Birzeit University
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SURVEYING Lab ENCE316

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

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❖ **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.
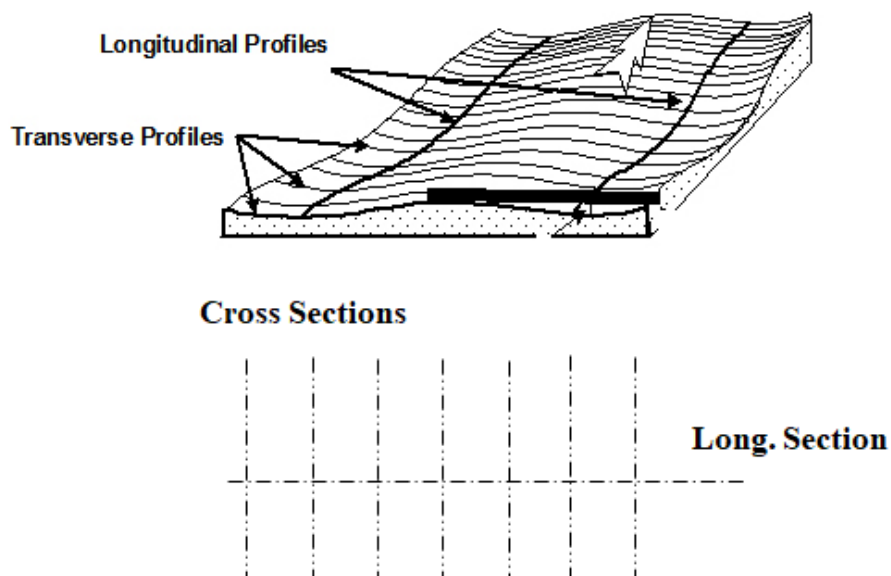
❖ **Data Arrangement**

Usually for profiles working elevations of points must be taken at constant intervals (5, 10, 15, 20,…) m using ordinary leveling.

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

Assume we make the transverse section at P4.

Point	B.S	I.S	F.S	HI (m)	H(m)	Correction	H corrected (m)	Remark
BM $_1$	√				767.33	---		
P1		√				C_1		
P_2		√				C_1		
P_3	√		√			C_1		T.P
P_4		√				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		
∑	∑ B.S	∑ I.S	∑ F.S		∑ H			

√ : staff reading at each point (r_2)

NOTE:

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

  Since $\frac{r1+r3}{2} \approx r_2$ 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) = - ε * $\frac{\text{No.of level setups up to the point}}{\text{total No.of setups}}$

H corrected = H calculated+ correction

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.