PRÁCTICA DE PANTALLAS
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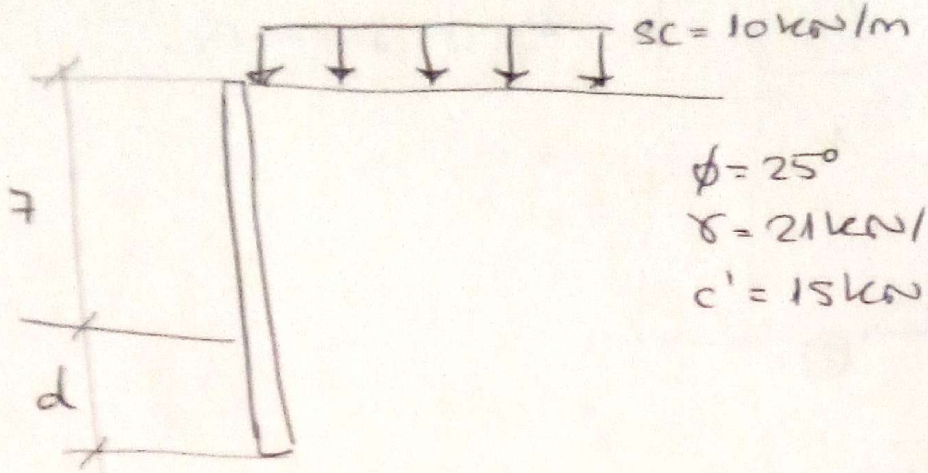


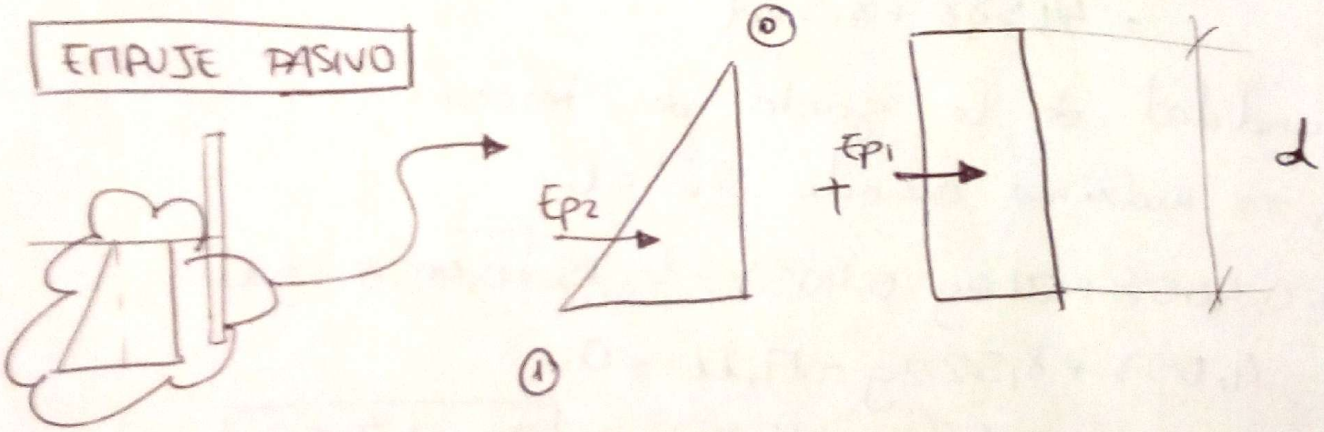
$\phi = 25°$
$\gamma = 21 kN/m^3$
$c' = 15 kN/m^2$

Coeficiente empuje activo: $ka = \frac{1-sen\phi}{1+sen\phi} = 0,4058.$

Coeficiente empuje pasivo: $kp = \frac{1}{ka} = 2,46.$

Como el terreno tiene cohesión, hay grieta de tracción en la parte superior de la pantalla de profundidad z_g.

