Chapter 5 Exercisie

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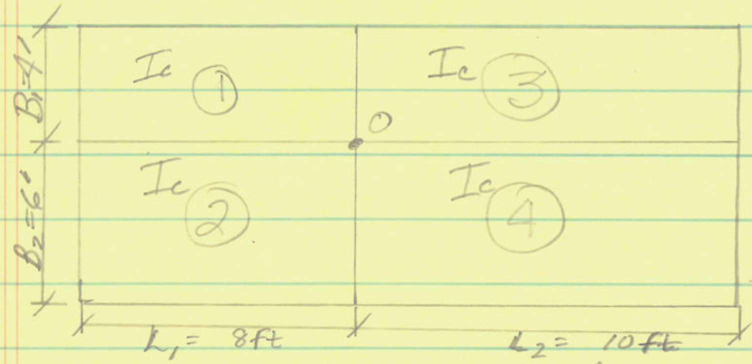
#5.4 Refer to figure below. Given: $B_1 = 4ft$, $B_2 = 6ft$
@9285 $L_1 = 8ft$ & $L_2 = 10ft$, the area is subjected to a uniform load of 3000 #/ft².

Determine the stress increase ($\Delta\sigma$) @ $z = 10ft$ below the center of the area, Use Eq [5.10]



[5.10] $\Delta\sigma = q_o I_c$

$q_o = 3000$ #/ft²

[5.12] $m_1 = \frac{L}{B}$

[5.13] $n_1 = Z/(B/2)$

Center of Area

$\therefore B = 10ft \therefore B/2 = 5ft$

$L = 18ft$

$m_1 = 18/10 = 1.8$

$n_1 = 10/5 = 2.0$

Tbl 5.3 m_1 @1 m_1 @2 @ $n_1 = 2.0$

0.336 0.481

$\therefore I_c = 0.452$

[5.10] $\Delta\sigma = q_o I_c = (3000 \text{ #/ft}^2)(0.452) = \boxed{1356 \text{ #/ft}^2}$

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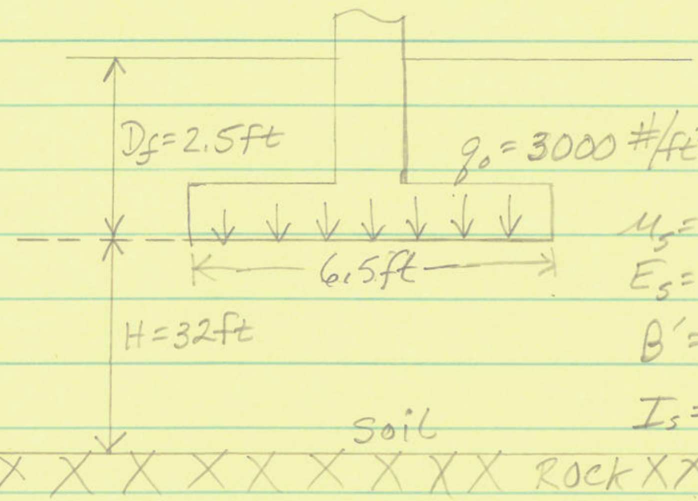
5.11 See Figure below, foundation is 10ft × 6.25ft
Pg 286 resting on a sand deposit. The net load per unit area @ the level of the foundation, $q_o = 3{,}000\ \#/ft^2$. For the sand $\mu_s = 0.3$, $E_s = 3200\ psi$ & $D_f = 2.5\ ft$ & $H = 32\ ft$. Assume a rigid foundation.

Determine the elastic settlement the foundation would undergo. Use Eq [5.33] & [5.41]



$\mu_s = 0.3$

$E_s = 3200\ \#/in^2 \times 144\ in^2/ft^2 = 460{,}800\ psf$

$B' = (\frac{1}{2})\ 6.5ft = 3.25ft$

$I_s = F_1 + \frac{1-2\mu_s}{1-\mu_s} F_2$

$I_f = f\left(\frac{D_f}{B}, \mu_s \,\&\, \frac{L}{B}\right)$

[5.33] flexible foundation $S_e = q_o(\alpha B')\ \frac{1-\mu_s^2}{E_s} I_s I_f$

$\boxed{\alpha = 4}$ (center of foundation)

$m' = \frac{L}{B} = \frac{10}{6.5} = 1.538 \approx \boxed{1.54}$

$n' = H/(B/2) = (32/3.25) = 9.846 \approx \boxed{9.85}$

Tbl 5.8 F_1

$m_1 = 1.4\ @\ n_1 = 9.75$ 0.568 $\{0.58258\}$ $m_1 = 1.6\ @\ n_1 = 9.75$ 0.595

$m_1 = 1.4\ @\ n_1 = 10.00$ 0.570 $\{0.58458\}$ $m_1 = 1.6\ @\ n_1 = 10.00$ 0.597

$F_1 = 0.583$

5.11 Cont.

→ $F_2 = \frac{n'}{2\pi} \tan^{-1} A_2$ (radians)

$A_2 = \frac{m'}{n'\sqrt{m^2+n^2+1}}$

$= \frac{1.54}{9.85\sqrt{1.54^2+9.85^2+1}}$

$F_2 = \frac{9.85}{2\pi} \tan^{-1}(0.0156 \text{ rad})$

$F_2 = 0.024455$

$A_2 = 0.0156$

→ $I_s = F_1 + \frac{1-2\mu_s}{1-\mu_s} F_2 = 0.583 + \left(\frac{1-2(0.3)}{1-0.3}\right)(0.02445) = \boxed{0.597}$

→ $I_f = \quad \mu_s = 0.3$

$D_f/B = 2.5/6.5 = 0.3846$

$B/L = 6.5/10 = 0.655$

Tbl 5.10 $\boxed{I_f \approx 0.89}$

[5.33] $S_e = q_o(\alpha B')\left(\frac{1-\mu_s^2}{E_s}\right) I_s I_f$ (Flexible foundantion)

$= 3000(4\times 3.25)\left(\frac{1-0.3^2}{460800}\right)(0.597)(0.89)$

$= 0.04029$ ft

[5.41] $S_e = 0.93 S_e = (0.93)(0.04029) = 0.03747 \text{ ft} \times 12''$

$\boxed{S_e \text{ (Rigid)} = 0.450 \text{ in}}$

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#5.17 The following are the results from a standard
Pg 288 penetration test in granular soil deposit.

Depth ft	Standard penetration number, N_{60}
5	11
10	10
15	12
20	9
25	14

Determine the net allowable bearing capacity of a foundation planned to be 6ft x 6ft? Let $D_f = 3ft$ & allowable settlement = 1 in. Use relationships Eq [5.60]

[5.60] $$q_{net}\,(kip/ft^2) = \frac{N_{60}}{4}\left(\frac{B+1}{B}\right)^2 F_d\, S_e$$

$$F_d = 1 + 0.33(D_f/B) = 1 + 0.33(3/6) = \boxed{1.165}$$

5ft $$q_{net} = \frac{11}{4}\left(\frac{6+1}{6}\right)^2 (1.165)(1) = \boxed{4.361\ kip/ft^2}$$

Since $D_f = 3ft$ use N_{60} @ 5ft