جامعة بيرزيت
BIRZEIT UNIVERSITY

Faculty of Engineering
Civil Engineering Department

Surveying lab

ENCE316

Experiment no. 1
Mapping using ties & offsets

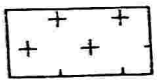
Done By Group (A, B, C, D):
student names Students no.

Date:

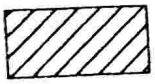
Units :

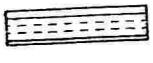
Scale:

Legend:


Soil


Concrete


Building


concrete wall


stone wall

Manhole


electric pole


Tree

North Arrow

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SURVEYING Lab ENCE316

Experiment no. 1: Tapping and Mapping using ties & offsets

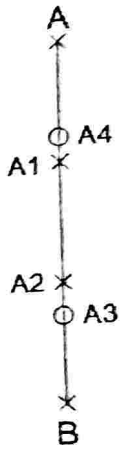
Prepared by: Eng. Shuroq Jamal

❖ Part 1 : Tapping

Data Arrangement:

Forward

Segment	Distance (m)
A A1	√
A1 A2	√
A2 B	√
Σ	Sum 1



Backward

Segment	Distance (m)
B A3	√
A3 A4	√
A4 A	√
Σ	Sum 2

Calculations:

AB avg = $\frac{Sum1+sum2}{2}$

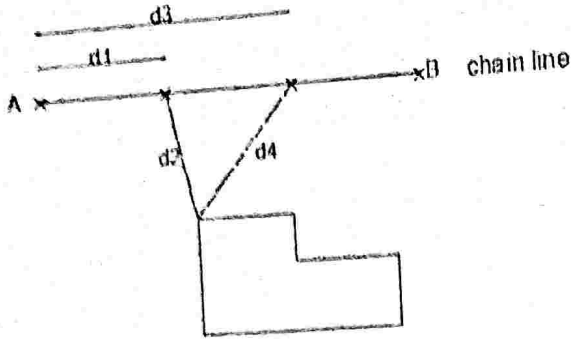
Error (e) = $|measured\ distance - known\ distance|$

RP= $\frac{1}{measured\ distance/|e|} \approx \frac{1}{3000}$

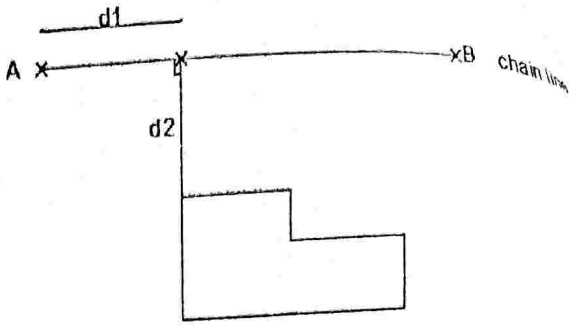
You have to submit
1- Data & Calculati
2- Tabulated data col
3- Sketch for
4- Map

Part 2: Mapping using ties & offsets

Data Arrangement:



Ties method



Offset method

Point	Ties Method				Offset Method		Notes
P1	d_1^*	d_2	d_3^*	d_4	d_1^*	d_2	
P2							
P3							
.							
.							
.							

Note: d_1^* and d_3^* measured on chain line.

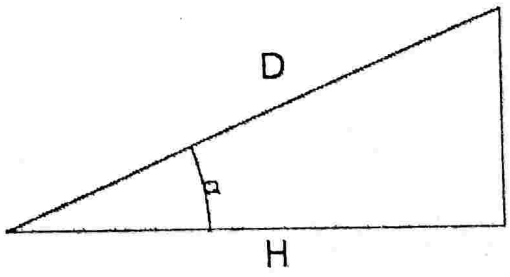
Calculations:

You have to check if it necessary to correct the distances measured on chain line.

$H = D \cos \alpha$,

Where α is angle of inclination of chain line measured using Abney level.

D is the largest distance measured on chain line.



If $H = D \pm 0.05$ m then no need for any correction and α can be neglected (means α has small value)

If not, then you have to correct d_1^* and d_3^* before drawing.

→ Known : 4 B.M

→ measured :

r_1, r_2, r_3 → to the B.M

r_1, r_2, r_3 → Point B

"

You have to submit the following:

1- Data & Calculations for tapping part.
2- Tabulated data collected for mapping exercise.
3- Sketch for mapping area.
4- Map on A3 paper for ties & offsets exercise as attached.