EMPUJE PASIVO

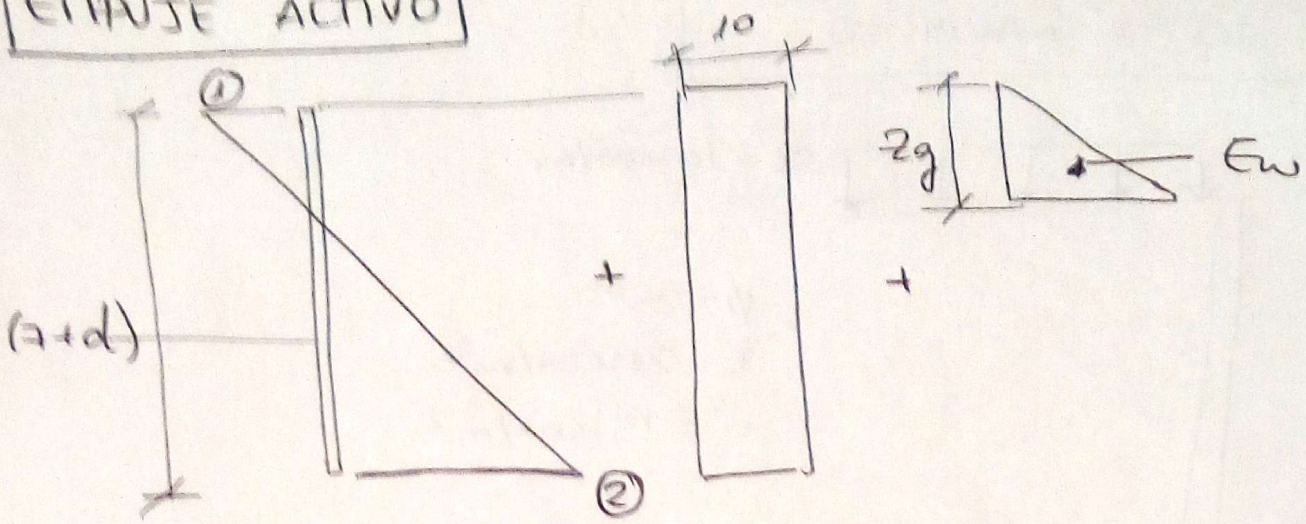


Factor de seguridad: $FS = 1,5.$

$$Ep① = \frac{\sigma_v \cdot kp + 2c'\sqrt{kp}}{1,5} = \frac{2.15\sqrt{2,46}}{1,5} = 31,38 kN/m^2.$$

$$Ep② = \frac{\sigma_v \cdot kp + 2c'\sqrt{kp}}{1,5} = \frac{21.d.2,46 + 2.15\sqrt{2,46}}{1,5} = 34,44d + 31,37 \ kN/m^2.$$

EMPUJE ACTIVO



$$\sigma_H' = \sigma_v' \cdot ka - 2c'\sqrt{ka}$$

$$\sigma_{H①}' = 10 \cdot 0{,}4058 - 2 \cdot 15\sqrt{0{,}4058} = -15{,}0538 \text{ kN/m}^2$$

$$\sigma_{H②}' = [10 + 21(7+d)]\,0{,}4058 - 2 \cdot 15\sqrt{0{,}4058} =$$

$$= 4{,}058 + 8{,}52(7+d) - 19{,}11 =$$

$$= 4{,}058 + 59{,}64 + 8{,}52d - 19{,}11 =$$

$$= 44{,}588 + 8{,}52d.$$

* Profundidad de la grieta de tracción:

z_g es máxima cuando $\sigma_v' = 0$.

