TERZAGI's Bearing Capacity equation:

. depend on < Type of shear falnir / Shape of foundation

• q_{ult} To The clay ≅ CNC BC $\phi = 0$

(1) General Shear failure:-

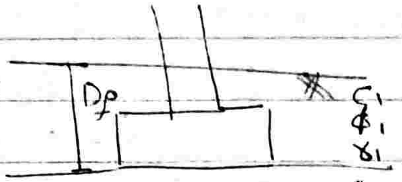
• For continaus strip footing

$$q_{ult} = CN_c + \bar{q} N_q + \frac{1}{2} B \gamma N_\gamma$$

(C [illegible]) (φ [illegible]) ↳ smaller dimension.

• Example:

$$q_{ult} = C_2 N_c + \gamma_1 D_f N_q + \frac{1}{2} B \gamma_2 N_\gamma$$



⇒ $N_\gamma / N_q / N_c$ ⇒ Bearing Capacity factors $f(\phi)$ ⇒ From Table 3.1
(ϕ_2)

• For squre footing:-

$$q_{ult} = 1.3\, CN_c + qN_q + 0.4 \gamma B N_\gamma$$

• For Circlelar footing:-

$$q_{ult} = 1.3 CN_c + q N_q + 0.3\, \gamma B N_\gamma$$

↳ Diameter

(2) Local Shear or Punching :-

• For continaus strip footing:-

$$q_{ult} = \frac{2}{3} C N_c' + q' N_q' + \frac{1}{2} B \gamma N_\gamma'$$

• For Square footing

$$q_{ult} = 0.867\, CN_c' + \bar{q} N_q' + 0.4\, B\gamma N_\gamma'$$

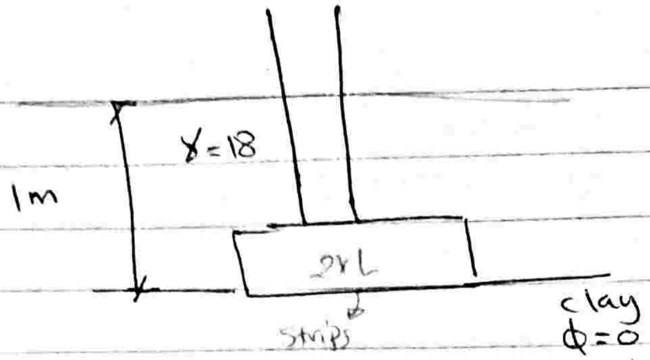
• For circular footing:-

$$q_{ult} = 0.867\, CN_c' + q N_q' + 0.3\, B\gamma N_\gamma'$$

⇒ $N_\gamma' / N_c' / N_q'$ / ⇒ Modified Bearing Capacity ⇒ Table 6.3.2

• Example:

Find q_{all} using $F.S = 3$?



① Type of failure?

→ ② Shape of foundation.

Because $C = 100\ kN/m^2$

Then The soil is [stiff] ⇒ so The failure IS General

أصلا = بعطينا صيغة ال q_{un}

$$C = \frac{q_{un}}{2}$$

$$\Rightarrow q_{ult} = CN_c + \bar{q}N_q + \frac{1}{2}B\gamma N_\gamma$$

[illegible] بنطرح γ_w

$\phi = 0 \Rightarrow$ clay (so $N_\gamma = 0$)

$$\Rightarrow q_{ult} = CN_c + \bar{q}N_q + \frac{1}{2}\gamma N_\gamma^{0}$$

$$= (100 \times 5.7) + (18 \times 1) = 588$$

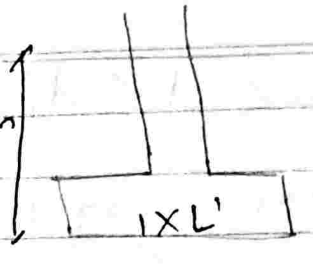
⇒ 97% q_{ult} (the term 100×5.7)

3% of q_{ult} (the term 18×1)

• Example: $F.S = 3$, q_{ult} ?? • Strip of wall footing 1m wide + stiff clay , Find ?

① q_{ult} ?

$q_{ult} = C\,N_c + \bar{q}\,N_q + \frac{1}{2} B \gamma N_\gamma$



* clay

$\gamma = 18\ KN/m^2$

$q_u = 200\ KN/m^2$

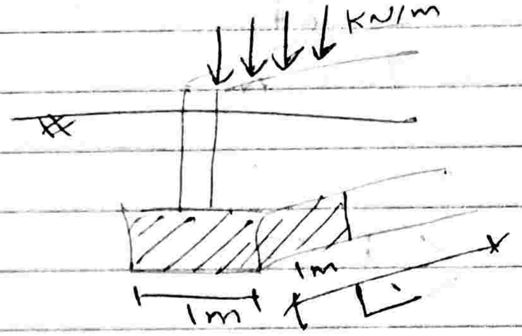
• $C = \frac{q_u}{2} = \frac{200}{2} = 100\ KN/m^2$

• For clay soil $\phi = 0$, $N_c = 5.7$, $N_q = 1$, $N_\gamma = 0$

$q_{ult} = 100 \times 5.7 + 0.7 \times 18 \times 1 + 0 = 583\ KN/m^2$

② $q_{allowable}$ wall load ?

