Fayoum University

Faculty of Engineering

Department of Civil Engineering

CE 402: Part A

Shallow Foundation Design

Lecture No. (2): Wall Footing

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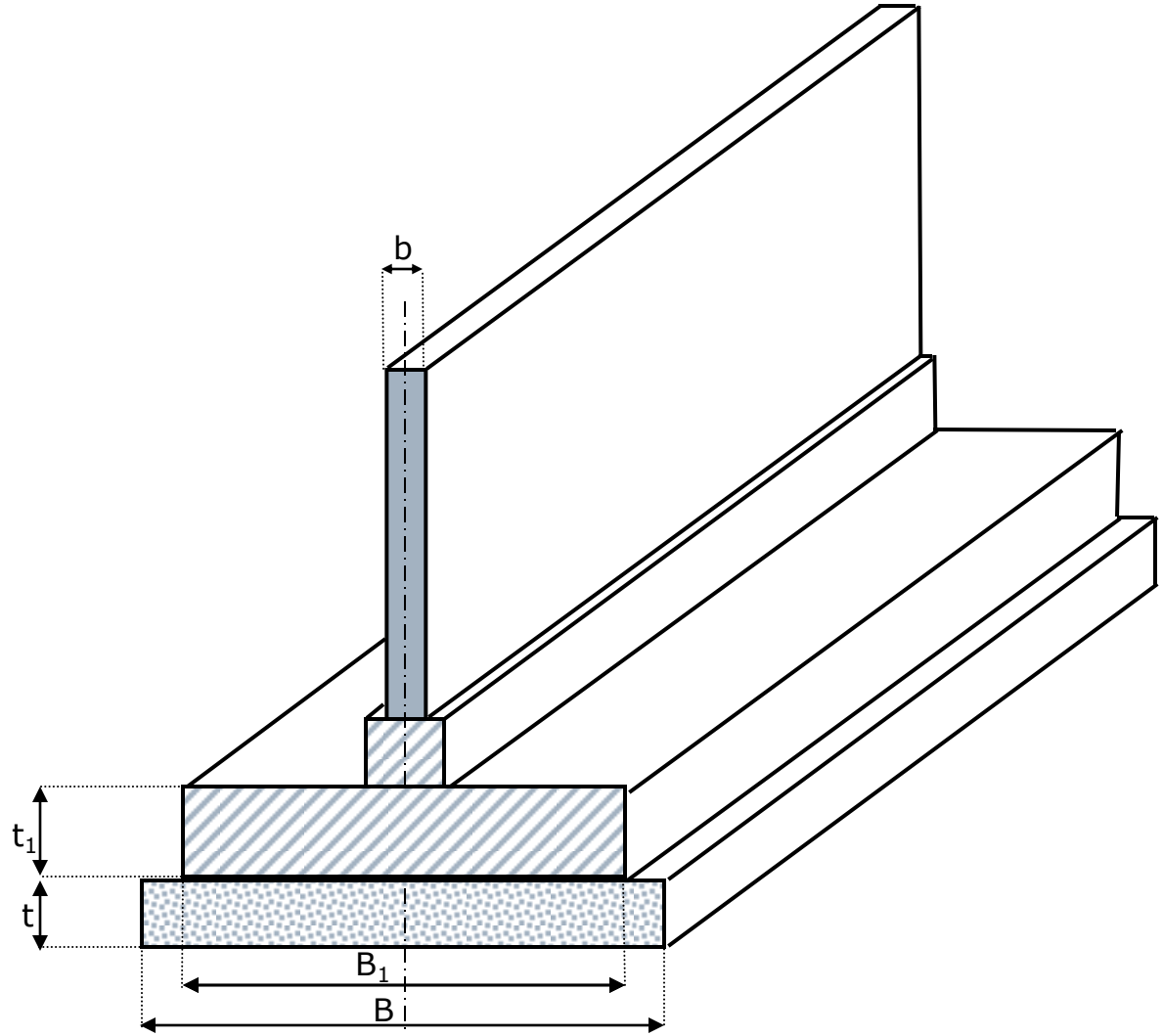
Wall Footing