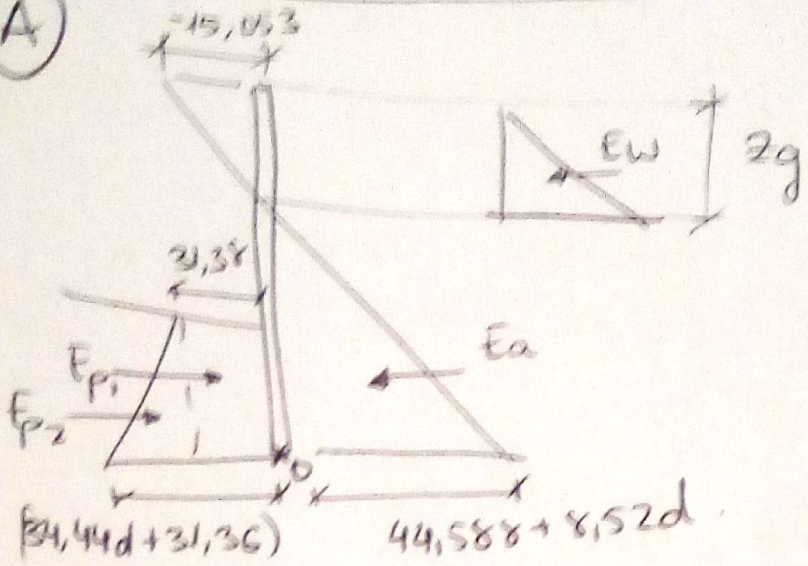
$$10 \cdot 0{,}4058 + 21 z_g \cdot 0{,}4058 - 2 \cdot 15\sqrt{0{,}4058} = 0.$$

$$4{,}058 + 8{,}52 z_g - 19{,}11 = 0.$$

$$8{,}52 z_g = 15{,}05 \rightarrow \boxed{z_g = 1{,}766 \text{ m}}$$

DIAGRAMA DE EMPUJE

(A)



$$E_{p2} = \frac{1}{2} d (34,44d + 31,36 - 31,38) = 17,22d^2 - 0,01d$$

$$d_{Ep2} = \frac{d}{3} \rightsquigarrow E_{p2} \cdot d_{Ep2} = 5,74 d^3 - 0,003 d^2$$

$$\left.\begin{array}{l} E_{p1} = 31,38d \\ d_{Ep1} = d/2 \end{array}\right\} E_{p1} \cdot d_{Ep1} = 15,69 d^2$$

$$\left.\begin{array}{l} E_w = \frac{1}{2}(1,766 \cdot 10 \cdot 1,766) = 15,59 \\ d_{Ew} = \frac{1,766}{3} + (7 - 1,766 + d) = 5,822 + d \end{array}\right\} E_w \cdot d_w = 90,76 + 15,59d$$

$$E_a = \frac{1}{2}(44,588 + 8,52d)(7 - 1,766 + d) = \frac{1}{2}(44,588 + 8,52d)(5,23 + d)$$

$$= (22,294 + 4,26d)\left(\frac{d}{2} + 2,61\right) = 11,147d + 58,34 + 2,13d^2 + 11,15d$$

$$= 2,13d^2 + 122,3d + 58,34$$

$$d_{Ea} = \frac{(7 - 1,766 + d)}{3} = \frac{(5,234 + d)}{3}$$

$$E_a \cdot d_{Ea} = 3,72d^2 + 0,71d^3 + 213,2d + 40,76d^2 + 101,7 + 19,4d$$

$$= 0,71d^3 + 151,62d^2 + 232,6d + 101,7.$$

$E_a \cdot d_{Ea} = \frac{1}{2}(44,588 + 8,52d)(7 - 1,766 + d) =$

$= \frac{1}{2}(44,588 + 8,52d)(5,23 + d) = 116,59 + 22,94d + 22,28d + 4,27d^2$

$= 4,27d^2 + 45,18d + 116,59$

$d_{Ea} = \frac{(7-1,766+d)}{3} = \frac{5,23+d}{3}$

$E_a \cdot d_{Ea} = (4,27d^2 + 45,18d + 116,59)\frac{(5,23+d)}{3} =$

$= 7,44d^2 + 1,42d^3 + 78,18d + 15d^2 + 203,25 + 38,53d =$

$= 1,42d^3 + 22,44d^2 + 116,71d + 203,25$

$\curvearrowleft +$

$\Sigma T_0 = 0 = E_w \cdot d_{ew} + E_a d_{Ea} - E_{p1} d_{Ep1} - E_{p2} d_{Ep2}$

