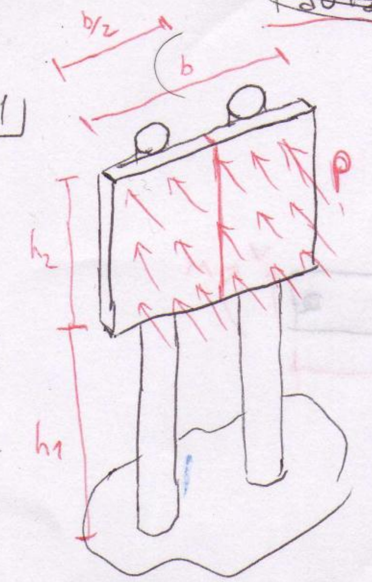
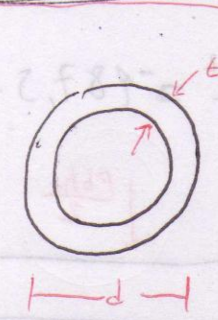
~~Pauta Auxiliar N°4 ME3202~~ ~~2019~~

P1





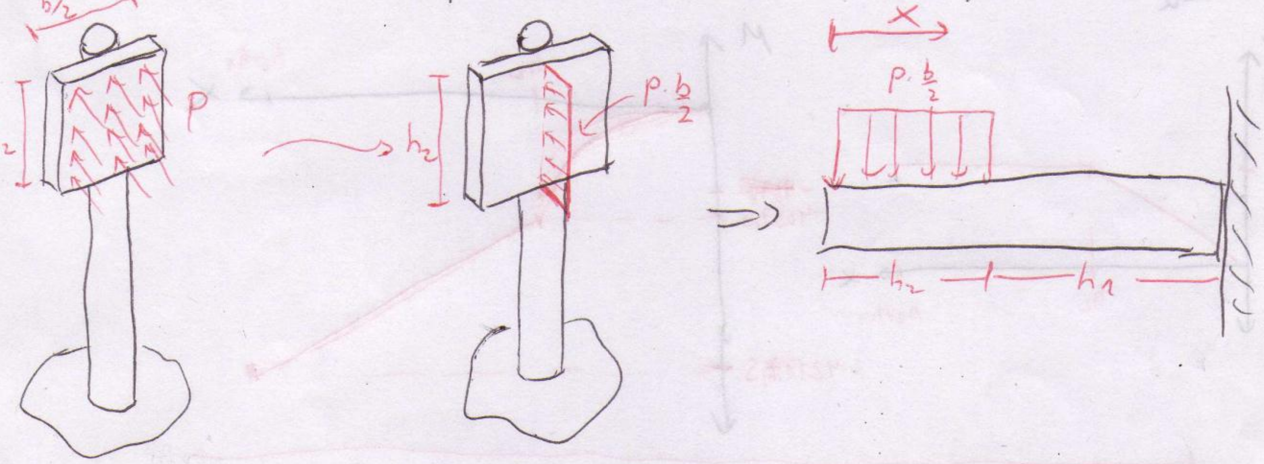
$p = 75 \ lb/ft$

$h_1 = 20 \ ft$

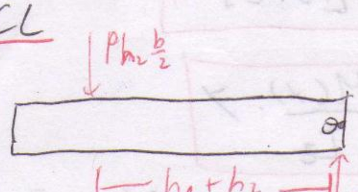
$h_2 = 5 \ ft$

$b = 10 \ ft$

• Veamos como afecta la presión del viento a cada poste



• DCL



$\cdot \sum F_y = 0 \implies \boxed{R = \frac{P h_2 b}{2} = 1875 \ lb}$

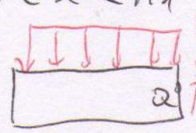
$\cdot \sum_{a} M_z = 0 \implies -M_R + P h_2 \frac{b}{2}\left(h_1 + \frac{h_2}{2}\right) = 0$

