Chap 6 Exercise

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#6.2 The following are results from an SPT (sandy soil)

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Depth (m)	Field value N_{60}
1.5	9
3.0	12
4.5	11
6.0	7
7.5	13
9.0	11
10.5	13

Estimate the net allowable bearing capacity of a mat foundation 6.5m x 5m, $D_f = 1.5m$ & allowable settlement = 50mm (S_e); Assume $\gamma = 16.5\ kN/m^3$

Assume standard penetration resistance between bottom of foundation & 2B below foundation ($2 \times 5 = 10m + 1.5m = 11.5m$)

Avg $N_{60} = 9+12+11+7+13+11+13 \div 7 = 10.86 \approx 11$

[6.12] $$q_{net(all)} = \frac{N_{60}}{0.08} F_d \left(\frac{S_e(mm)}{25}\right) \leq 16.63 N_{60} \left[\frac{S_e(mm)}{25}\right]$$

$$= \frac{N_{60}}{0.08}\left[1 + 0.33\left(\frac{D_f}{B}\right)\right]\left[\frac{S_e(mm)}{25}\right] \leq 16.63 N_{60}\left[\frac{S_e(mm)}{25}\right]$$

$$= \frac{11}{0.08}\left[1 + 0.33\left(\frac{1.5}{5}\right)\right]\left[\frac{50mm}{25}\right] \leq 16.63(11)\left(\frac{50mm}{25}\right)$$

$$\boxed{q_{net(all)} = 302.22\ kN/m^2} \leq 365.86\ kN/m^2 \quad \text{OK} \checkmark$$

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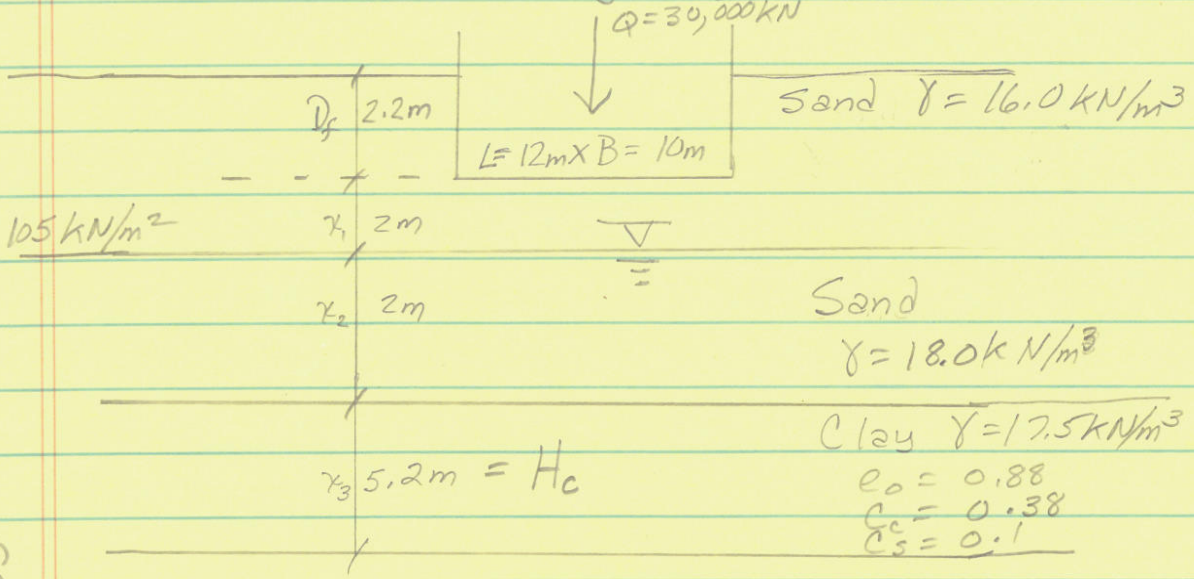
6.6 A mat foundation is shown in Figure below. The design considerations are $L = 12\,m$, $B = 10\,m$, $D_f = 2.2\,m$, $Q = 30\,MN$ or $30,000\,kN$, $x_1 = 2\,m$, $x_2 = 2\,m$, $x_3 = 5.2\,m$ & preconsolidation pressure $\sigma' = 105\,kN/m^2$.

Calculate the consolidation settlement under the center of the mat. ($S_{c(p)}$)



Example 6.4 Pg 303

$$q = \frac{Q}{A} - \gamma D_f = \left(\frac{30,000\,kN}{10m \times 12m}\right) - (16.0 \times 2.2) \approx 214.8\ kN/m^2$$

$$\sigma_o' = (4.2m)(16.0\,kN/m^3) + (2m)(18.0 - 9.81)kN/m^3 + \left(\frac{5.2m}{2}\right)(17.5 - 9.81)kN/m^3$$

$$\sigma_o' = 67.2\,kN/m^2 + 16.38\,kN/m^2 + 19.99\,kN/m^2 = 103.57\,kN/m^2$$

∴ Consider 4 equal areas of foundation each measuring $L = 6m \times B = 5m$

[5.19] $$\Delta\sigma'_{AVG}\,(H_2/H_1) = q_o\left[\frac{H_2 I_{a(H2)} - H_1 I_{a(H1)}}{H_2 - H_1}\right]$$

$$= (214.8)\left[\frac{(2m + 2m + 5.2m) I_{a(H2)} - (2m + 2m) I_{a(H1)}}{5.2m}\right] =$$

$I_{a(H2)}$ $\quad m_2 = \dfrac{B}{H_2} = \dfrac{(10m/2)}{9.2m} = 0.54$

$n_2 = \dfrac{L}{H_2} = \dfrac{(12m/2)}{9.2} = 0.65$

(Fig 5.7 Pg 234) $I_{a\,H2} = 0.185$

next ↓

6.6 Cont

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$I_{a\,H_1}$

$$m_2 = \frac{B}{H_1} = \left(\frac{10m/2}{4m}\right) = 1.25$$

$I_{a\,H_1} = 0.235$

$$n_2 = \frac{L}{H_1} = \left(\frac{12m/2}{4m}\right) = 1.5$$

[5.19] $$\Delta\sigma_{Avg(H_2/H_1)} = q_o\left[\frac{H_2 I_{a(H_2)} - H_1 I_{a(H_1)}}{H_2 - H_1}\right]$$

$$= (214.8)\left[\frac{(9.2m)(0.185) - (4m)(0.235)}{5.2m}\right] = 31.48 kN/m^2$$

So total stress increase would be $31.48 \times 4 = 125.92 kN/m^2$

[1.61] $$S_{c(p)} = \frac{C_c H_c}{1+e_o} \log\left(\frac{\sigma_o' + \Delta\sigma_{Avg}}{\sigma_o'}\right)$$

$$S_{c(p)} = \frac{(0.38)(5.2m)}{1+0.88} \log\left(\frac{103.57 + 125.92}{103.57}\right)$$

$$= 1.051 \quad \log(2.2158) = 0.363 m$$

Consolidation Settlement $= 363 mm$

#6.10

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The subgrade reaction of a sandy soil obtained from the plate load test (1m x 0.7m) is $18\ MN/m^3 = 18{,}000\ kN/m^3$

What will be the value of k on the same soil for a foundation measuring 5m x 3.5m?

[6.42] $$k = k_{0.3}\left(\frac{B + 0.3}{2B}\right)^2$$

$$k = 18{,}000\ kN/m^3\left(\frac{3.5m + 0.3}{(2)(3.5)}\right)^2$$

$$k = 5{,}304.49\ kN/m^3$$