$90,76 + 15,59d + 1,42d^3 + 22,44d^2 + 116,71d + 203,25 - 13,220$

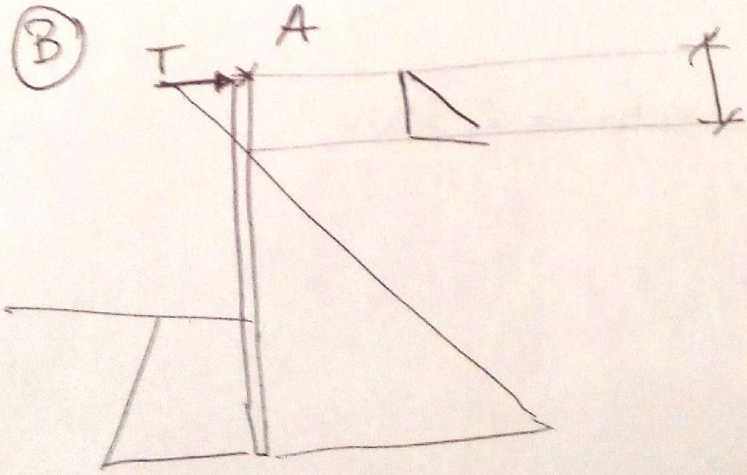
$-5,74d^3 - 15,69d^2 = 0.$

$-4,5d^3 + 6,75d^2 + 132,3d + 294 = 0.$

$\boxed{d = 7\,m}$

Longitud de empotramiento de la pantalla = 8,4m.

(B)



Tenemos el mismo diagrama de empuje añadiendo el anclaje.

$\Sigma \Gamma_A = 0$.

$$\left[\begin{array}{l} E_{p2} = 17{,}22d^2 \\ d_{Ep2} = \frac{2}{3}d + 7 \end{array}\right\} E_{p2} \cdot d_{Ep2} = 11{,}48d^3 + 120{,}54d^2$$

$$\left[\begin{array}{l} E_{p1} = 31{,}38d \\ d_{Ep1} = \frac{d}{2} + 7 \end{array}\right\} E_{p1} * d_{Ep1} = 15{,}69d^2 + 219{,}66.$$

$$\left[\begin{array}{l} E_w = 15{,}59 \\ d_{Ew} = \frac{2}{3} \cdot 1{,}77 \end{array}\right\} E_w \cdot d_{Ew} = 18{,}3962$$

$$\left[\begin{array}{l} E_a = 4{,}27d^2 + 45{,}18d + 116{,}59. \\ d_{Ea} = \frac{2(7-1{,}766+d)}{3} = \frac{2(5{,}23+d)}{3} \end{array}\right.$$

$$E_a \cdot d_{Ea} = 14{,}88d^2 + 2{,}84d^3 + 157{,}88d + 30{,}12d^2 + 406{,}51 + 77{,}72d.$$

$$= 2{,}84d^3 + 45d^2 + 235{,}24d + 406{,}51.$$

$+\circlearrowleft$

$\Sigma M_A = 0.\quad -E_w d_{Ew} + E_{p1} d_{Ep1} + E_{p2} d_{Ep2} - E_a d_{Ea} = 0.$

