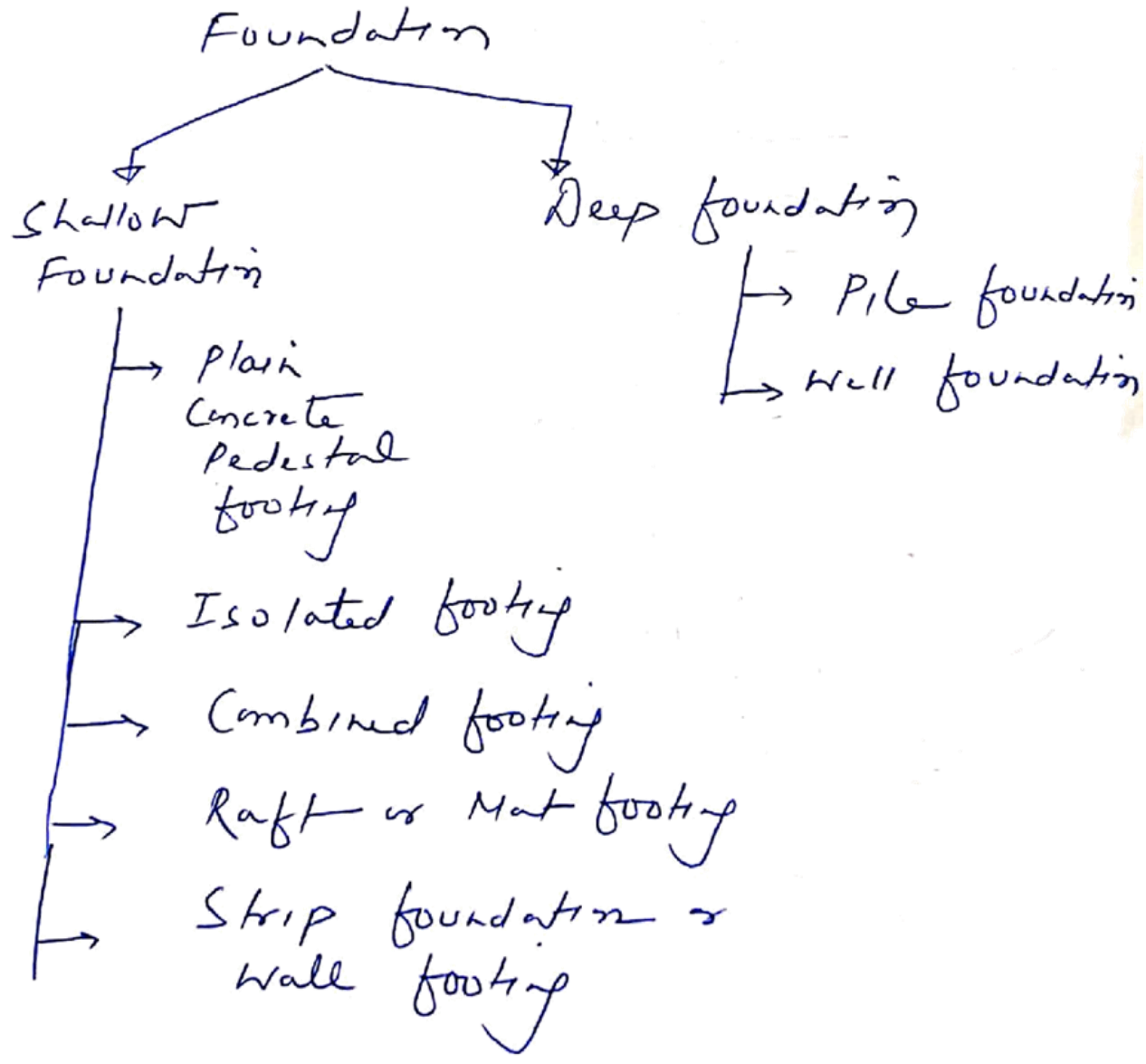
Department of Civil Engineering
Katihar Engineering College, Katihar

Subject: Design of Concrete Structure-I
Topic: Footing
Lecture: 01
Course Instructor: Prof. Rashid Mustafa

⇒ Design of footing



Depth of footing (D_f):

→ Valid for all types of foundations

→ As per IS 1080 - 1962, Minimum depth should be 50 cm

→ Rankine given expression to compute minimum depth of a footing

A/c to Rankine

$$D_f = \frac{q_c}{\gamma}\left(\frac{1-\sin\phi}{1+\sin\phi}\right)^2$$

Where D_f → Minm depth of footing

q_c → Gross bearing Capacity of soil

γ → density of soil

ϕ → Angle of reposse of soil.

⇒ Eccentricity loaded footing.

