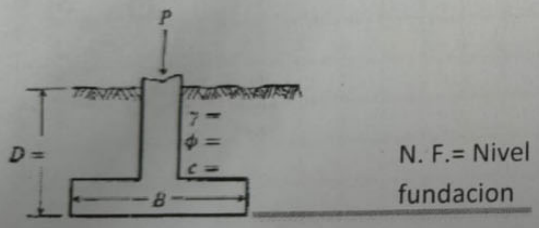
2- Indique la **carga admisible** considerando un factor de seguridad de 2.50 para parámetros no drenados y de 3.0 para parámetros drenados, para una zapata continua de B= 2,0 m, cimentada a 1,0 metros de profundidad. El nivel freatico coincide con la cota de fundacion. Suelo: γ=19 kN/m^3, Su=80 kPa, ϕ'=30°; c'=5 kPa. Considerar el peso de la base en el análisis.

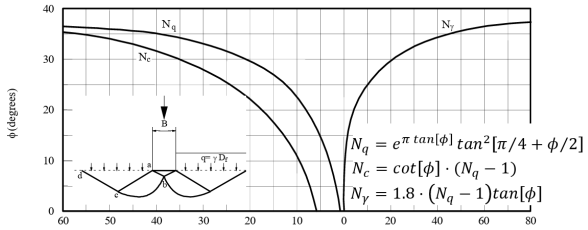


$\gamma := 19\ \frac{kN}{m^3}$ $S_u := 80\ kPa$ $\varphi' := 30\ °$ $c' := 5\ kPa$ $d := 1\ m$

$B := 2\ m$ $FS_D := 3$ $FS_{ND} := 2,5$ $\gamma' := \gamma - 9,81\ \frac{kN}{m^3}$

$\sigma'_{v0} := \gamma \cdot d$ $\sigma'_{v0} = 19\ kPa$

$$q_f = c\,N_c[\phi] + \sigma'_0\,N_q[\phi] + \tfrac{1}{2}B\,\gamma\,N_\gamma[\phi]$$



Peso suelo y base

Espesor elementos base aprox $\frac{1}{3}$ del ancho de la base

$b := \frac{B}{3}$

Peso e la base

$\gamma_H := 24\ \frac{kN}{m^3}$

$W_{base} := \gamma_H \cdot B \cdot b$ $W_{base} = 32\ \frac{kN}{m}$

Peso suelo

$W_{suelo} := \gamma \cdot B \cdot (d - b)$ $W_{suelo} = 12,6667\ \frac{kN}{m}$

$W := W_{base} + W_{suelo}$ $W = 44,6667\ \frac{kN}{m}$

Caso drenado

$$N_q := e^{\pi \cdot \tan(\varphi')} \cdot \left(\tan\left(45° + \frac{\varphi'}{2}\right)\right)^2$$

$$N_c := \frac{1}{\tan(\varphi')} \cdot (N_q - 1)$$

$$N_\gamma := 1{,}8 \cdot (N_q - 1) \cdot \tan(\varphi')$$

$N_q = 18{,}4011$

$N_c = 30{,}1396$

$N_\gamma = 18{,}0838$

$$q := c' \cdot N_c + \sigma'_{v0} \cdot N_q + \frac{1}{2} \cdot B \cdot \gamma' \cdot N_\gamma$$

$q = 666{,}5094\ \text{kPa}$

$$Q_{ult} := q \cdot B \qquad Q_{ult} = 1333{,}0187\ \frac{\text{kN}}{\text{m}}$$

$$P_{adm} := \frac{Q_{ult}}{(FS_D)} - W \qquad \boxed{P_{adm} = 399{,}7\ \frac{\text{kN}}{\text{m}}}$$

Caso no drenado

$$\gamma' := \gamma - 9{,}81\ \frac{\text{kN}}{\text{m}^3} \qquad \varphi' := 0°$$

$$N_q := e^{\pi \cdot \tan(\varphi')} \cdot \left(\tan\left(45° + \frac{\varphi'}{2}\right)\right)^2$$

$$N_c := 2 + \pi$$

N

$$N_\gamma := 1{,}8 \cdot (N_q - 1) \cdot \tan(\varphi')$$

$$q := S_u \cdot N_c + \sigma'_{v0} \cdot N_q + \frac{1}{2} \cdot B \cdot \gamma' \cdot N_\gamma$$

$N_q = 1$

$N_c = 5{,}1416$

$N_\gamma = 0$

$q = 430,3274\ \text{kPa}$

$Q_{ult} := q \cdot B \qquad Q_{ult} = 860,6548\ \frac{\text{kN}}{\text{m}}$

$P_{adm} := \frac{Q_{ult}}{\left(FS_{ND}\right)} - W \qquad \boxed{P_{adm} = 299,6\ \frac{\text{kN}}{\text{m}}}$

Mismo ejercicio calculado con Brinch Hansen extendida

Caso drenado

$\varphi' := 30\ °$

$L := 1000000000\ \text{m}$

$N_q := e^{\pi \cdot \tan\left(\varphi'\right)} \cdot \left(\tan\left(45\ ° + \frac{\varphi'}{2}\right)\right)^2$

