

Profile (Longitudinal Section)

(5)

Example/ Draw the profile depending on data below and calculate the depth of the cut and fill in each station, where the grade elevation of A was 51m and the design grade was raised and was 0.5%. The R.L.A was 52.0

| Staff reading | staff station | Distance | H.I | R.L | grade | cut | fill | |
|---------------|---------------|----------|-----|-----|-------|-------|---------|------|
| B.S | I.S | F.S | | | | | | |
| 1.85 | | | A | 0 | 53.85 | 52 | 51 | 1.0 |
| | 2.1 | | B | 20 | = | 51.75 | 51.1* | 0.65 |
| | 1.1 | | C | 60 | = | 52.75 | 51.3** | 1.45 |
| | | 0.98 | D | 80 | = | 52.87 | 51.4*** | 1.47 |

$$\text{grade elev. of next point} = \text{grade elev. of previous point} \pm \text{slope} * \text{Distance between these points}$$

↑ fall
↓ Rise

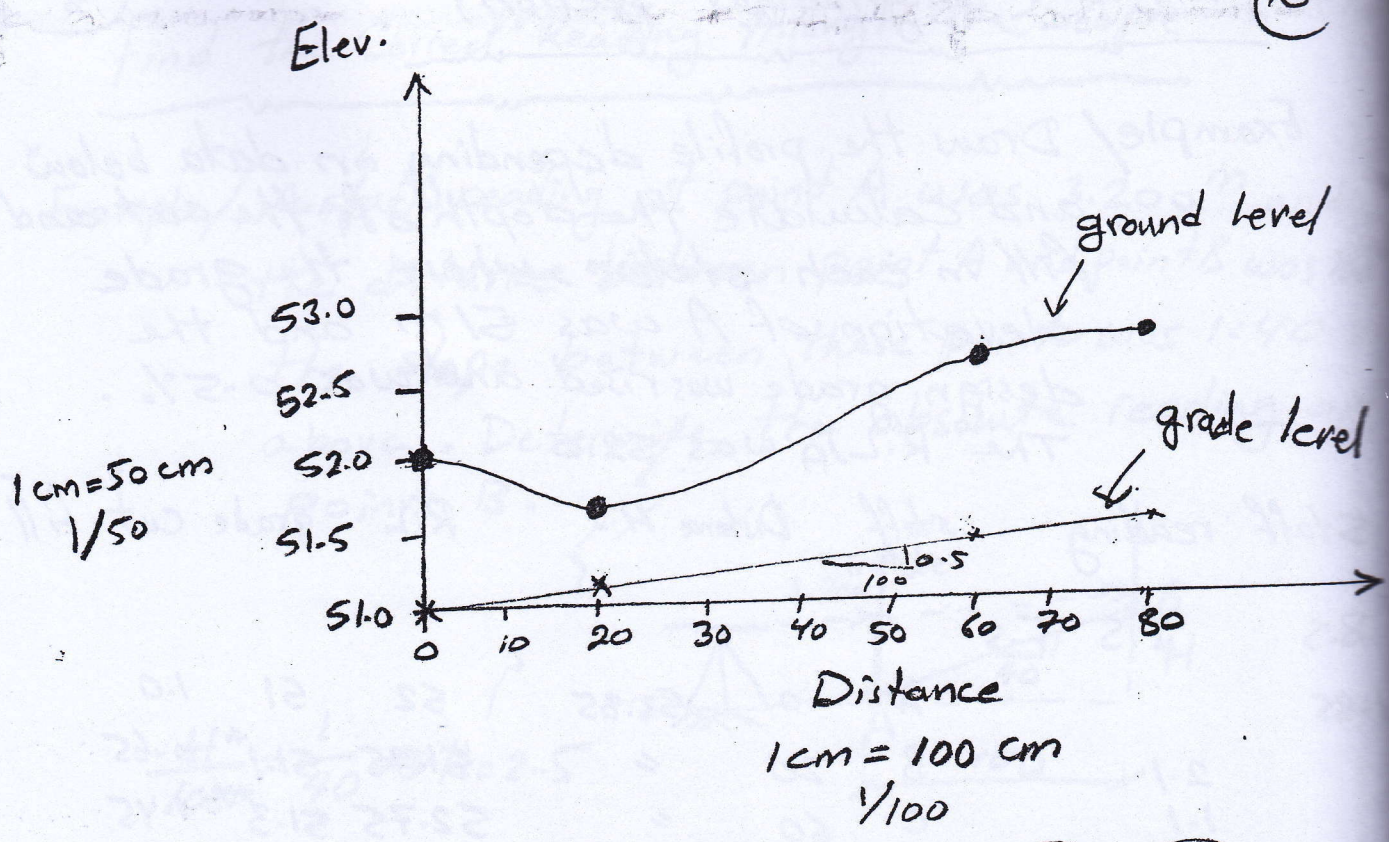
$$* = 51 + \frac{0.5}{100} * 20 = 51.1 \text{ m}$$

$$** \left\{ \begin{array}{l} 51 + \frac{0.5}{100} * 60 = 51.3 \text{ m} \\ \text{or } 51.1 + \frac{0.5}{100} * 40 = 51.3 \text{ m} \end{array} \right.$$

$$*** \left\{ \begin{array}{l} 51 + \frac{0.5}{100} * 80 = 51.4 \text{ m} \\ \text{or } 51.3 + \frac{0.5}{100} * 20 = 51.4 \text{ m} \end{array} \right.$$