Corel. If $e \leq \frac{L}{6}$ (Where L → length of footing)

σ = Normal stress ± Bending stress

$$= \frac{P_{total}}{A} \pm \frac{M.y}{I}$$

$$\sigma_{max}/\sigma_{min} = \frac{P+\Delta P}{A} \pm \frac{M}{Z}$$

Where ΔP → sum of weight of footing & backfill

Z → Section Modulus $= \frac{BL^2}{6}$

A → Area of footing $= B \times L$

B → Breadth of footing

$M = (P+\Delta P) \cdot e$

e → Eccentricity

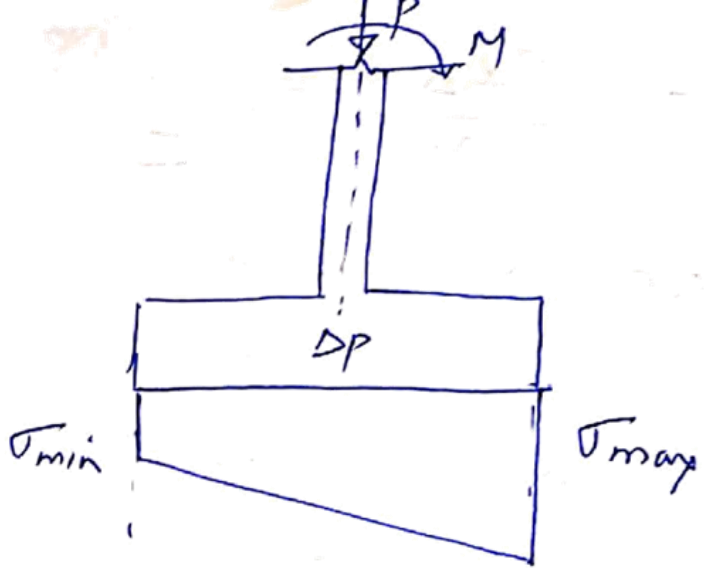
$$\sigma_{max} = \left(\frac{P+\Delta P}{A}\right) + \frac{M}{Z}$$

$$\sigma_{min} = \frac{P+\Delta P}{A} - \frac{M}{Z}$$

Valid only $e \leq L/6$

Where σ_{max} → Maximum value of base pressure at one extreme

σ_{min} → Minimum base pressure at other extreme



$e \leq L/6$

Case 2. When $e > \frac{L}{6}$

→ The above formula is not valid.

→ Effective length (L_{eff}) of contact is reduce from L to L_{eff}

Where $L_{eff} = 3 \cdot a$

$(a = 0.5L - e)$

$$\sigma_{max} = \frac{2(P + \Delta P)}{B \cdot L_{eff}}$$

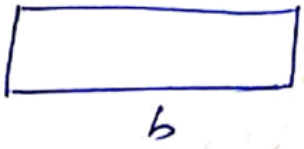
$$\sigma_{min} = 0$$

⇒ Design of Rectangular Isolated footing

Given Value

(1) Load from Column (P) [working load]

(2) Size of Column (a x b)



(3) Safe Bearing Capacity of soil (q_0)

(4) Grade of Concrete / steel.

Step 1: Size of footing

→ Load from Column (Working Load) = P

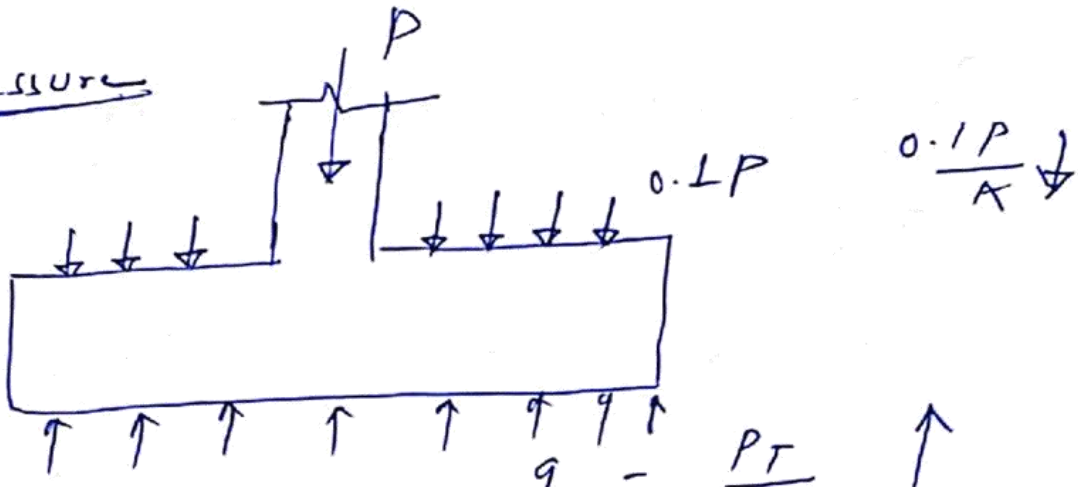
Weight of foundation = 0.10P
(Add 10% of column load)

Total Load (P_T) = 1.1P.

