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Subject	Foundation and Pavement
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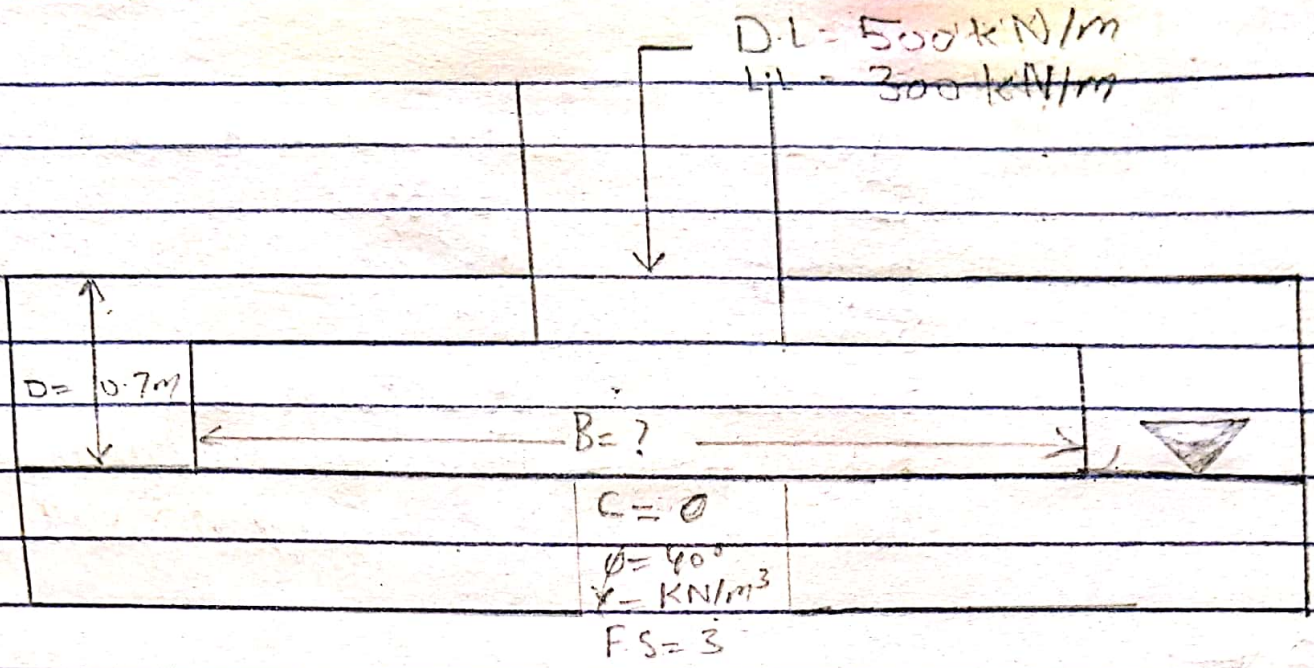
Q NO: (1)

A strip footing is to be design for the proposed 2 story building in swat which support the dead load of 500 kN/m and live load of 300 kN/m at depth of 0.1m and the soil is found gravelly sand and characteristic values of the shear strength parameters are $C = 0$ and $\phi = 40°$. Determine the required width of the footing if the factor of safety of 3.0 against shear failure of the soil is specified. Assuming that WT may rise to foundation level. The unit weight of the sand above the WT is 17 kN/m³ and below the wt the saturated unit weight is 20 kN/m³

NOTE: For ϕ 40° The Terzaghi BC factors are $N_q = 81.3$ and $N_\gamma = 100.4$

Shape factor	strip footing
S_c	1
S_γ	1



Given Data:-

D.L = 500 KN/m

L.L = 300 kN/m

D = 0.7 m

C = 0

ϕ = 40°

N_q = 81.3

N_γ = 100.4

F.O.S = 3.0

γ = 17 KN/m³

γ_{sat} = 20 kN/m³

Sol:-

$$F.O.S = \frac{q_u}{q_{app}}$$

$$q_u = F.O.S \times q_{app} = 3 \times \frac{800}{B} = \frac{2400}{B}$$

For ϕ = 40° the terzaghi B factor

N_q = 81.3 , N_γ = 100.4

$q_u = CN_c + \gamma D N_q + \frac{1}{2} \gamma B N_\gamma$

use bulk unit weight ($17 kN/m^3$) in 2nd term and submerged unit (weight) ($\gamma' = \gamma_{sat} - \gamma_w$)
$= 20 - 9.8 = 10.2 kN/m^3$ in 3rd term of Bc equation

$$q_u = 0 + (17 \times 0.7 \times 81.3) + (0.5 \times 10.2 \times B \times 100.4)$$

$$q_u = 967.47 + 512B$$

$$\frac{2400}{B} = 967.47 + 512B$$

$$2400 = 967.47B + 512B^2$$

$$512B^2 + 967.47B - 2400 = 0$$

By Quadratic equation

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$\therefore a = 512$

$b = 967.5$

$c = -2400$

$$x = \frac{-(967.5) \pm \sqrt{(967.5)^2 - 4(512 \times (-2400))}}{2(512)}$$

$$= \frac{-967.5 \pm \sqrt{(967.5)^2 + (4915200)}}{1024}$$

$$x = \frac{-967.5 + 2418.93}{1024}$$

$$x = \frac{-967.5 + 2418.93}{1024} \quad \text{or} \quad x = \frac{-967.5 - 2418.93}{1024}$$

$$x = \frac{1451.43}{1024}, \quad x = \frac{-3386.43}{1024}$$

$$x = 1.42, \quad x = -3.3$$

Ans = B = 1.42 m