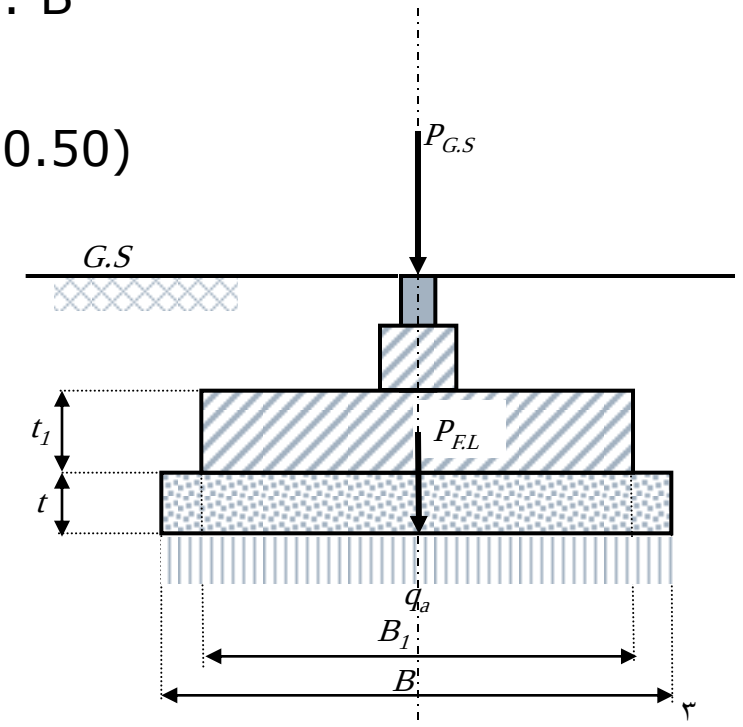
Design of Wall Footing

- Plain concrete footing (P.C.)

$$Area = B * 1.00 = \frac{P_{F.L}}{q_a} \longrightarrow \text{Get: B}$$

Assume thickness of P.C., t = (0.25 to 0.50)

Dim. of P.C. = $B * t$



Design of Wall Footing

- Reinforced concrete footing (R.C.)