Area of footing (A) = $\frac{P_T}{q_0}$

→ Decide Size of footing (A = L x B)

Net Pressure



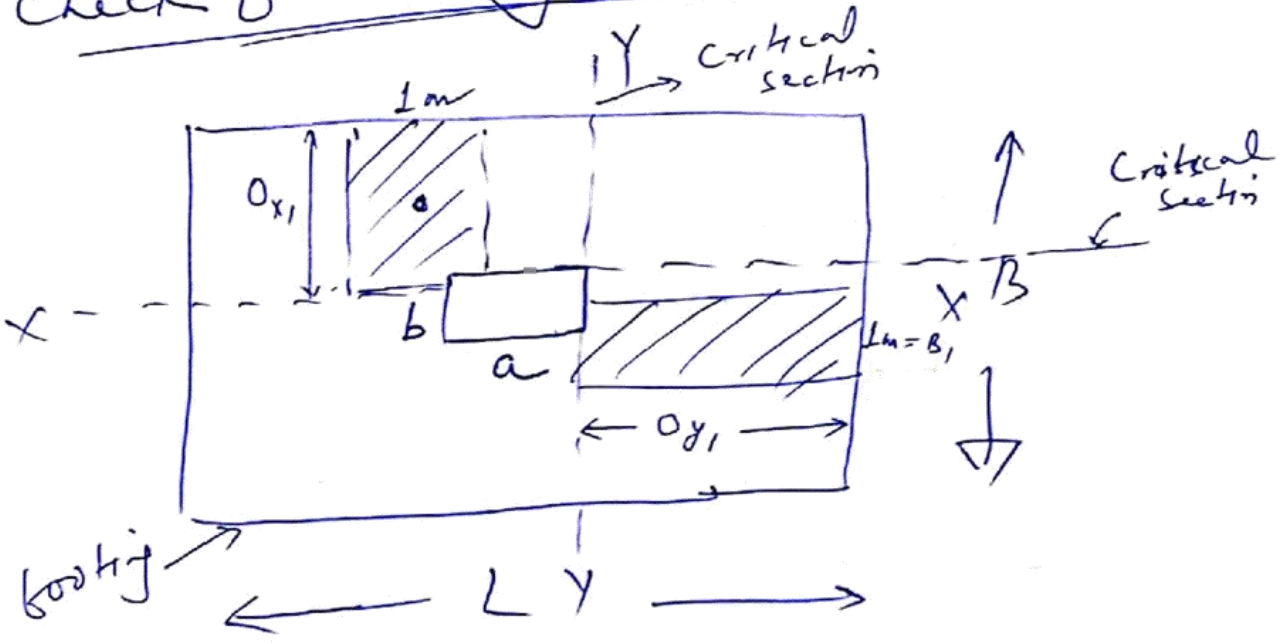
$$W_0 = \frac{P_T}{A} - \frac{0.1P}{A} = \frac{1.1P - 0.1P}{A}$$

$$W_0 = P/A \rightarrow \text{design soil pressure} \quad [WSM]$$

In LSM

$$W_{U0} = \frac{1.5P}{A}$$

(2) Check for Bending Moment



Critical Section for BM

At face of the column where foundation is provided for a RCC Column/Wall

(1) At X-X

Consider 1 m width of foundation

Overhang out Critical section one side

$$OX_1 = \left(\frac{B-b}{2}\right)$$

Max^m BM at X-X

$$M_x = w_0 \times 1m \times OX_1 \times \frac{OX_1}{2}$$

$$M_x = w_0 \times 1 \times \left(\frac{B-b}{2}\right) \times \left(\frac{B-b}{4}\right)$$

$$\boxed{M_x = w_0 \times 1 \times \frac{(B-b)^2}{8}}$$

(2) About Y-Y

$$OY_1 = \left(\frac{L-a}{2}\right)$$

$$M_y = w_0 \times 1 \times \left(\frac{L-a}{2}\right)\left(\frac{L-a}{4}\right)$$

$$\boxed{M_y = w_0 \times 1 \times \frac{(L-a)^2}{8}}$$

In LSM

$$M_{ux} = W_{uu} \times \frac{(B-b)^2}{8}$$

$$M_{uy} = W_{uu} \times \frac{(L-a)^2}{8}$$

Check for depth of footing

$$d = \sqrt{\frac{M_{max}}{Q \cdot B_1}}$$

Where B_1 = Width of strip
= 1000 mm

HAPPY LEARNING