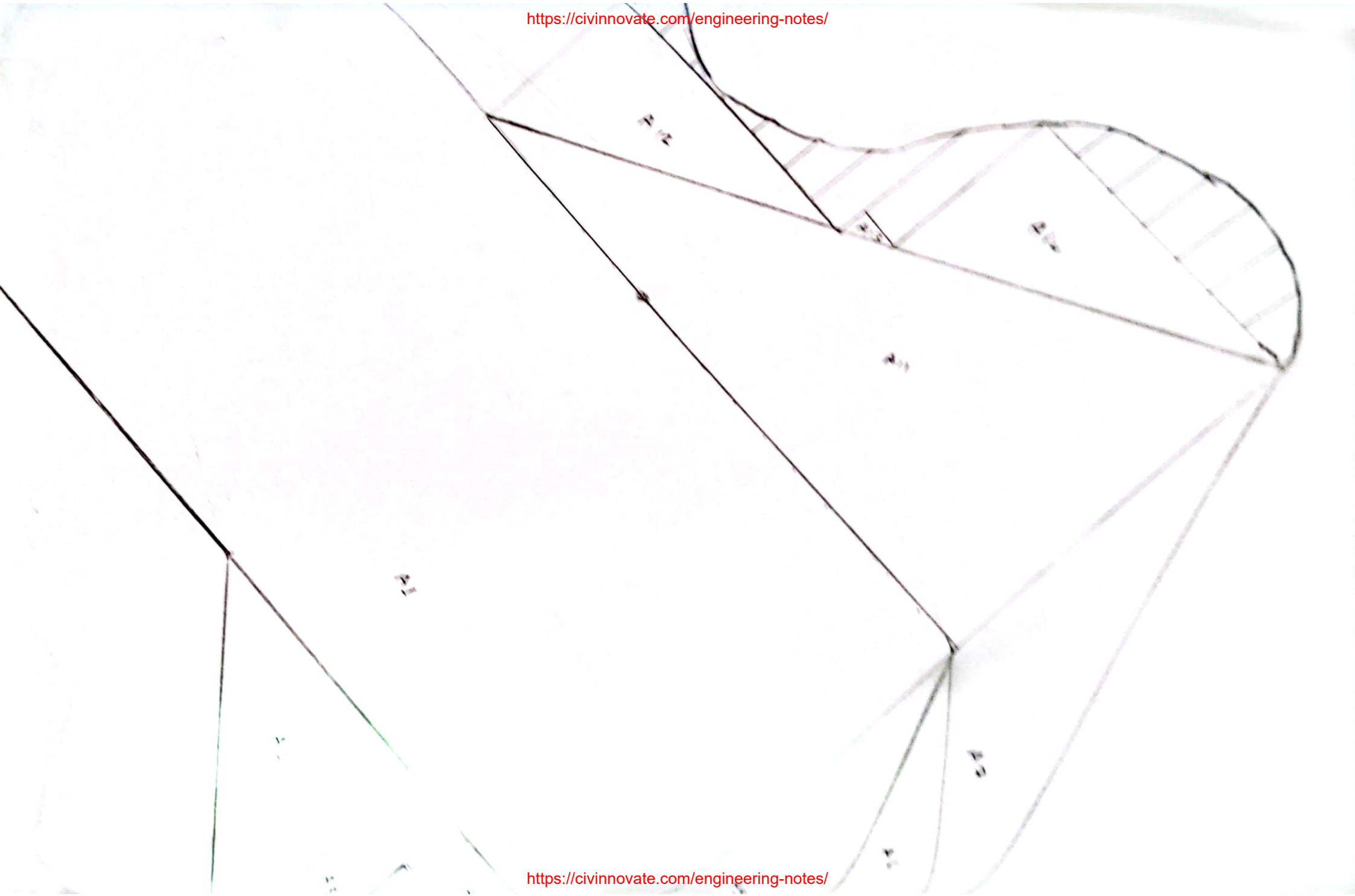

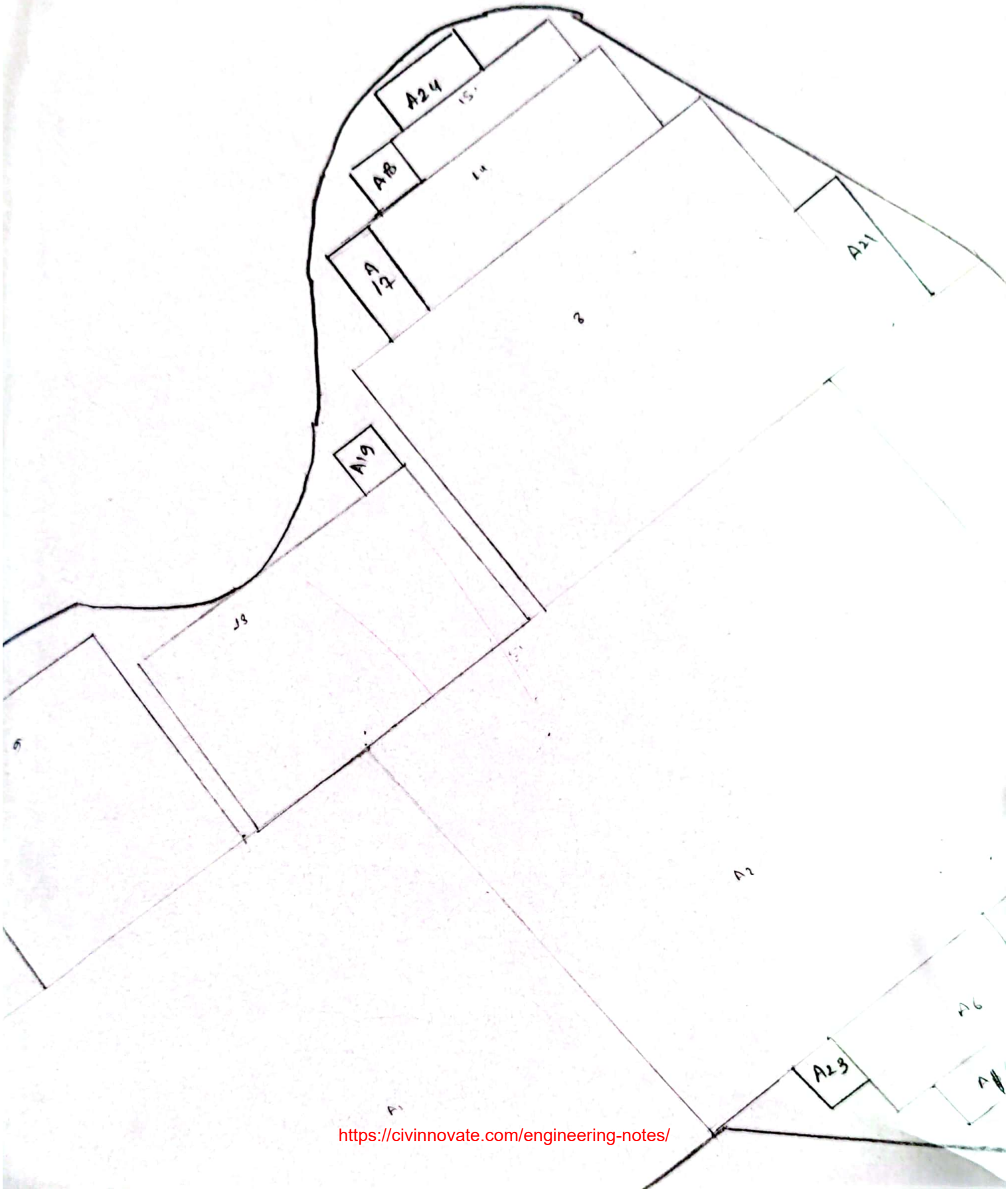

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DEPARTMENT OF CIVIL ENGINEERING

Survey Instruction Committee

Report on
Surveying Practical

Course Surveying-I

CE – 504

A report on
Handling of Theodolite

Submitted by:

Group No. : **B-2**

Roll No. : 073-BCE-030

Ashok Sapkota

Submitted to:

Survey Instruction Committee

Department of Civil Engineering

Central Campus, Pulchowk

OBJECTIVES

i) To be familiar with theodolite.
ii) To be able to make temporary adjustment of theodolite
iii) To be able to measure the horizontal and vertical angle using theodolite

INSTRUMENTS AND ACCESSORIES USED:

- Theodolite - 1
- Tripod - 1
- Ranging rods - 3
- Plumb bob - 1
- Hammer - 1
- Pegs - 1

THEORY:

Theodolite is the most precise instrument for the measurement of horizontal and vertical angle and has the work applicability in surveying such as laying the horizontal angles, locating survey lines, establishing grade determining diff in elevations, setting curvatures etc.