Experiment no.4: Closed Loop Levelling (longitudinal and transverse profiles)

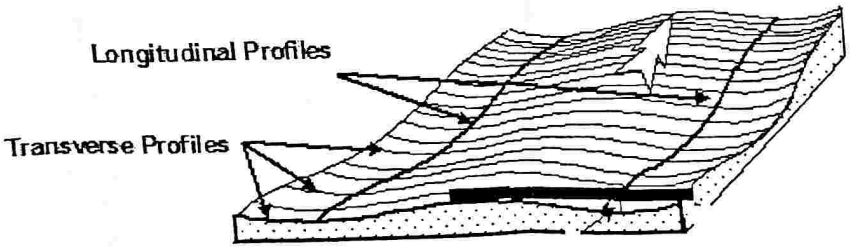
Prepared by: Eng. Shuroq Jamal

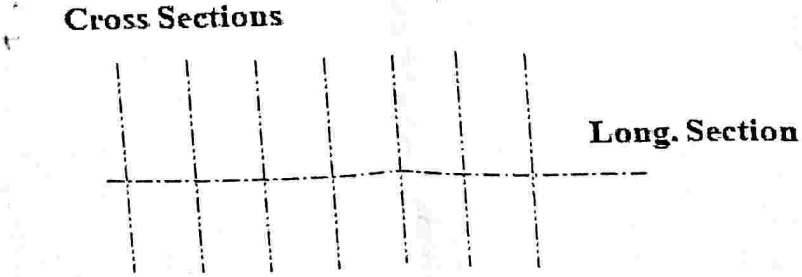
❖ Closed Loop (Polygon) Levelling

Closed Leveling is the process of determining the height of points with respect to certain level (MSL) by starting and ending at the same point.

The purpose of this exercise is drawing longitudinal and transverse profiles. Since Profiling is a way of graphically representing changes of ground topography in a sectional view, with a horizontal scale and a vertical scale (Usually horizontal scales are smaller than vertical scales). There are two types of profiling:

- Longitudinal profiles: If profiling is taken along the centre line.
- Transverse profiles (Cross section): If profiling is taken orthogonal to the centre line.





...by for profile working elevations of points must be taken at constant intervals (5, 10, ...) using ordinary levelling.

...ts experiment 10 m intervals will be used. Where (P1 , P2 , P3 , P4 , P5 & P6) called ...ons.

...ample we make the transverse section at P4.

	B.S	I.S	F.S	HI (m)	H(m)	Correction	H corrected (m)	Remark
...	√				767.174	---		
		√				C_1		
		√				C_1		
	√		√			C_1		T.P
		√				C_2		
a		√				C_2		
b		√				C_2		
c		√				C_2		
d		√				C_2		
f		√				C_2		
P_5	√		√			C_2		T.P
P6		√				C_3		
A	√		√			C_3		T.P
B	√		√			C_4		T.P
C	√		√			C_5		T.P
BM1			√			C_6		
Σ	Σ B.S	Σ I.S	Σ F.S		Σ H			

staff reading at each point (r_2)

NOTE:

- Measure (r_1, r_2, r_3) for both benchmark BM 1.

Since $\frac{r_1+r_3}{2} \approx r_2$ with difference = 2 mm

- a, b, c, d & f : are points taking transverse profile, and their readings recorded as I.S also they must be taken in consideration while doing levelling calculations.
- A , B & C : are points taking just to close the loop at BM1 (Not a part of longitudinal profile) and their readings recorded as B.S and F.S in the table above.

  But it must be taken in consideration while doing levelling calculations.

Levelling calculations

H for all points determined using ordinary levelling calculations with the required checks, as followed:

1. No. of setups= No. of T.P. +1
2. No. of B.S = No. of F.S
3. $\sum$ B.S - $\sum$ F.S = Elev. of the last point – Elev. of the first point
4. $\sum$ Elev. for all points – Elev. Of BM_1 = [$\sum$ (HI_i* (# of IS + # of FS))] - $\sum$ IS - $\sum$ FS

Misclosure error (ε) = BM computed elevation (from leveling) – known elevation for BM

Tolerance error (mm) = $C\sqrt{K}$ where → C : constant

K: loop length (Km)

