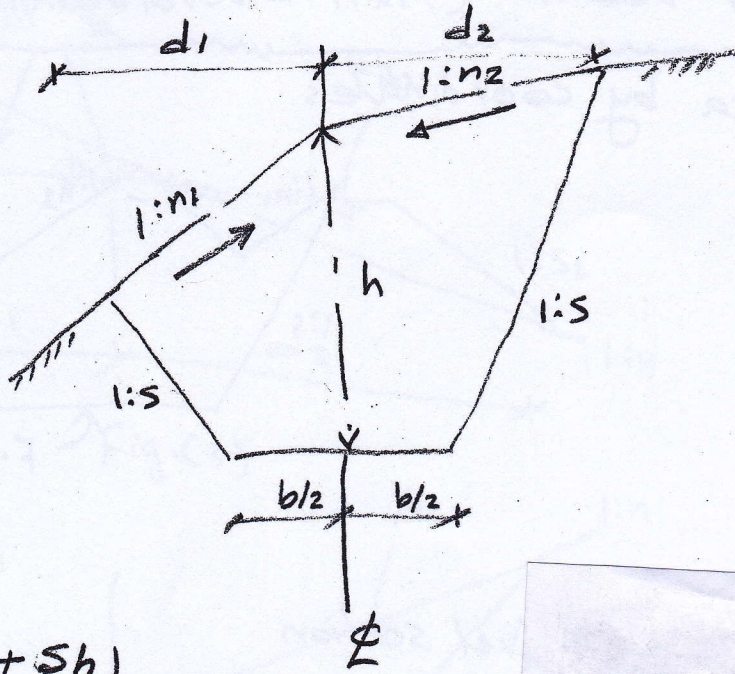


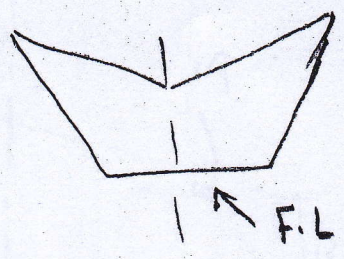
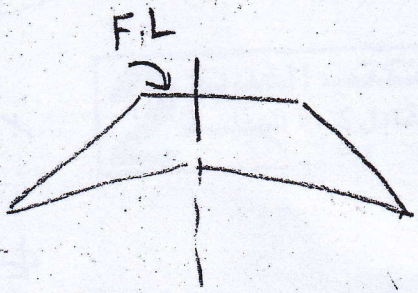
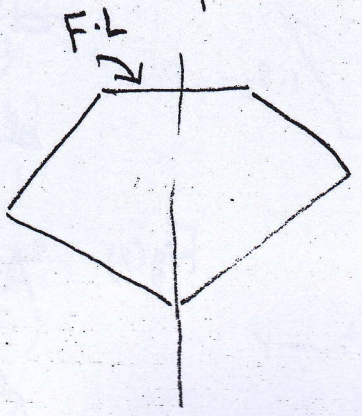
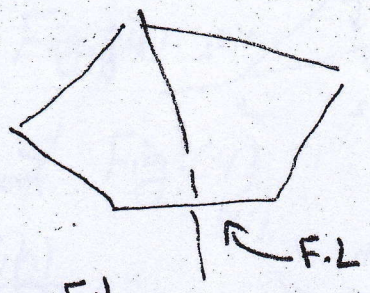
③ Three-level section



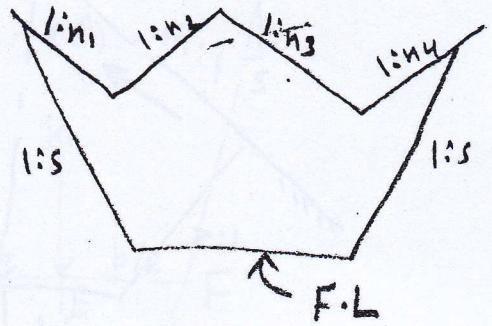
$$d_1 = \frac{n_1 \left(\frac{b}{2} + sh \right)}{(n_1 + s)}$$

$$d_2 = \frac{n_2 \left(\frac{b}{2} + sh \right)}{(n_2 - s)}$$

$$A = \frac{1}{2} \left[\left(\frac{b}{2s} + h \right) (d_1 + d_2) - \frac{b^2}{2s} \right]$$