$$X = (0.80 \rightarrow 1.00) * t$$

$$B_1 = B - 2X$$

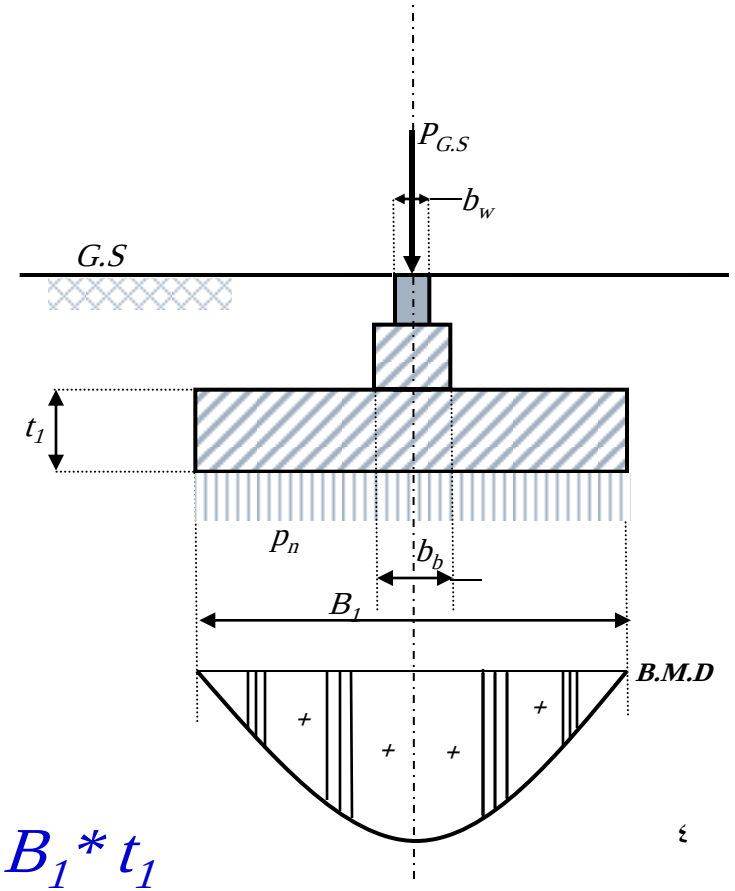
$$p_n = \frac{P_{G.s}}{B_1}$$

$$M_I = p_n \frac{\left[(B_1 - b_b)/2\right]^2}{2}$$

$$d = C\sqrt{\frac{M}{b * F_{cu}}}$$

$$t = d + \text{cover}$$

Steel cover=5.0 to 7.0cm



Dim. of R.C. = $B_1 * t_1$

Design of Wall Footing

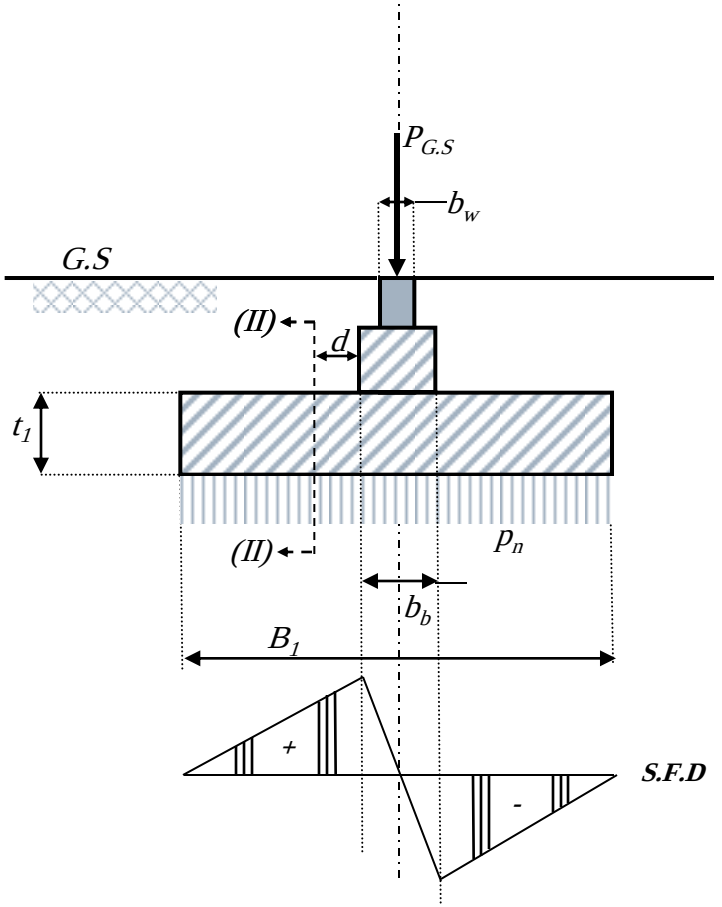
- Shear Stress:

$$Q_s = p_n * \left(\frac{B_1 - b_b}{2} - d \right)$$

$$q_s = \frac{Q_s}{b * d} \leq q_{su}$$

$$q_{su} = 0.75 \sqrt{\frac{f_{cu}}{\gamma_c}}$$

If $q_s > q_{su}$, *Increase d*



Notes:

•No shear RFT in Footing.

•For no footing beam, critical locates at distance *d* from wall face.

Q_s: shear force at critical sec. (II).

q_s: shear stress.

q_{su}: ultimate shear strength.