Essential parts of theodolite are:

i) Telescope

An integral part of theodolite and is mounted in the spindle. Telescope may be integral focusing type or external focusing type

ii) Vertical circle

It is the circular graduated and attached to horizontal axis of telescope

iii) Index frame/vernier frame:

iv) levelling head:

To support the main part of the instrument, to attach the theodolite on the tripod and to provide the means for levelling the theodolite levelling head is used.

v) two spindles

vi) lower plate / scale plate
It carries the horizontal circle, lower clamp screw corresponding to the slower tangential screw

vii) upper plate / vernier plate
It is attached to inner arc and carries two vernier upper clamp screw and corresponding tangential screw.

viii) plate levels
Two plate levels are placed perpendicular to each other.

ix) Tripod x) plumb bob xi) Compass

Terms used in theodolites.

i) vertical axis
It is the axis about telescope and vertical plane

ii) Horizontal axis:
It is the axis about which telescope and horizontal plane passes. It is also called trunnion axis

iii) line of sight / collimation:
It is line passing through intersection of horizontal & vertical cross-bar and optical centre of object glass and its continuation.

iv) level tube's axis
- It is straight line tangential to longitudinal curve of level tube at its centre.

v) centering
Process of setting theodolite directly above station accurately

vi) Transiting / plunging / reversing
Process of turning telescope in horizontal plane. It is known as right swinging or left swinging depending upon the rotation of telescope in clockwise.

vii) Faces left observation
If the faces of vertical circle is at left of the observer, then it is face left observation.

Telescope normal
when the face of the vertical circle is left and bubble up telescope is said to be inverted or reversed

changing face:
operation of bringing the face of telescope from right to left

Temporary adjustment
It is made at every instrument setting prior to taking obs with the instrument was directly observed from station.
i) setting up theodolite
ii) levelling
iii) centering
iv) Removal of parallax

Parallax
i) To remove horizontal angle
ii) To measure vertical angle
iii) To measure magnitude bearing of line
iv) Direct angle & deflection angle.

PROCEDURE
i) Required instrument were taken to field
ii) centering leveling and focusing were done simultaneously. turn by turn and by multiple repetition leveling was checked.
iii) Ranging rods were sighted and required data were noted first station is made 0 0' 0" for left face. reading and 180°
iv) one complete rotation was completed and data were noted and errors were calculated & submitted

11a (5)

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DEPARTMENT OF CIVIL ENGINEERING
Survey Instruction Committee

Observer :
Recorder :
Instrument :

TRAVERSE by THEODOLITE
Horizontal Angle Observation Sheet

Weather :
Temperature :
Date :

Project :- **JOB Site :-** **Bearing** **Leg**

Inst st and Ht of Inst	Object Sighted to	FACE	Horizontal Angle Observation												Hz. Angle Mean of Set I & II			Horizontal Distance (m)	Remarks
			Set - I			Mean - I			Set - II			Mean - II							
			d	m	s	d	m	s	d	m	s	d	m	s	d	m	s	Tape Dst	
A	A	L	00	00	00	180			90	00	00							d m s	
B	B	L	123	13	24	123	13	24	213	16	54	123	16	54				94 0 14	94 18 54
C	C	L	266	44	55	143	31	32	356	49	42	143	32	48				95 6 24	94 17 36
A	A	L	359	59	30	93	14	35	89	57	12	93	7	30				98 34 22	99 5 27
																		94 17 58	94 38 24
A	A	R	179	59	10				269	57	12								
B	B	R	302	54	56	122	55	46	33	22	48	123	25	36				265 40 37	265 22 48
C	C	R	86	23	24	143	28	28	176	45	42	143	22	54				264 53 31	264 32 48
A	A	R	179	40	15	93	16	51	269	57	12	93	11	30				261 18 36	250 51 36
																		265 39 05	265 19 48
						123	4	35				123	21	15					
						143	30	00				143	27	51				359 40 51	359 41 42
						93	15	43				93	9	30				359 59 55	358 50 24
				Mean		359°	56	18		mean		359°	58	36				359 52 58	358 57 3
																		359 57 3	359 58 12

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CALCULATIONS AND CORRECTIONS

Average angles are given by :-

$\angle AOB = 123°12' 55''$

$\angle BOC = 103°28' 55''$

$\angle COA = 93°12' 37''$

Sum of angle of measurements = $359°54' 27''$

Theoretical sum = $360° 00' 60''$

Observed sum = $359° 54' 27''$

error = (Observed - Theoretical) sum

$= 359° 54' 27'' - 360° 00' 00''$

$= -5' 33''$

Error is negative. Hence correction is positive

correction for each angles $= \frac{+5'33''}{3} = +1°51''$

Hence corrected angles are

$\angle AOB = 123° 14' 46''$

$\angle BOC = 103° 30' 46''$

$\angle COA = 93° 13' 28''$

Precision $= 30''\sqrt{n} = 30''\sqrt{n} = 5'58''$

CONCLUSION

Hence, the handling of theodlite was learnt and the horizontal and vertical angles measurements were done using theodolite, However the result was not within precision due to inexperience of using instrument properly