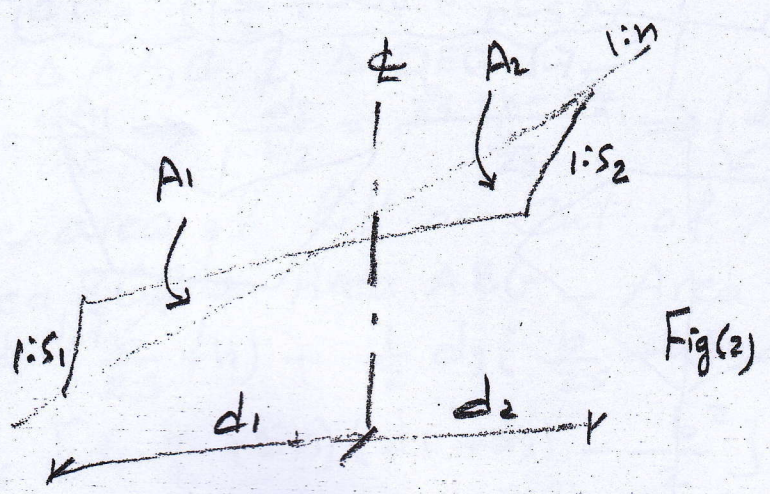
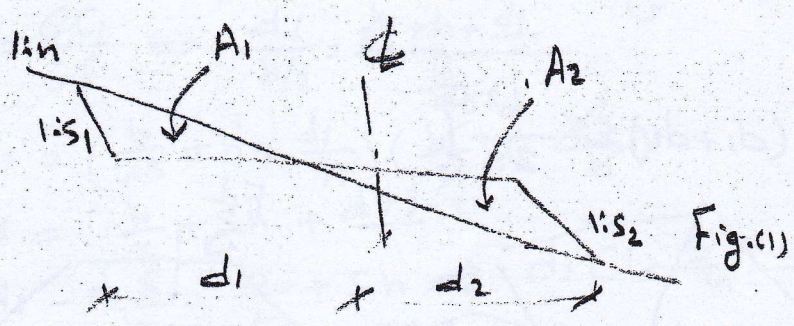


④ Irregular section (Multi-level section)
 used area by coordinates.



⑤ Side hill two-level section

Ⓐ when ϕ to the right



From Fig(1) & Fig(2)

$$d_1 = \frac{n(\frac{b}{2} - s_1 h)}{(n - s_1)}$$

$$d_2 = \frac{n(\frac{b}{2} + s_2 h)}{(n - s_2)}$$

$$A_1 = \frac{(\frac{b}{2} - hn)^2}{2(n - s_1)}$$

$$A_2 = \frac{(\frac{b}{2} + hn)^2}{2(n - s_2)}$$

Ⓑ When ϕ to the left

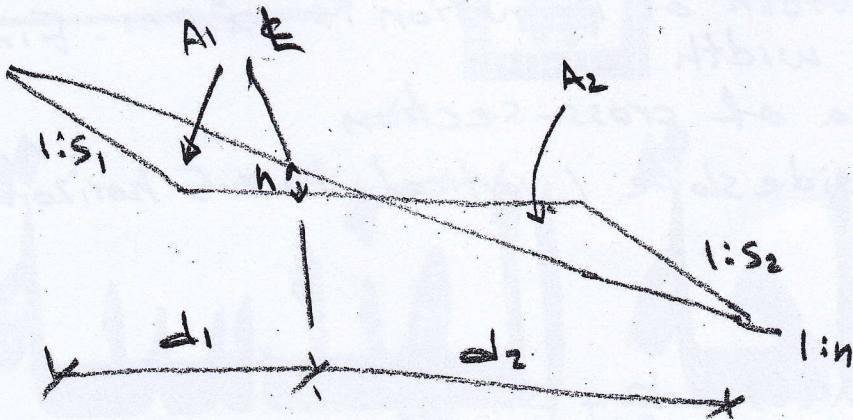


Fig.(3)

