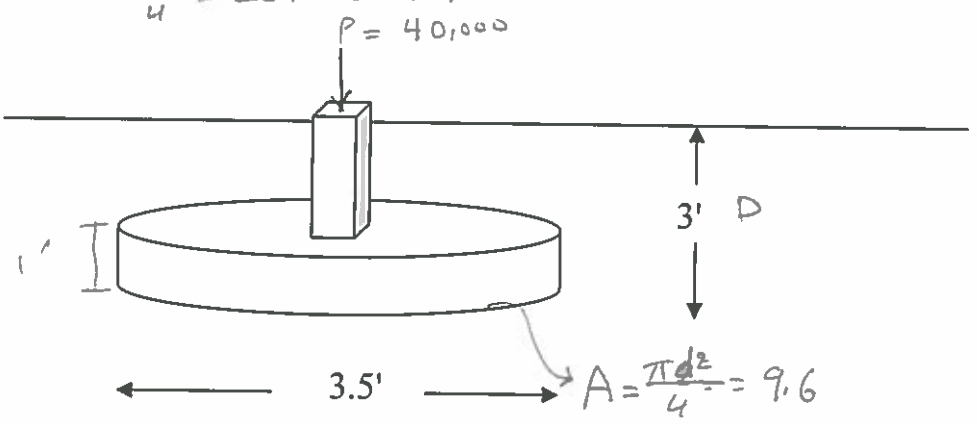
class prob 1

You have just taken the job as City Engineer of Pea Ridge, Arkansas. One of your first tasks is to evaluate the safety of an elevated water tank in the national park. The tank weighs approximately ~~40~~ 80 tons when full and is supported on four legs. Each leg has a circular foundation as shown below. ~~Determine the allowable capacity of the foundations. Use both general shear considerations and local shear considerations.~~ F.S

$\frac{80}{4}$ = 20 tons = 40,000 lb



$q_a = q = \frac{P + W_f}{A}$

Properties:

$W_f = A * D * \gamma_c = 9.6 * 3 \times 150\ pcf = 4320\ lb$

Silt (ML)

$\phi = 25°$
$\gamma = 110$ pcf
$c = 170$ psf

$q_a = \frac{40{,}000 + 4320}{9.6} = 4616\ psf$

$q_u = 1.3\,cN_c + qN_q + 0.3\gamma B N_\gamma$

$q = \gamma D = 110 * 3 = 330$

from Table for $\phi = 25°$; $N_c = 25.1$, $N_q = 12.7$, $N_\gamma = 9.2$

$q_u = 1.3(170)(25.1) + (330)(12.7) + 0.3(110)(3.5)(9.2)$

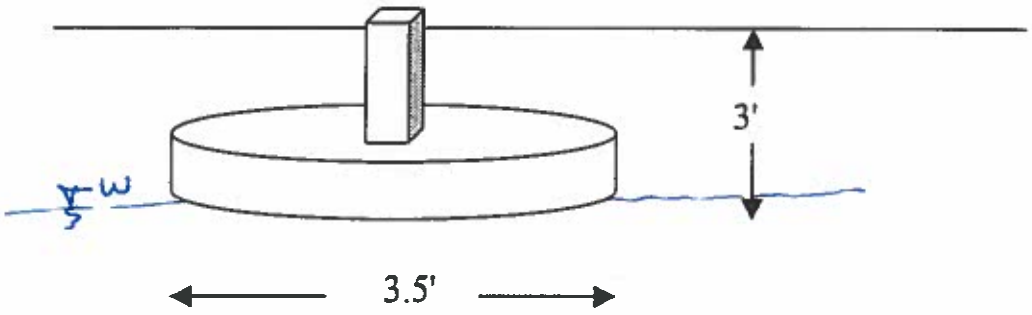
$q_u = 10{,}800\ psf$

$F = \frac{q_u}{q_a} = \frac{10{,}800}{4{,}616} = 2.33 < 2.5$ Not ok

CVEG 4143 BEARING CAPACITY CLASS PROBLEM (2) (4)

You have just taken the job as City Engineer of Pea Ridge, Arkansas. One of your first tasks is to evaluate the safety of an elevated water tank in the national park. The tank weighs approximately 20 tons when full and is supported on four legs. Each leg has a circular foundation as shown below. Determine the allowable capacity of the foundations. Use both general shear considerations and local shear considerations.