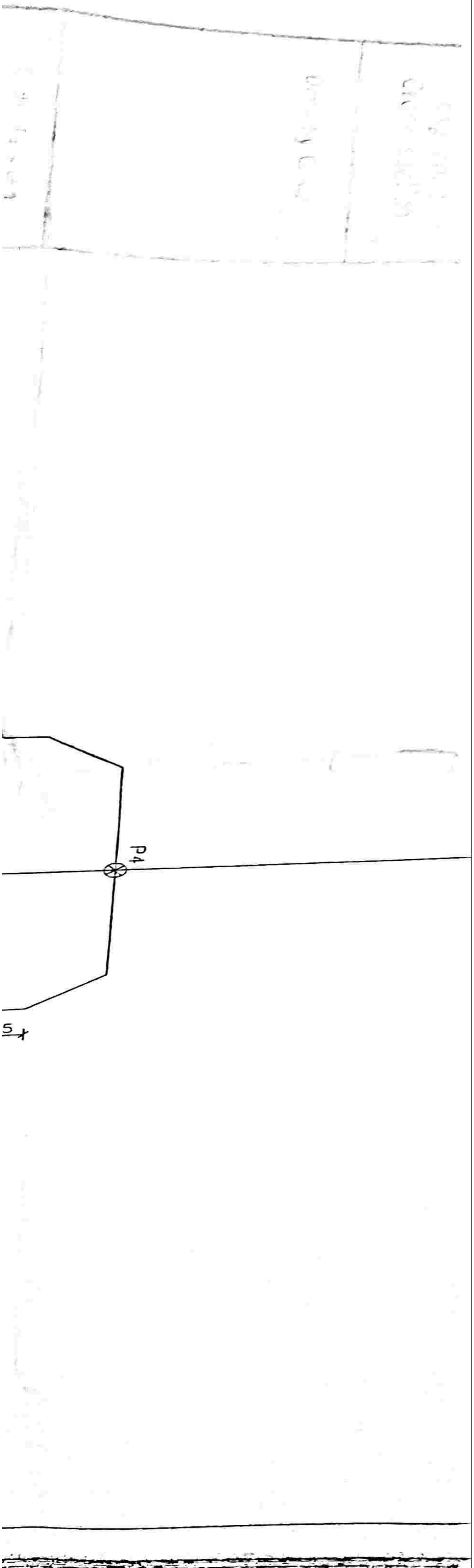
Correction (C_i) = $-\varepsilon * \frac{\text{No.of level setups up to the point}}{\text{total No.of setups}}$

H corrected = H calculated+ correction

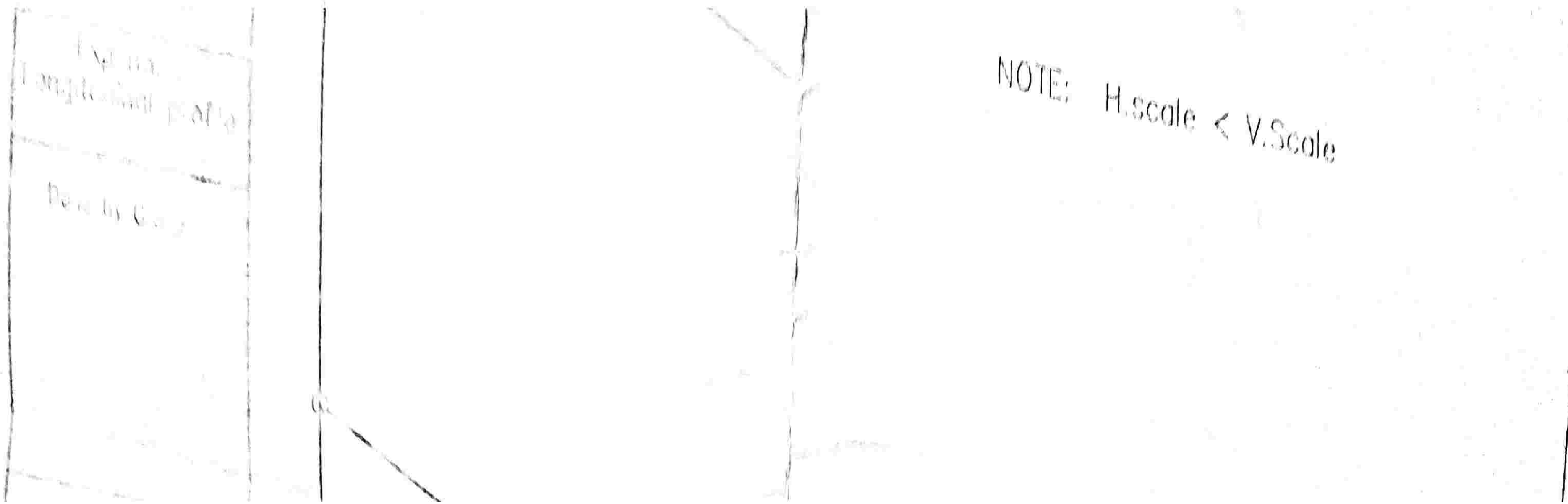
using

You have to submit the following:

1. Copy of your data
2. Full levelling calculations (Calculate corrected elevation at each point).
3. Longitudinal profile on A3 paper
4. Transverse profile on A4.


