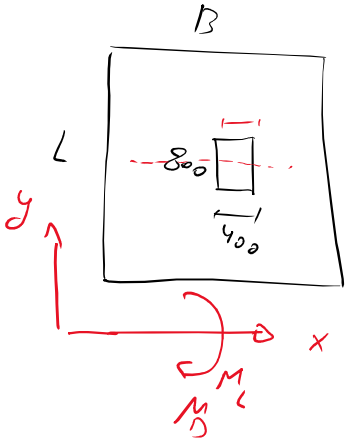
Design of single footing



Example: Design single footing to support column 400 x 800 mm, carrying

P_{D_L} = 1700 kN , $q_{all\ soil}$ = 400 kN/m²

P_{LL} = 1300 kN , f'_c = 28 MPa

Footing weight = 10% of total service load

Moment Dead = 255 kN
Moment live = 195 kN
} in the strongest columns axis

Solution

① P_u

P_s = 1700 + 1300 = 3000 kN

foot weight = 0.1 x 3000 = 300 kN → Dead load.

$P_{D\ total}$ = 1700 + 300 = 2000 kN.

P_s = 3300 kN

M_s = 450 kN

800

⇒ hint if same example without moment

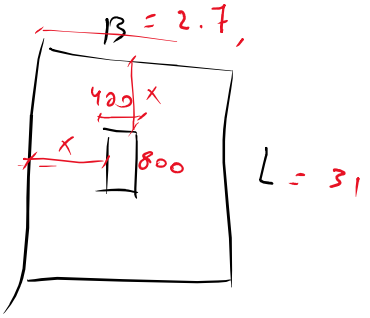
⇒ Dimension $A = \frac{3300}{400} = 8.25\ m^2$

B − 400 = L − 800

if square column $B = L = \sqrt{8.25} = 2.87\ m \approx 2.9\ m$

L ≥ 2.9 → Lc − bc = 800 − 400 = 400 → $\frac{400}{2} = 200$

B < 2.9 →



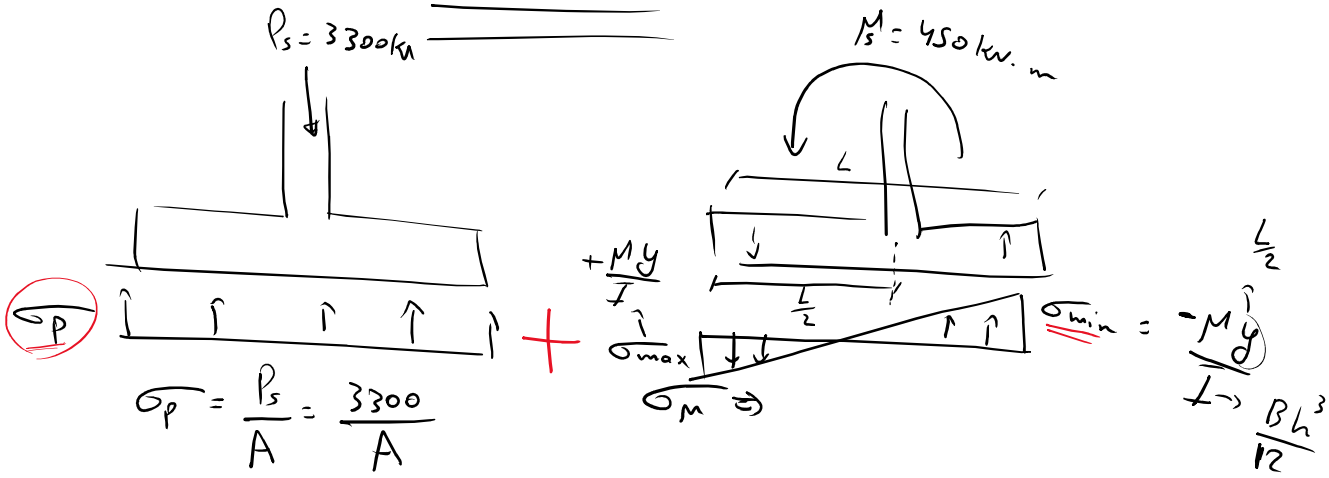
L = 2.9 + 0.2 = 3.1 → 3.1 − 0.8 = 2.3 m ✓

