# Department of Civil Engineering

Subject: Foundation Engineering

Instructor: Prof. Rashid Mustafa

## Mid Term Solution

**Q-1** (i) (d)

(ii) (b)

(iii) (d) Area ratio (Ar) = $\frac{D_o^2 - D_i^2}{D_i^2} \times 100 = 44\%$

(iv) (c)

$Q_u = \pi d L \alpha C_u$

$= \pi \times 0.5 \times 16 \times 0.75 \times 50 = 940\ kN$

**Q-2.**

Footing size: 3m x 2m

q : 140 kN/m², E = $5 \times 10^4$ kN/m²

ν : 0.50

(i) $S_i = \frac{q \cdot B (1-\nu^2)}{E_s} \times I.F$

$= \frac{140 \times 2 \times (1-0.5^2)}{5 \times 10^4} \times 1.36$

$= 5.712\ mm$

(ii) $S_i = \frac{140 \times 2 \times (1-0.5^2)}{5 \times 10^4} \times 1.06$

$S_i = 4.45\ mm$

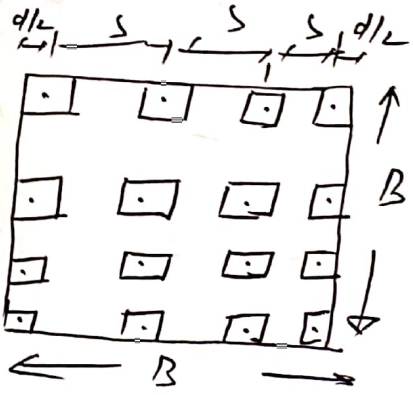
**Q-3**

$B_a = 3S + d_b$

$B = 3S + 0.3$

$d_b = 0.3\ m$

$L = 12\ m$



$Q_{up} = 9c \cdot b^2 + \alpha \cdot c \cdot 4bL$

$= 9 \times 0.3^2 \times c + 0.8 \times 4 \times 0.3 \times 12 \times c$

$= 12.33c$

$Q_{up} = 9c \cdot B^2 + \alpha' c \cdot 4BL$

$= (9B^2 + 48B)c$

$\eta_g = 1 \Rightarrow Q_{ug} = n \cdot Q_{up}$

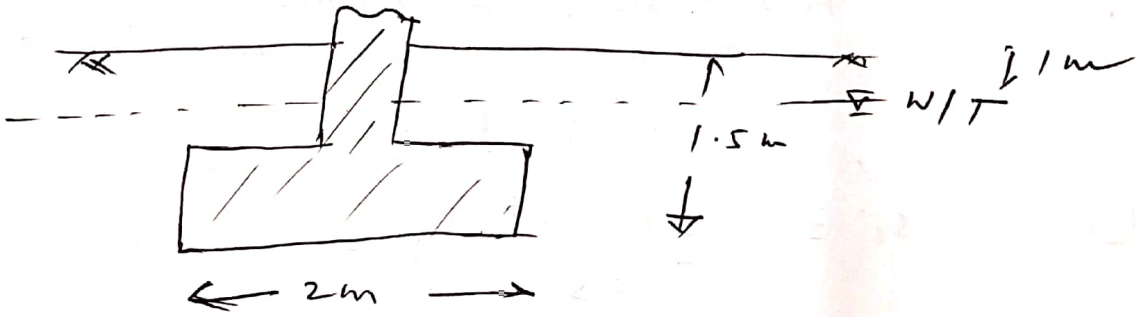
$(9B^2 + 48B)c = 16 \times 12.33c$

$B = 2.72\ m$

$3S + 0.3 = 2.72$

$S = 0.81\ m$

Q-4




$R_{W1} = 0.5\left(1 + \frac{2w_1}{D}\right) = 0.5 \times \left(1 + \frac{1}{1.5}\right) = 0.83$

$R_{W2} = 0.5\left(1 + \frac{2w_2}{B}\right) = 0.50$

$q_u = cN_c + qN_q R_{W1} + 0.5 B \gamma N_\gamma R_{W2}$

$= 0 + 18.5 \times 1.5 \times 42 \times 0.83 + 0.5 \times 2 \times 18.5 \times 47 \times 0.5$

$= 1402.115\ kN/m^2$

$q_{nu} = q_u - \gamma D_f = 1402.115 - 18.5 \times 1.5$

$= 1374.365\ kN/m^2$

$q_{ns} = \frac{q_{nu}}{FOS} = \frac{1374.365}{3} = 458.1217\ \frac{kN}{m^2}$

Safe B.C ($q_s$) = $q_{ns} + \gamma D_f$

= 458.12 + 18.5 × 1.5

$q_s$ = 485.87 kN/m²

— END OF THE SOLUTION —