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Q  $\Rightarrow$

Ans

Given Data

$$\text{Dead load} = D.L = 500 \text{ kN/m}$$

$$\text{Live load} = L.L = 300 \text{ kN/m}$$

$$D = 0.7 \text{ m}$$

$$\phi = 40^\circ$$

$$e = 0$$

$$N_1 = 100.4$$

$$N_2 = 81.3$$

$$F.O.S = 3.0$$

$$V_{\text{sat}} = 20 \text{ kN/m}^3$$

$$V = 17 \text{ kN/m}$$

$$FOS = \frac{Q_u}{Q_{APP}}$$

$$Q_u = FOS \times Q_{APP} = 3 \times \frac{800}{13} = \frac{2400}{13}$$

For  $\phi = 40^\circ$  the Terzaghi equation for BC factors are  $N_q = 81.3$  &  $N_r = 100.4$

$$Q_u = C N_c + \gamma D N_q + \frac{1}{2} \gamma B N_r$$

use Bulk unit weight ( $17 \text{ kN/m}^3$ ) in 2nd term and submerged unit weight ( $\gamma = \gamma_{sat} - \gamma_w$ )

$$= 20 - 9.8$$

$$= 10.2 \text{ kN/m}^3$$

In 3rd term of BC equation

$$Q_u = 0 + (17 \times 0.7 \times 81.3) + (0.5 \times 10.2 \times 13 \times 100.4)$$

$$Q_u = 967.47 + 512.13$$

$$\therefore Q_u = \frac{26}{13}$$

$$\frac{2400}{13} = 967.47 + 512.13$$

$$= 2400 = 512 B^2 + 967.5 B$$

$$= 512 B^2 + 967.5 B - 2400 = 0$$

Now use quadratic equation

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

$$\begin{aligned} \therefore a &= 512 \\ b &= 967.5 \\ c &= -2400 \end{aligned}$$

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

$$x = \frac{-967.5 \pm \sqrt{936056.25 + 4915200}}{1024}$$

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

But we take only the value.

$$x = \frac{1451.43}{1024}$$

$$x = 1.42$$

$$B = x = 1.42$$

$$B = 1.42$$