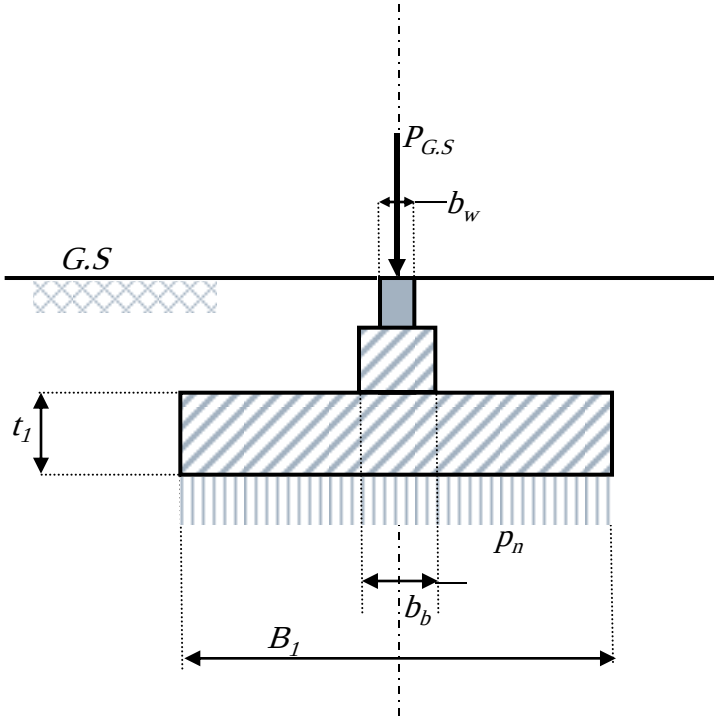
Design of Wall Footing

- Punching Stress:

No Punching stress check

why?

Is there a check for punching of columns in solid slab? why?



Design of Wall Footing

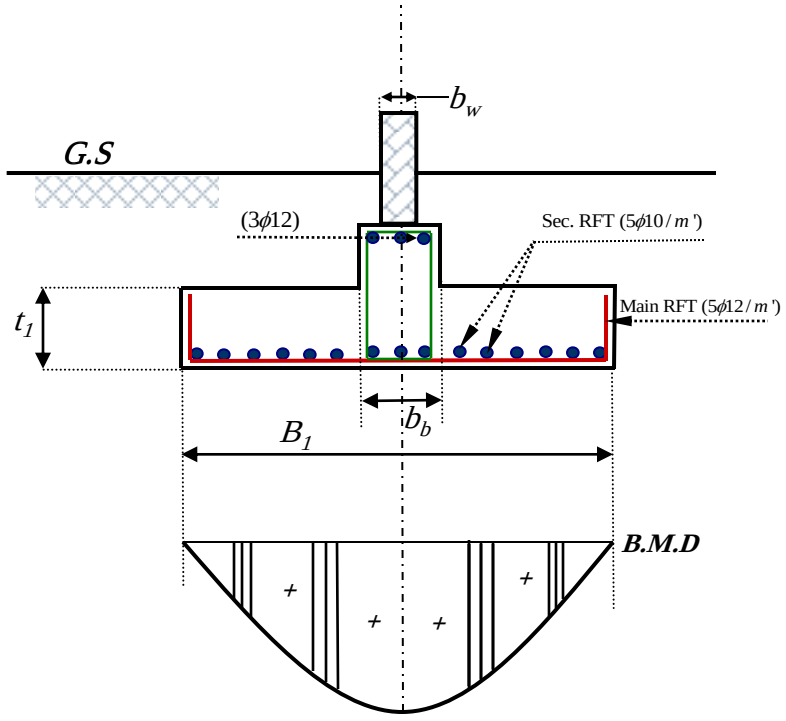
- Footing Reinforcement:

Which is required?

Top or bottom RFT

why?

$$A_s = \frac{M_I}{f_y * d * j}$$



Notes:

- Minimum number of bars per meter is five.
- Minimum diameter for main RFT is 12mm.
- Minimum diameter for secondary RFT is 10mm.
- Number of bars may be taken 5 to 8.
- Diameter of bars may be selected from 12 to 18mm.

Design of Wall Footing

- Example(1):

A 0.30 m thick masonry wall exerts 20t/m' at ground surface and is to be supported on a strip footing. The foundation level is 1.50m below ground surface. The soil below the base has a gross allowable bearing capacity of 1.0 kg/cm^2. it is required to give a complete design and neat sketches for the strip footing.

