Example 1

Determine the net ultimate bearing capacity of a 10m ×15m mat located 2 m below ground in a saturated clay with c_u = 100 kPa.

Solution

$$q_{u(net)} = 5.14 \times 100 \left(1 + \frac{0.195 \times 10}{15}\right)\left(1 + 0.4\frac{2}{10}\right) = 627.3\text{kPa}$$

Example 2

A 4' thick mat foundation is 125'×220' in plan area. It carries a DL = 40,000 kips and LL = 25,000 kips. Mat is placed in a soft clay with q_u = 700 psf and γ = 114 pcf.

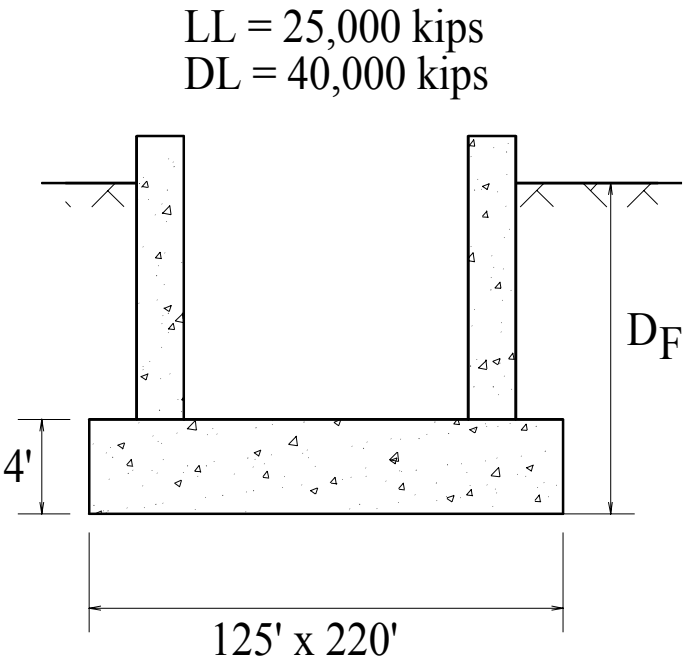
Determine:

a. D_F for a fully compensated foundation.

b(i). D_F for FS = 3

b(ii). What will be the FS if the total load is increased by 50 %.

Solution:



(a) $q_0 = \frac{Q}{A} = \frac{40{,}000 + 25{,}000}{125 \times 220} + \frac{150 \times 4}{1{,}000}$

$q_o = 2.964$ ksf

$$D_F = \frac{q_o}{\gamma} = \frac{2.964}{0.114} = 26 \text{ ft}$$

b(i). For exact solution

$FS(q_0 - \gamma D_F) = q_{ult(net)}$

$$3(2964 - 114D_F) = 5.14 \times 350\left(1 + \frac{0.195 \times 125}{220}\right)\left(1 + 0.4\frac{D_F}{125}\right) \text{ or}$$

$D_F = 19.79' \approx 20'$

b(ii). $q_o = 2964 \times 1.5 = 4446$ psf

$$FS = \frac{2126}{4446 - 20 \times 114} = 0.98$$

Note: 50% increase in load reduced FS <1, not just by 50%