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ENCE 4340 Foundation Engineering Fall 2011 Homework # 1 (due: 9-19-2011)

Problem 1 : A square column foundation has to carry a gross allowable load of 1805 kN (F.S. = 3). Given $D_f = 1.5m$; $\gamma = 15.9\ kN/m^3$; $\phi' = 34^0$; and $c' = 0$. Use Tergaghi's equation to determine th size of the foundation (B). Assume general shear failure.

$q_{all} = \frac{Q_{ALL}}{B^2} = \frac{1805\,kN}{B^2}$

[3.12] $q_{all} = \frac{q_u}{FS}$ ∴ $q_u = q_{all} FS = \frac{1805\,kN}{B^2} \times 3 = \frac{5415\,kN}{B^2}$

[3.7] $q_u = 1.3c'N_c + qN_q + 0.4\gamma B N_\gamma$

$\frac{5415\,kN}{B^2} = \emptyset + (23.85)(36.5) + (0.4)(15.9)B(38.04)$

$B = 1.996\,m \approx$ **2.0 m**

Problem 2 : An eccentrically loaded foundation is shown in Figure P3.8. Use F.S. of 4 and determine the maximum allowable load that the foundation can carry. Use Meyerhof's effective area method.

$B' = B - 2e = 1.5m - 2(0.1)m = 1.3m$ (Step 1 pg 159)

$L' = L = 1.5m$ (Step 1 pg 159)

[3.12] $q = \gamma D_f = (17kN/m^3)(0.8m) = 13.6\ kN/m^2$

Tbl 3.3

	N_c	N_q	N_γ
$\phi' = 32°$	35.49	23.18	30.22

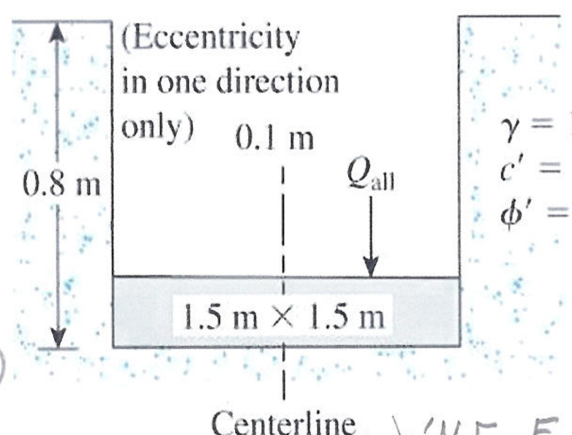

Figure P3.8

Tbl 3.4

$F_{qs} = 1 + \left(\frac{B}{L}\right)\tan\phi'$

$F_{qs} = 1 + \left(\frac{1.3}{1.5}\right)\tan 32° = 1.542$

$F_{qd} = 1 + 2\tan\phi'(1-\sin\phi)^2\left(\frac{D_f}{B}\right)$

$F_{qd} = 1 + 2\tan 32°(1-\sin 32)^2\left(\frac{0.8}{1.5}\right)$

$F_{qd} = 1.147$

$F_{qi} = \left(1 - \frac{\beta°}{90°}\right)^2 = (1-0)^2 = 1$

Tbl 3.4

$F_{\gamma s} = 1 - 0.4\left(\frac{B}{L}\right) = 1 - 0.4\left(\frac{1.3}{1.5}\right) = 0.65$

$F_{\gamma d} = 1$

$F_{\gamma i} = \left(1 - \frac{\beta}{\phi'}\right) = (1-0) = 1$

[3.40] $q_u' = c'N_c F_{cs} F_{cd} F_{ci} + qN_q F_{qs} F_{qd} F_{qi} + \frac{1}{2}\gamma B' N_\gamma F_{\gamma s} F_{\gamma d} F_{\gamma i}$

$q_u' = \emptyset + (13.6)(23.8)(1.542)(1.147)(1) + \left(\frac{17}{2}\right)(1.3)(30.22)(0.65)(1)(1)$

$q_u' = 789.54\ kN$

[3.41] $Q_{ult} = q_u'(B')(L') = (789.54)(1.3)(1.5) = 1539.6\ kN$

$FS = \frac{Q_{ULT}}{Q}$ ∴ $Q = \frac{Q_{ULT}}{FS} = \frac{1539.6}{4} =$ **384.9 kN**