$N_c := \frac{1}{\tan\left(\varphi'\right)} \cdot \left(N_q - 1\right)$

$N_\gamma := 1,5 \cdot \left(N_q - 1\right) \cdot \tan\left(\varphi'\right)$

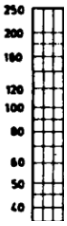
$N_q = 18,4$

$N_c = 30,1$

$N_\gamma = 15,1$

Fórmula de Brinch-Hansen

- $q_f = \frac{1}{2}\gamma B' N_\gamma s_\gamma d_\gamma i_\gamma + \sigma_0' N_q s_q d_q i_q + c N_c s_c d_c i_c$
- $N_c = cot[\phi] \cdot (N_q - 1)$
- $N_q = e^{\pi\, tan[\phi]}\, tan^2[\pi/4 + \phi/2]$
- $N_\gamma = 1.5 \cdot \left(N_q - 1\right) tan[\phi]$



factores de corrección

$s_c := 1 + \left(0,2 + \tan\left(\varphi'\right)^6\right) \cdot \frac{B}{L} \qquad s_q := s_c - \frac{\left(s_c - 1\right)}{N_q} \qquad s_\gamma := 1 - \frac{1}{2} \cdot \left(0,2 + \left(\tan\left(\varphi'\right)\right)^6\right) \cdot \frac{B}{L}$

$d_c := 1 + \frac{0,35}{\frac{B}{d} + \frac{0,6}{1 + 7 \cdot \left(\tan\left(\varphi'\right)\right)^4}} \qquad d_q := d_c - \frac{\left(d_c - 1\right)}{N_q} \qquad d_\gamma := 1$

$d_c = 1,1497$

$d_q = 1,1416$

$$q := c' \cdot N_c \cdot s_c \cdot d_c + \sigma'_{v0} \cdot N_q \cdot s_q \cdot d_q + \frac{1}{2} \cdot B \cdot \gamma' \cdot N_\gamma \cdot s_\gamma \cdot d_\gamma$$

$$q = 710,8803 \text{ kPa}$$

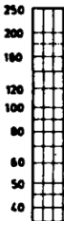
$$Q_{ult} := q \cdot B \qquad Q_{ult} = 1421,7606 \frac{\text{kN}}{\text{m}}$$

$$P_{adm} := \frac{Q_{ult}}{\left(FS_D\right)} - W \qquad \boxed{P_{adm} = 429,3 \frac{\text{kN}}{\text{m}}}$$

Caso no drenado

Fórmula de Brinch-Hansen

- $q_f = \frac{1}{2}\gamma B' N_\gamma s_\gamma d_\gamma i_\gamma + \sigma'_0 N_q s_q d_q i_q + c N_c s_c d_c i_c$
- $N_c = cot[\phi] \cdot (N_q - 1)$
- $N_q = e^{\pi\, tan[\phi]}\, tan^2[\pi/4 + \phi/2]$
- $N_\gamma = 1.5 \cdot (N_q - 1) tan[\phi]$



$$\varphi' := 0 \text{ °} \qquad L := 1000000000 \text{ m}$$

$$N_q := e^{\pi \cdot \tan(\varphi')} \cdot \left(\tan\left(45 \text{ °} + \frac{\varphi'}{2}\right)\right)^2$$

$$N_c := 2 + \pi$$

$$N_\gamma := 1,5 \cdot \left(N_q - 1\right) \cdot \tan(\varphi')$$

$$N_q = 1$$

$$N_c = 5,1$$

$$N_\gamma = 0$$

factores de corrección

$$s_c := 1 + \left(0,2 + \tan(\varphi')^6\right) \cdot \frac{B}{L} \qquad s_q := s_c - \frac{\left(s_c - 1\right)}{N_q} \qquad s_\gamma := 1 - \frac{1}{2} \cdot \left(0,2 + \left(\tan(\varphi')\right)^6\right) \cdot \frac{B}{L}$$

$$d_c := 1 + \frac{0,35}{\frac{B}{d} + \frac{0,6}{1 + 7 \cdot \left(\tan(\varphi')\right)^4}} \qquad d_q := d_c - \frac{\left(d_c - 1\right)}{N_q} \qquad d_\gamma := 1$$

$d_c = 1,1346$

$d_q = 1$

$q := S_u \cdot N_c \cdot s_c \cdot d_c + \sigma'_{v0} \cdot N_q \cdot s_q \cdot d_q + \frac{1}{2} \cdot B \cdot \gamma' \cdot N_\gamma \cdot s_\gamma \cdot d_\gamma$

$q = 485,6984\ \text{kPa}$

$Q_{ult} := q \cdot B$ $\quad Q_{ult} = 971,3968\ \frac{\text{kN}}{\text{m}}$

$P_{adm} := \frac{Q_{ult}}{\left(FS_{ND}\right)} - W$ $\quad \boxed{P_{adm} = 343,9\ \frac{\text{kN}}{\text{m}}}$