Solve the problem for CH and w.T at 3ft



Properties:

Silt (~~ML~~ (CH))

ϕ_u = ~~28°~~ 0

γ = 110 pcf

c_u = ~~730 psf~~ 800 psf

q_a = 4616 psf from #1

$q_u = 1.3 C_u N_c + \gamma N_q + 0.3 \gamma B N_\gamma$ → 0

for $\phi_u = 0$, $N_c = 5.7$, $N_q = 1$, $N_\gamma = 0$

N_q correction is needed (Total stress analysis)

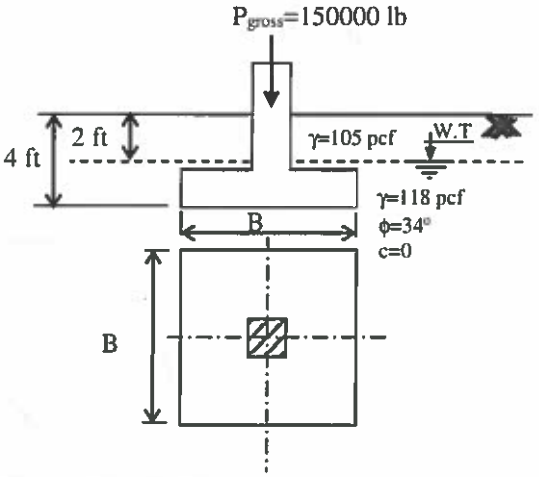
$q_u = 1.3(800)(5.7) + (330)(1) = 6260$

$F = \frac{q_u}{q_a} = \frac{6260}{4616} = 1.35 < 2.5$

Using total stress analysis highly ↓ B.C

CVEG 4143 **Bearing Capacity** **Class Problem 3**

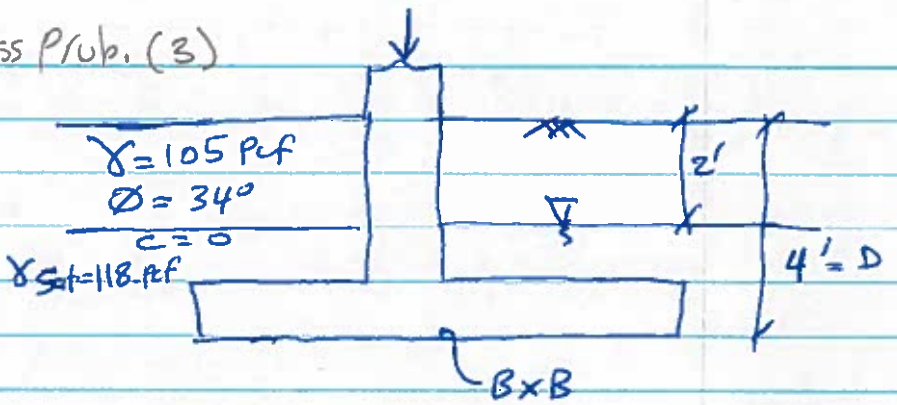
A square foundation has to be constructed as shown below. Determine the size of the footing with F=3.



$P_{gross} = 150{,}000$ lb (12)

~~Example~~: Class Prob. (3)

Req. B @ F = 3



Solution:

$$q_a = \frac{P + W_f}{A} = \frac{150000}{B^2}$$

$$q_a = \frac{q_u}{F} \Rightarrow q_a = \frac{1}{3}(q_u) \quad \text{?} \quad \text{---eq(1)}$$

$$q_a = \frac{1}{3}(q N_q S_q d_q + 0.5 \gamma B N_\gamma S_\gamma d_\gamma)$$

For $\phi = 34°$, from Table 7.2, $N_q = 29.4$, $N_\gamma = 41.1$

Shape f. $S_q = 1 + \left(\frac{B}{L}\right)\tan\phi = 1.67$

$$S_\gamma = 1 - 0.4\left(\frac{B}{L}\right) = 0.6$$

depth f.

$$d_q = 1 + 2(k)\tan\phi\,(1 - \sin\phi)^2 = 1 + \frac{1.05}{B}$$

$$(k) = \frac{D}{B}$$

$$d_\gamma = 1$$

Corr. for W.T: $q = 2 \times (105) + 2(118 - 62.4) = 321.2$ lb/ft²

$\gamma \longrightarrow \gamma'$ third term $= 118 - 62.4 = 55.6$ psf

$$q_a = \frac{1}{3}\left[321.2(29.4)(1.67)\left(1 + \frac{1.05}{B}\right) + 0.5(55.6)(B)(41.1)(0.6)(1)\right]$$

~~Sub in eqn 1~~

$$\frac{15000}{B^2} = 5263.9 + \frac{5527.1}{B} + 228.3\,B$$

by trial and error, $B \simeq 4.5$ ft

Determine the adequacy of the footings (shown below) against a *general* shear failure. The total load is 100 tons. Use a factor of safety of three.

Soil Properties:
$\phi = 33^o$
C = 100 psf