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6

Report on
Surveying Practical

Course Surveying-I
CE - 504

Theodolite Surveying Closed Traverse

Submitted by :- ~~Ashok Sapkota~~

Group No. :- ~~073BCE03~~ B2

Roll No. :- 073BCE030

Name :- Ashok Sapkota

Submitted To :-

Class teacher :-

Survey Instruction Committee
Department of CivilEngineering
Central Campus, Pulchowk

TITLE: CLOSED TRAVERSE BY THEODOLITE

OBJECTIVES

i) To take two sets of horizontal angle within each station of a close traverse

ii) To know error and calculation of correction.

INSTRUMENTS AND ACCESSORIES REQUIRED:

i) Theodolite (Vernier theodolite) - 1no)

ii) Tripod stand - 1no

iii) Ranging rods - 2nos)

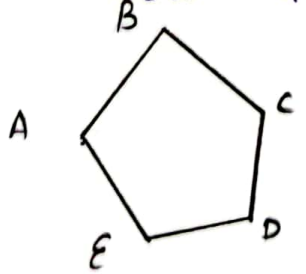
iv) Plumb bob - 1no)

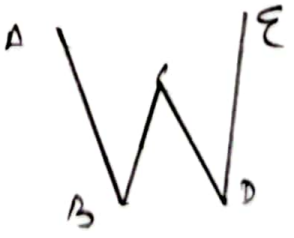
THEORY:

Theodolite is a precise instrument for measuring horizontal angles, vertical angles, etc. which are used for prolongation of survey lines.

Closed traverse is a traverse which either originates from a station and returns to the same station and returns to the same station completeting a circuit or runs betn two known stations is called closed traverse.

Theodolite traversing: A traversing in which angular measurement betn traverse sides are made a theodolite is known as theodolite traversing





General principle of theodolite survey:

According to the accuracy aimed at the nature of ground, the lengths of traverse legs and measured directly on the ground either by chaining or taping. The traverse angles are the angles betn consecutive legs are measured with a theodolite by setting up the instrument at each trm.

Method of theodolite traversing

It can be done by:

- measuring the direct angles between two consective traverse legs
- measuring the direct bearing of the traverse legs

Theodolite traversing by observing included angles:-

Bearing of the initial traverse leg and other legs at frequent intervals as well as that of last traverse leg are generally observed from astronomical observation.

In closed traverse the angles may be exterior or interior. It is customary to run a closed traverse in anti-clockwise dirn in which only interior angles are measured. The accuracy of angular measurements is easily checked by summing up all the included angles as their sum should be equal to $(2n-4) \times 90°$ where n is number of traverse leg.

PROCEDURE:-

i) Required instruments were taken to the field.

ii) Recce was done, six stations were fixed and pegged.

iii) At stations A, temporary adjustment of theodolite i.e. centering, levelling, focusing was done simultaneously and repeated for multiple times to level very accurately over the marked stations for theodolite

iv) Two sets of data for 0°0'0" setting and 90°0'0" setting were taken for both face left, right & noted in field book.

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Survey Instruction Committee

Observer :
Recorder :
Instrument :

TRAVERSE by THEODOLITE
Horizontal Angle Observation Sheet

Weather :
Temperature :
Date :

Project :- **JOB Site :-** **Bearing** **Leg**

Inst st and Ht of Inst	Object Sighted to	FACE	Horizontal Angle Observation												Hz. Angle Mean of Set I & II			Horizontal Distance (m)	Remarks
			Set - I			Mean - I			Set - II			Mean - II							
			d	m	s	d	m	s	d	m	s	d	m	s	d	m	s	Tape Dst	
A	E	L	0	00	00				90	0	0								
	B	L	153	46	30	153	46	50	243	46	30	153	46	30	153	46	33		
	B	R	333	47	28				63	46	56								
	E	R	179	59	48	153	47	40	270	1	22	153	45	34					
B	A	L	0	00	00				90	0	0								
	C	L	97	38	52	97	38	52	187	24	34	97	24	34	97	01	12		
	C	R	277	37	58				7	25	28								
	A	R	180	2	22	97	35	36	269	58	46	97	26	42					
C	B	L	0	00	00				90	0	0								
	D	L	128	59	58	128	59	58	218	6	28	128	6	28	128	02	4		
	D	R	308	58	59				40	5	37								
	13	R	180	1	7	128	57	2	272	0	50	128	4	47					
D	C	L	0	0					90	0	0								
	E	L	116	21	6	116	21	6	206	21	6	116	21	6	116	20	51		