P4

ng height ... method:



NOTE: H.scale < V.Scale

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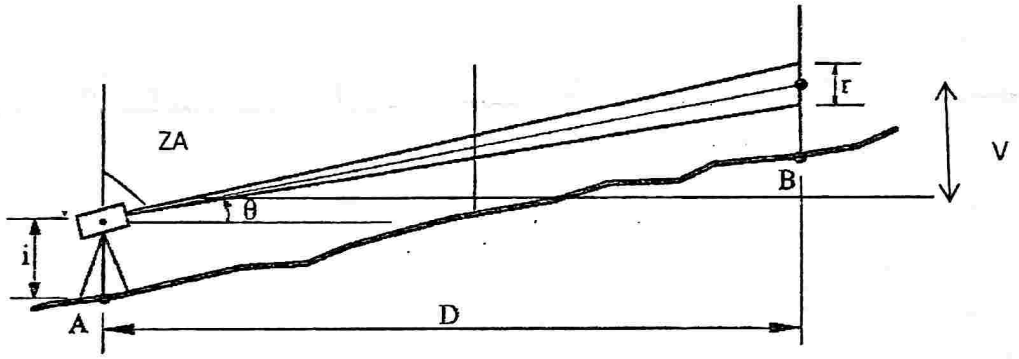
Experiment no. 6 : Measuring Height of object using Stadia Method

Prepared by: Eng. Shuroq Jamal

The Stadia is a method of measuring distances and height of points with theodolite when there is no possibility to take any staff readings at those points such as building corner or tower.

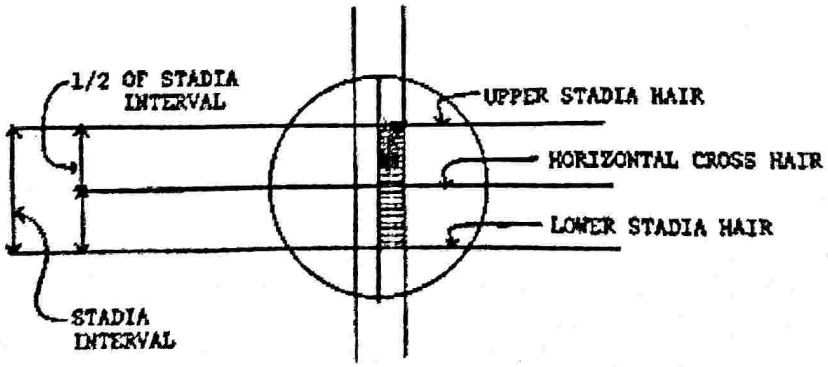


Vertical distance $V = \frac{1}{2} K r \sin(2 Z.A)$

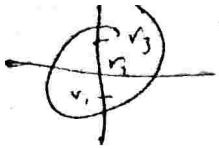
Horizontal distance $D = K r \sin^2 Z.A$

Where K is stadia constant

r is stadia interval = $r_1 - r_3$



Purpose: to find the height of tower (or point C)



Group B

Required Data :

Station	Point	HCR	Staff reading			ZA	HI
			r_1	r_2	r_3		
A	BM	------	√ 1.186	√ 1.387	√ 1.579	√ 89°58'25"	√ 1.45m
A	B	0° 0' 0"	√ 1.225	√ 1.620	√ 1.992	√ 91°08'38"	√
	C	HCR_1 56°51'36"	-------	--------	-------	√ 75°58'07"	√
B	C	0° 0' 0"	-------	--------	-------	------	-------
	A	HCR_2 92°05'48"	-------	--------	-------	------	------

(1.4)

Where:

HCR: Horizontal circle reading

ZA: Zenith Angle

HI : Height of instrument

BM: Bench Mark

------ : No need to be measured

√ : Record measurement.

Calculations:

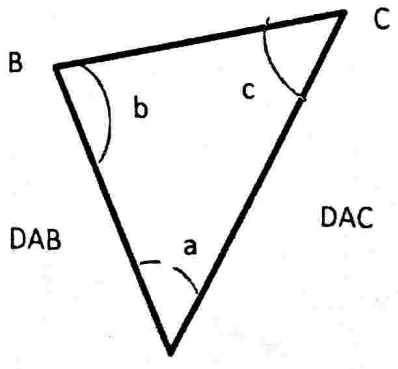
Use K = 100 , (F+C= 0) for all equations.

- H_{BM} : Known
- Find H_A

$H_{BM} = H_A + HI_A + V_{A,BM} - r_{2\,BM}$ where : $V_{A,BM} = \frac{1}{2} K r \sin(2 Z.A)$

$r = r1 - r3$

- $\measuredangle a = HCR1 - 0º\,0'\,0''$
  $\measuredangle b = HCR2 - 0º\,0'\,0''$
  $\measuredangle c = 180º - \measuredangle a - \measuredangle b$



- DAB = K r $\sin^2$ Z.A where : $r = r_1 - r_3$
- Find DAC from sine low

$\frac{DAC}{\sin b} = \frac{DAB}{\sin c}$

- Find H c

$H_c = H_A + HI_A + \frac{DAc}{\tan ZA}$