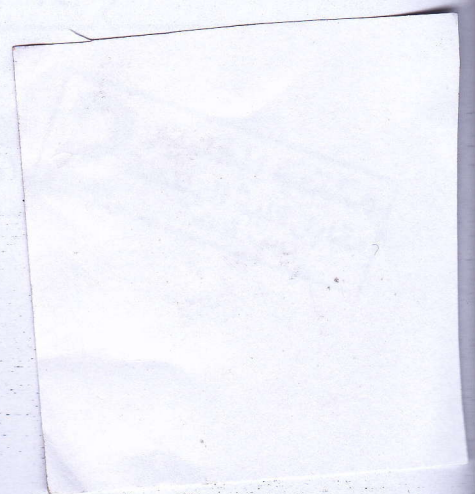
$$\begin{aligned} 52 - 51 &= 1.0 \text{ m} \\ 51.75 - 51.1 &= 0.65 \text{ m} \\ 52.75 - 51.3 &= 1.45 \text{ m} \\ 52.87 - 51.4 &= 1.47 \text{ m} \end{aligned}$$

$$\text{ground elev.} - \text{grade elev.} = \begin{cases} + \text{Cut} \\ - \text{Fill} \end{cases}$$



note:

$$\text{Slope} = \frac{(\Delta \text{ grade}) \text{ between two points}}{(\Delta \text{ distance}) \text{ between the same points}}$$



(7)

Example/ For construction a channel with 65m length and filling slope from 0^m to 30^m with angle equal to 5° and from 30^m to 50^m with angle 3° and from 50^m to the end with zero angle. The reading staff and distance as follow:

| | | | | | | | | | | | | | | | |
|---------------|-----|-----|-----|------|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|
| Dist. | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | B.M |
| Staff Reading | 1.5 | 1.7 | 2.3 | 1.35 | 2.2 | 2.7 | 2.1 | 0.67 | 0.9 | 1.8 | 1.7 | 1.2 | 2.6 | 2.4 | 2.5 |

R.L of B.M was 40m. Calculate the depth of cut for every point. Assume the depth of cut at point zero was 1.3 m.



Sol.

(8)

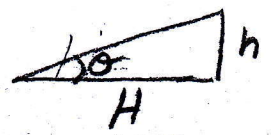
| Dist. | staff reading | | | H.I | R.L | grade | cut |
|-------|---------------|------|------|------|-------|-------|------|
| | B.S | I.S | F.S. | | | | |
| 0 | 1.5 | | | 42.5 | 41.0 | 39.7* | 1.3 |
| 5 | | 1.7 | | " | 40.8 | 39.26 | 1.54 |
| 10 | | 2.3 | | " | 40.2 | 38.82 | 1.38 |
| 15 | | 1.35 | | " | 41.15 | 38.38 | 2.77 |
| 20 | | 2.2 | | " | 40.3 | 37.94 | 2.36 |
| 25 | | 2.7 | | " | 39.8 | 37.5 | 2.3 |
| 30 | | 2.1 | | " | 40.4 | 37.06 | 3.34 |
| 35 | | 0.67 | | " | 41.83 | 36.8 | 5.03 |
| 40 | | 0.9 | | " | 41.6 | 36.54 | 5.06 |
| 45 | | 1.8 | | " | 40.7 | 36.28 | 4.42 |
| 50 | | 1.7 | | " | 40.8 | 36.02 | 4.78 |
| 55 | | 1.2 | | " | 41.3 | 36.02 | 5.28 |
| 60 | | 2.6 | | " | 39.9 | 36.02 | 3.88 |
| 65 | | 2.4 | | " | 40.1 | 36.02 | 4.08 |
| B.M | | | 2.5 | " | 40 | 36.02 | 3.98 |
| | 1.5 | | 2.5 | | | | |

$$\sum B.S - \sum F.S = R.L)_{last} - R.L)_{first}$$

$$1.5 - 2.5 = 40 - R.L)_{first} = 41.0m$$

∴ ground elev. - grade elev. = cut
(R.L)

$$41 - \text{grade elev.})_{0m} = 1.3 \Rightarrow \text{grade elevation at } 0m = 41 - 1.3 = 39.7m^*$$



$$\tan \theta = \frac{h}{H} \Rightarrow h = H \tan \theta$$

$$= 5 \tan 5^\circ = \begin{cases} -0.44 & (0-30m) \\ -0.26 & (30-50m) \end{cases}$$