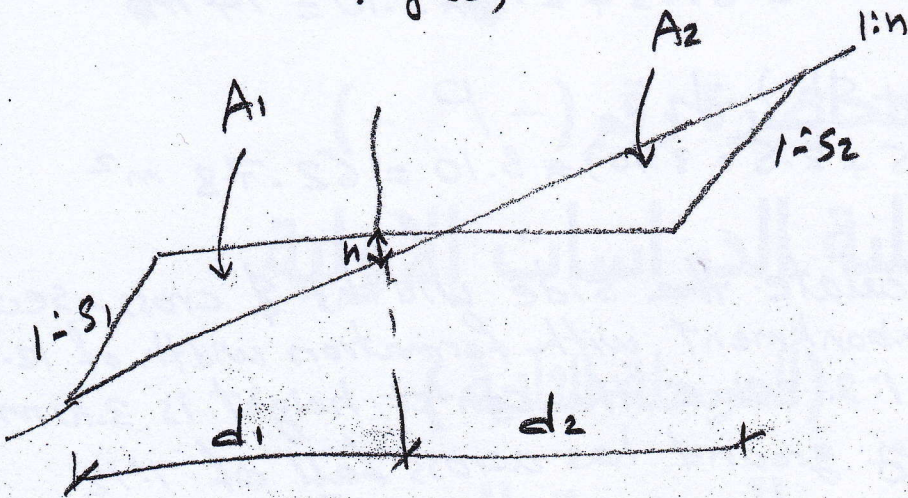


Fig.(4)

From Fig.(3) & Fig.(4)

$$d_1 = \frac{n(\frac{b}{2} + S_1 h)}{(n - S_1)}$$

$$d_2 = \frac{n(\frac{b}{2} - S_2 h)}{(n - S_2)}$$

$$A_1 = \frac{(\frac{b}{2} + hn)^2}{2(n - S_1)}$$

$$A_2 = \frac{(\frac{b}{2} - hn)^2}{2(n - S_2)}$$

(8)

Example ①) An embankment formed with height at center line 3.10 m. The width of formation is 12.5 m. Find

- a) the side width
- b) the area of cross-section

Assume the side slope 1 vertical to 2.5 horizontal

Sol.

$$\begin{aligned} \text{a) side width } (d) &= \frac{b}{2} + Sh \\ &= 6.25 + 2.5 \times 3.10 = 14 \text{ m.} \end{aligned}$$

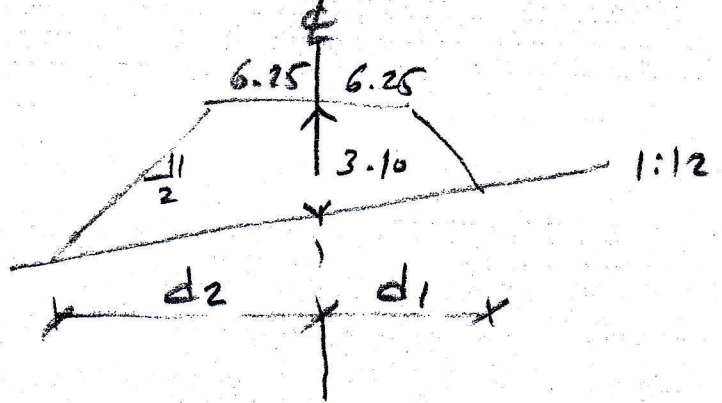
$$\begin{aligned} \text{b) } A &= (b + Sh) \cdot h \\ &= (12.5 + 2.5 \times 3.10) \times 3.10 = 62.78 \text{ m}^2 \end{aligned}$$

Example ②) Calculate the side widths & cross-section area of an embankment with formation width of 12.5 m and side slope 1:2 when the center height is 3.10 m and the existing ground has across fall of 1:12

Sol.

$$\begin{aligned} d_1 &= \left(\frac{b}{2} + sh\right) \left(\frac{h}{n+s}\right) \\ &= (6.25 + 2(3.1)) \left(\frac{12}{12-2}\right) \\ &= 14.94 \text{ m} \end{aligned}$$

$$\begin{aligned} d_2 &= \left(\frac{b}{2} + sh\right) \left(\frac{h}{n+s}\right) \\ &= (6.25 + 2(3.1)) \left(\frac{12}{12+2}\right) = 10.67 \text{ m} \end{aligned}$$



$$\begin{aligned} \text{Area} &= \frac{1}{2} \left[\left(\frac{b}{2s} + h\right) (d_1 + d_2) - \frac{b^2}{2s} \right] \\ &= \frac{1}{2} \left[\left(\frac{12.5}{2(2)} + 3.10\right) (14.94 + 10.67) - \frac{12.5^2}{2(2)} \right] = 60.18 \text{ m}^2 \end{aligned}$$