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Institute of Engineering
Central Campus Pulchowk, Lalitpur, Nepal
DEPARTMENT OF CIVIL ENGINEERING
Survey Instruction Committee

Observer :
Recorder :
Instrument :

TRAVERSE by THEODOLITE
Horizontal Angle Observation Sheet

Weather :
Temperature :
Date :

Project :- **JOB Site :-** **Bearing** **Leg**

Inst st and Ht of Inst	Object Sighted to	FACE	Horizontal Angle Observation												Hz. Angle Mean of Set I & II			Horizontal Distance (m)	Remarks
			Set - I			Mean - I			Set - II			Mean - II							
			d	m	s	d	m	s	d	m	s	d	m	s	d	m	s	Tape Dst	
.	E	R	296	21	22				26	21	58								
.	C	R	180	0	48	116	20	34	270	1	2	116	20	38					
.	D	L	60	60	60				90	00	00								
E	F	L	116	45	40	116	45	40	207	24	14	116	24	14	116	34	35		
.	F	R	296	46	2				28	24	34								
.	D	R	180	0	50	116	45	12	270	1	20	116	23	14					
F	E	L	60	60	60				90	0	0								
	A	L	108	30	10	108	30	10	198	19	27	108	19	27	108	24	25		
	A	R	288	30	38				18	19	27								
	E	R	180	3	10	108	27	28	269	58	51	108	01	36					

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CALCULATION AND CORRECTION

Total number of sides of polygon $n = 6$

Theoritical internal angles $= (2n-4) \times 90^\circ$

$= 720^\circ 00' 00''$

Observed internal angle $= \angle A + \angle B + \angle C + \angle D + \angle E$

$= 720^\circ 9' 40''$

Error = Observed angle - Theoritical angle

$= +9' 40''$

Here error is +ve so that the correction should be -ve and amount of correction angle for each angle is

$$\frac{(-9)' 40''}{6} =$$

$$= -0^\circ 1' 37''$$

So, corrected angles are

Corrected angles

$\angle A = 153^\circ 46' 33'' - 0^\circ 1' 37'' = 153^\circ 44' 56''$

$\angle B = 97^\circ 01' 12'' - 0^\circ 1' 37'' = 96^\circ 59' 35''$

$\angle C = 128^\circ 02' 41'' - 0^\circ 1' 37' = 128^\circ 01' 27''$

$\angle D = 116^\circ 20' 51'' - 0^\circ 1' 37'' = 116^\circ 19' 14''$

$\angle E = 116^\circ 34' 35'' - 0^\circ 1' 37'' = 116^\circ 32' 58''$

$\angle F = 108^\circ 24' 25'' - 0^\circ 3' 37'' = 108^\circ 22' 48''$

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Report on
Surveying Practical

Course Surveying-I
CE - 504

Plane Table Surveying

Submitted by :-

Group No. :- B1

Roll No. :- 073BCE030

Name :- Ashok Sapkota

Submitted To :-

Class teacher :-

Survey Instruction Committee
Department of CivilEngineering
Central Campus, Pulchowk

TITLE: PLANE TABLE SURVEYING

INSTRUMENT AND ACCESSORIES

i) plane table
ii) Alidade
iii) plumbing fork and plumb bob
iv) spirit level
v) compass
vi) Drawing paper
vii) measuring tape

THEORY

Plane table is a graphical method of surveying in which the field observation and plotting proceed. It can be used simultaneously. It can be used to tie topography by existing control and to carry its own control system by triangulation or traverse and by lines of level).

Working operation

Three operations are needed

a) Fixing : The table should be fixed on the table with tripod & drawing sheet attached.

b) setting

i) Table is levelled by placing the level on the board into two positions at right angles & getting bubbles central in both directions.

ii) centering : The table should be placed on the ground that the point plotted on the sheet corresponding to the stations occupied should be exactly over the station on ground

iii) Orientation : orientation is the process of putting the table into some fixed directions so that line representing a certain direction on the plane is parallel to that direction on the ground. There are 2 main methods of orienting the plane table.