$b_w = 0.30m.$

$p_{G.S} = 20t/m'$

$q_a = 1.0kg/cm^2 = 10t/m^2.$

$f_{cu} = 250kg/cm^2.$

$f_y = 3600kg/cm^2$

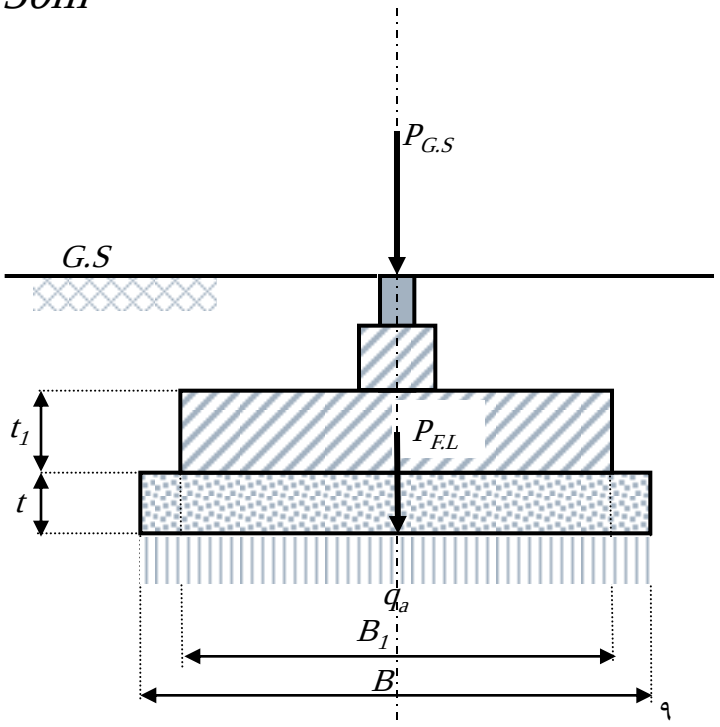
Design of Wall Footing

- Plain concrete footing (P.C.)

$$Area = B * 1.00 = \frac{1.15 * 20}{10} = 2.30m \longrightarrow B=2.30m$$

Assume thickness of P.C., $t = 0.30m$

Dim. of P.C. = ***2.30 * 0.30***



Design of Wall Footing

- Reinforced concrete footing (R.C.)

$$X = (0.80 \rightarrow 1.00) * t = 0.30m$$

$$B_1 = B - 2X = 2.30 - 2*0.30 = 1.60m$$

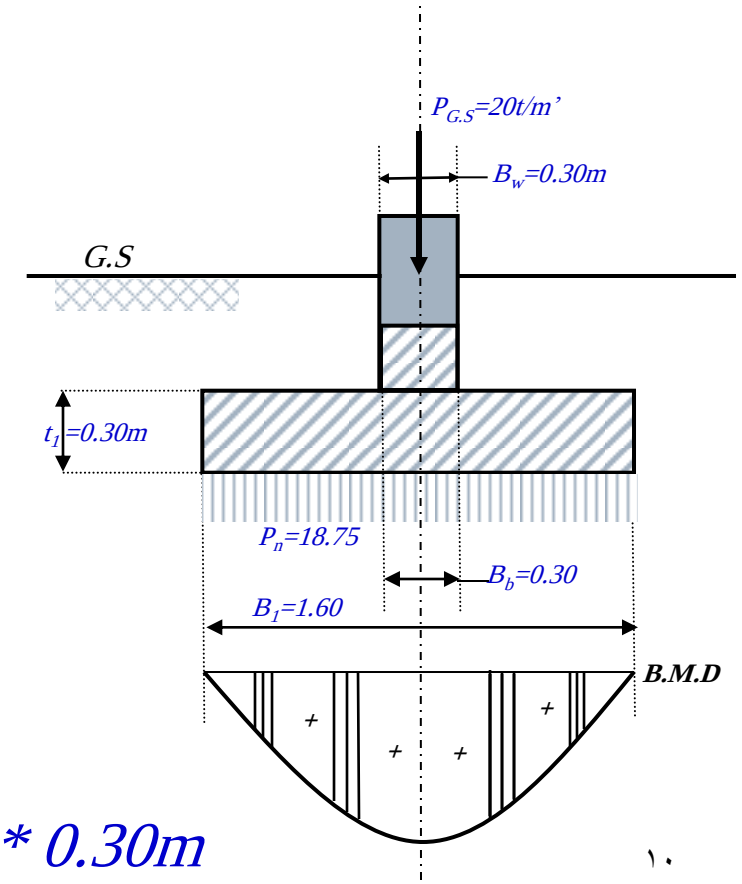
$$p_n = \frac{P_{G.s}}{B_1} = \frac{20*1.50}{1.60} = 18.75t/m^2$$