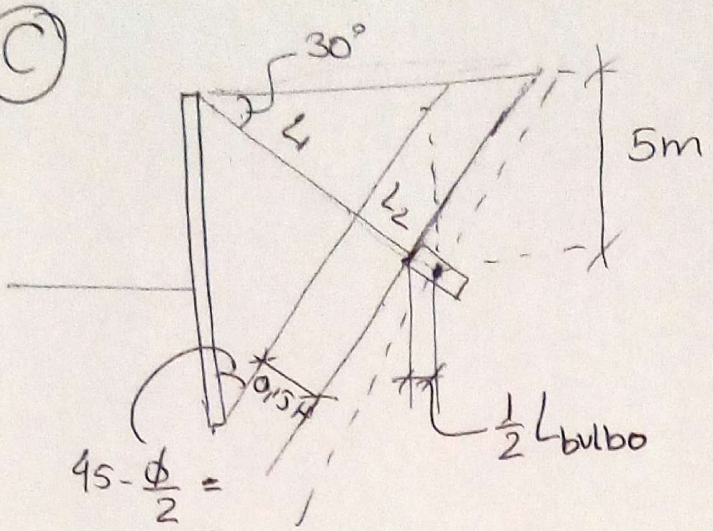
$$+11{,}48d^3 + 120{,}54d^2 + 15{,}69d^2 + 219{,}66 - 18{,}39 - 2{,}84d^3 - 45d^2 - 235{,}24d - 406{,}51$$

$$= 8{,}64d^3 + 91{,}23d^2 - 235{,}24d - 186{,}85 = 0.$$

$$d = 2{,}123 m.$$

Longitud de empotramiento $= 2{,}55 m$.

(C)



$45 - \frac{\phi}{2} =$

$= 32,5°$.

$L_2 = 0,15\,H$.

~~$H = 7 + d = 9,55m$~~.

~~$L_2 = 1,43m$~~.

$L_2 = 1,05\,m$.

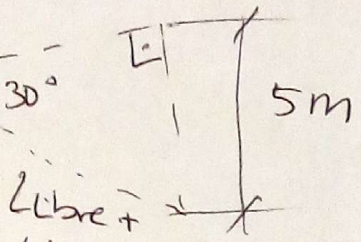
$sen32,5 = \frac{L_1}{H+d}$

$L_1 = (H+d)\,sen32,5 =$

$= 9,55\,sen32,5 = 5,13m$.

Longitud libre $= L_1 + L_2 = 5,13 + 1,05 = 6,2\,m$.

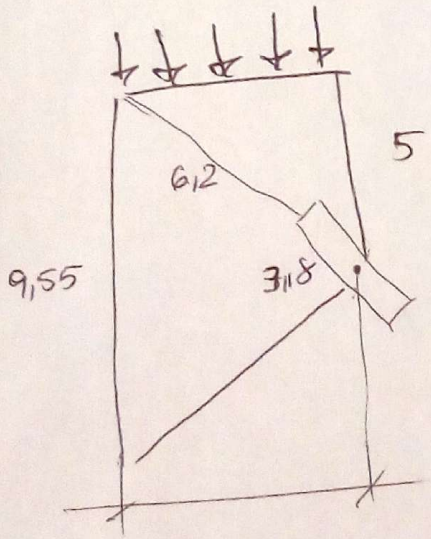
$\left(L_2 + \frac{1}{2}L_{bulbo}\right) sen30° = 5$

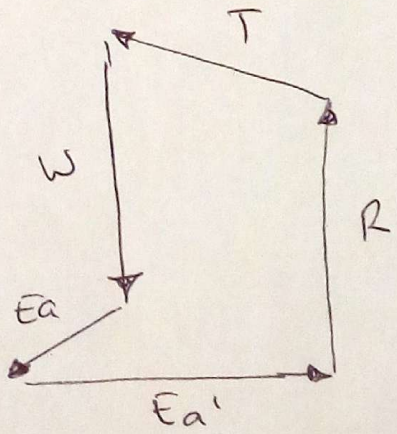


$(6,2 + \frac{1}{2}L_b)\,sen30° = 5$

$6,2 + \frac{1}{2}L_b = \frac{5}{sen30°}$

$L_b = 7,6m$.





$\Sigma F_H = 0$.

~~$-Ea + Ea + T\cos 30° = 0$~~.

$-Ea + Ea.\cos\frac{2}{3}\phi + T\cos 30° = 0$.

$-259,6 + 259,6.\cos 16,6 + T.\cos 30° = 0$.

$-10,81 + T\cos 30° = 0 \rightarrow \boxed{T = 12,5}$