Sighting - After centering, levelling and orientation is done the point to be located are sighted through the alidade the alidade is kept pivoted about theplotting location of the instrument station and is turned so that the line of sight passes or bisects the signal at the station along the eage of altitude.

Methods of plane table surveying

i) Radiation
ii) Traversing
iii) Intersection
iv) Resection.

Errors in plane table surveying

various sources of error may be classified as:-

i) Instrumental error
ii) error in plotting
iii) errors due to manipulation and sighting. These include non-horizontal board, defective sight, defective orientation, movement of board betn sights or defective or in accurate centering

Disadvantages

i) measurement are not recorded
ii) Most inconvienient in rainy season or wet climate.
iii) Due to hearyness, it is inconvinient to transport.

CONCLUSION:-

Plane table is means of making manuscript map in field while the ground can be seen by topographe,-

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Report on Surveying Practical

Course Surveying-I
CE - 504

11/29

EDM - Demo

Submitted by :-

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TITLE: EDM DEMO

OBJECTIVES

i) To obtain high accuracy measurement in difficult terrain or for long distance, measurement are taken electronically.

ii) Direction measurement when terrain is rough.

INSTRUMENTS

Electronic measurement of distance is being carried out either by using an electro-optical (light wave) device coupled with reflector or by a pair of electromagnetic (micro-waves) instruments

EDM INSTRUMENTS

It is usually an integrated unit called EDMI consisting of an electro-wave generator, an oscillator a modulator, a transmitted and a receiver etc. The type range and accuracy of EDM instrument depend on the type of carrier waves it can be generated and subsequently can transmit, receive and analyse.

THEORY

The main principle of EDM are pulse method and phase diff methods. The doppler methods and interferometry are used only for special purposes

The pulse methods.

The pulse method is not easy to realize with sufficent accuracy but it is very simple method to understand the principle. A short, intensive signal is transmitted by an instrument. It travels to a target point and back. If this covers twice the distance. It can be calculated as

$$d = \frac{c}{2n} \times \Delta t \quad \text{or} \quad \frac{v}{2} \times \Delta t$$

ii) The phase difference method

Historically most important principle which emobled eom instrument to measure with high accuracy In the phase difference method. still a lot of today's instruments use it, regardless of wheather they use light waves infrared waves or microwaves at carrier wave.

$$Y_E = A\sin\omega t = A\sin\phi$$
$$Y_R = A\sin(\Delta\phi+\phi) = A\sin\omega(t+\Delta t)$$

because a continous signal is used the voive of y change with time but the phase lead the time constant. Distance cannot be computed as simple because information about light time is not obtained through phase comparsion.

SKETCH

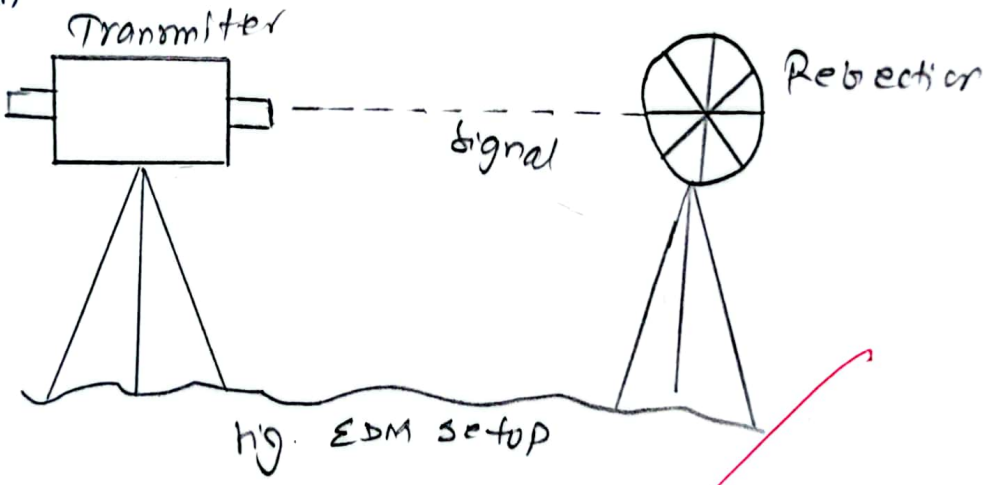

fig. EDM setup

CONCLUSION

Thus, from the demo, we were able to understand diffrent parts of EDM ie total station and its basic working principle. As the device is highly precise we must pay much more attention while measuring angle.

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