B = 2.9 − 0.2 = 2.7 → 2.7 − 0.4 = 2.3 m ✓

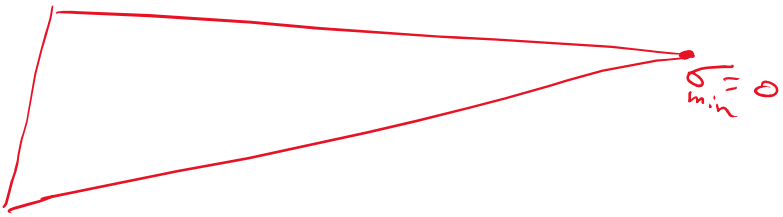
Solution for this example (with moment)

→ stress without moment $\frac{P}{A} = \sigma_{max}$

→ stress with moment $\frac{P}{A} \mp \frac{My}{I}$



① if $|\sigma_{min}| = |\sigma_P|$



$\sigma_{max} = \sigma_P + \sigma_{M\,max}$

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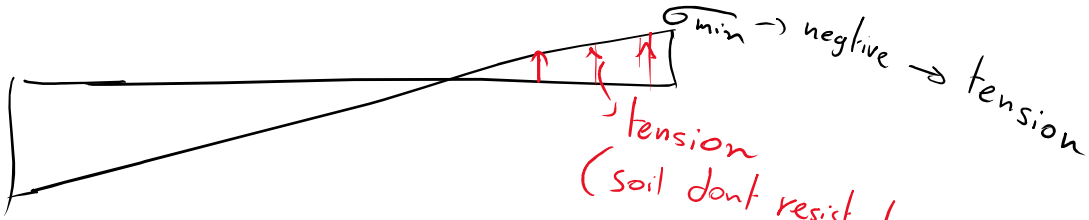
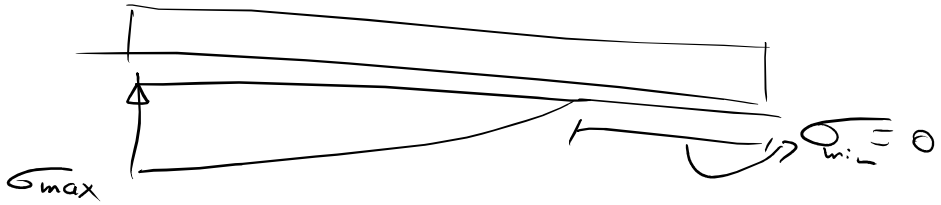
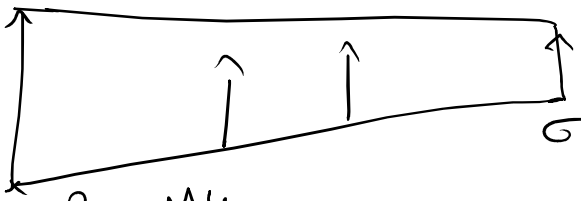
if $|\sigma_{min}| > \sigma_P$



$\sigma_{max} = \sigma_P + \sigma_{M\,max}$



③ if $|\sigma_{min}| < \sigma_p$



$\sigma_{min} = \left(\frac{P}{A} - \frac{My}{I}\right)$ → Positive → Compression

$\sigma_{max} = \frac{P}{A} + \frac{My}{I}$

$\sigma_{max} \leq q_{all}$

→ σ_{max} Case 1 > σ_{max} Case 2 > σ_{max} Case 3

→ $M = e \times P$ → $e = \frac{M}{P}$

e: الازاحة عن مركز القاعدة

$\sigma_{max} \leq q_{all}$

$\sigma_{min} \geq 0$ to avoid tension on Soil

$\sigma_{max} = \frac{P_s}{A} + \frac{(e \times P_s)\, y}{I}$

$\frac{P_s}{A} + \frac{e P_s\, y}{\frac{BL^3}{12}}$ $\Rightarrow \frac{P}{A(BL)}\left(1 + \frac{6 \times e}{L}\right)$

$\sigma_{min} = \frac{P_s}{A}\left(1 - \frac{6e}{L}\right)$