• معناها كل متر من هاد دا الجدار كم تحمل ؟



*note:- For Example:-

• isolated ⇒ $q_{all} = 400\ KN/m^2$ → في مسافات بينهم

• Strip ⇒ $q_{all} = 350\ KN/m^2$ → ملزقتين القطع بحصل فراح يصير تداخل بالسكرسين إذا ابتقلل ال q_{all} .

Sol: $q_{all} = \frac{q_{ult}}{F.S} \times Area$

$= \frac{q_{ult}}{3} \times [B \times 1]$

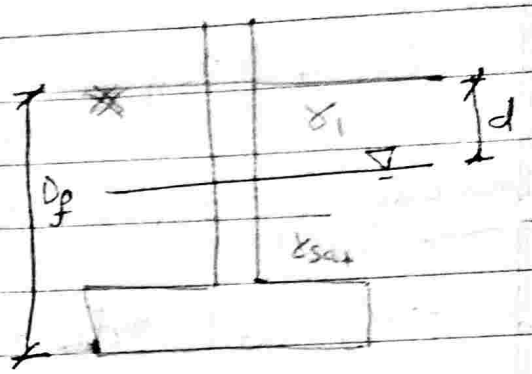
$= \frac{583}{3} \times [1 \times 1] = 194.33\ KN/$

← بناخذ وحدة واحدة بس بال Strip Footing ، بالباقي منحسب مساحة ال Footing .

✱ WATER TABLE ▽ :- وجود الماء يضعف q_{ult}

• Location of water Table:

1 $0 \leq d < df$



$$q_{ult} = CN_c + \bar{q} N_q + \frac{1}{2} B \gamma N_\gamma$$

$$\bar{q} = d\gamma_1 + (D_f - d)(\gamma_{sat} - \gamma_w)$$

$\gamma' = \gamma_{sat} - \gamma_w$ = Gama effective/Submarge.

$\bar{q}$ ↓↓

• $\gamma = \gamma'$ ↓↓

⇒ q_{ult} ↓↓

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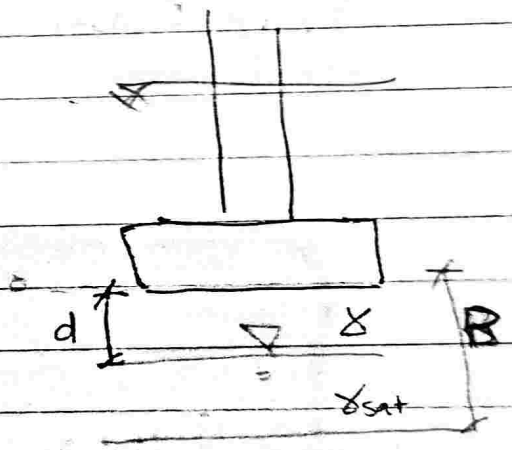
2 $0 \leq d < B$



$$q_{ult} = CN_c + \bar{q} N_q + \frac{1}{2} B \gamma N_\gamma$$

• $\bar{q}$ ⇒ يتأثر

• $\gamma = \dfrac{d\gamma + (B-d)\gamma'}{B}$ ↓↓

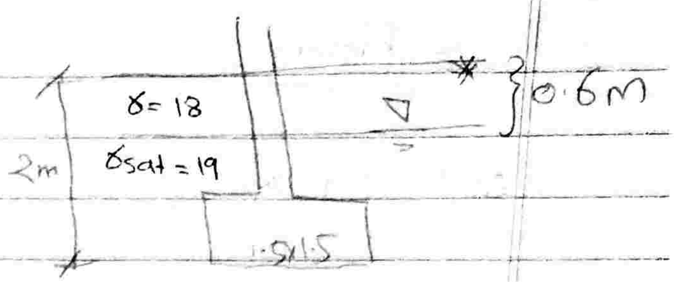
↓ Weighted average

3 $d > B$ ⇒ No effect.

Example:

Calculate?

- $\gamma = \gamma' = 19 - 10 = 9$



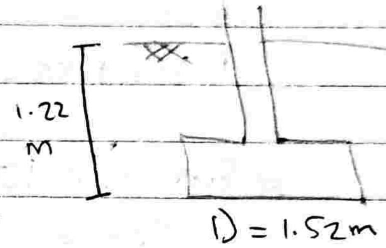
- $\bar{q} = 0.6 \times 18 + 0.6 \times 9$

← في حالة الفاونديشن الدائرية القطر بيكون B.

Example:

← نوع التربة هان (C-φ soil) مش بنربط نستخدم الجداول اللي بتحدد نوع التربة، فإذا السؤال يعطينا نوعها.

← لأنه c بتضعف φ، والعكس صحيح.



Dense Soil
$\phi = 25$
$C = 48 \, KN/m^2$
$\gamma = 20.12 \, KN/m^3$

- Dense Soil ⟹ General Shear faulier.
- Soft loose Soil ⟹ Local Shear fuilier.