$$M_I = p_n \frac{[(B_1 - b_b)/2]^2}{2}$$

$$M_I = 18.75 \frac{[(1.60 - 0.30)/2]^2}{2} = 3.96m.t/m'$$

$$d = C\sqrt{\frac{M}{b*F_{cu}}} = 5.0\sqrt{\frac{3.96*10^5}{100*250}} = 20cm$$

$$t = d + cover = 20 + 5.0 = 25cm$$



Dim. of R.C. = *1.60* 0.30m*

Design of Wall Footing

- Shear Stress:

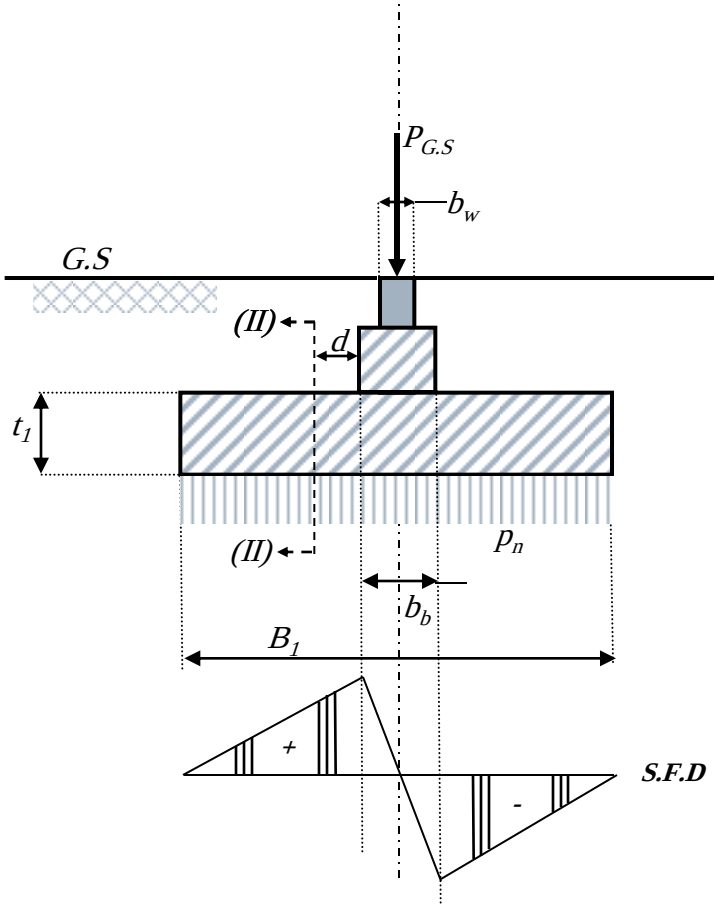
$$Q_s = p_n * \left(\frac{B_1 - b_w}{2} - d \right)$$

$$Q_s = 18.75 * \left(\frac{1.60 - 0.30}{2} - 0.25 \right) = 7.50 t / m'$$

$$q_s = \frac{Q_s}{b * d} = \frac{7.50 * 1000}{25 * 100} = 3 kg / cm^2$$

$$q_{su} = 0.75 \sqrt{\frac{f_{cu}}{\gamma_c}} = 0.75 \sqrt{\frac{250}{1.5}} = 9.68 kg / cm^2$$

$q_s \le q_{su}$ safe shear.



Q_s: shear force at critical sec. (II).

q_s: shear stress.

q_{su}: ultimate shear strength.

Design of Wall Footing

- Footing Reinforcement:

$$A_s = \frac{M_I}{f_y * d * j} = \frac{3.96*10^5}{3600*25*0.695} = 6.33 cm^2$$

A_s (main)= *6φ12mm/m'*

A_s (sec.)= *5φ10mm/m'*