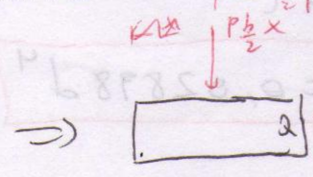
$\boxed{\therefore M_R = \cancel{3837,5} \ [lb \cdot ft]}$

$\boxed{42187,5 \ [lb \cdot ft]}$

• Corte y momento interno

$* \ 0 < x < h_1$

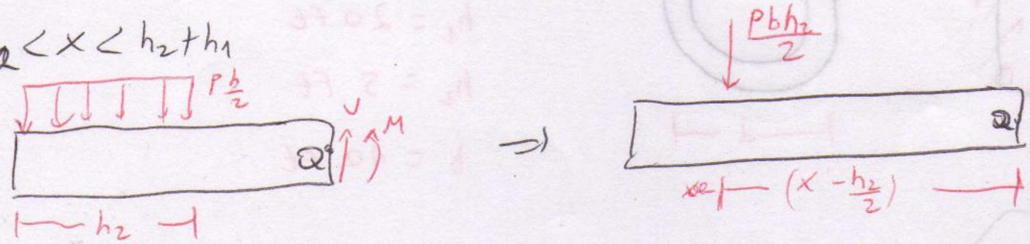




$\cdot \sum F_y = 0 \Rightarrow V(x) = \frac{Pb}{2} x = 375\, x$

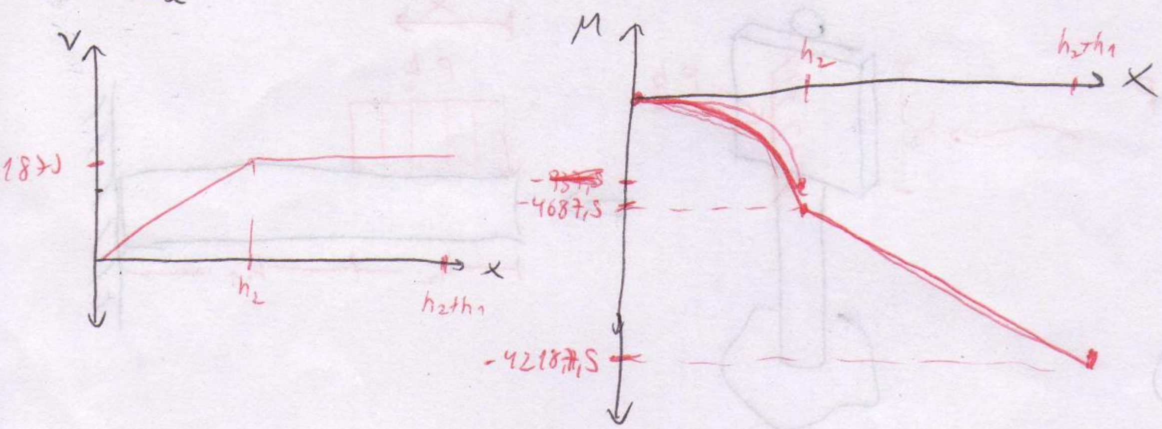
$\cdot \sum_a M_z = 0 \Rightarrow M(x) = -\frac{Pbx^2}{4} = -187{,}5\, x^2$

$\cdot\ h_2 < x < h_2 + h_1$



$\cdot \sum F_y = 0 \Rightarrow V(x) = \frac{Pbh_2}{2} = 1875$

$\cdot \sum_a M_z = 0 \Rightarrow M(x) = -\frac{Pbh_2}{2}\left(x - \frac{h_2}{2}\right) = -1875\, x + 4687{,}5$



$\boxed{\therefore V_{max} = 1875\ lb \ \ y\ \ |M_{max}| = 42187{,}5\ [lb\, ft]}$

a) Esfuerzo normal debido a Flexión: $\boxed{\sigma_x = -\frac{M(x)}{I_z} \cdot y}$

$\rightarrow \sigma_{max} = -\frac{M_{max} \cdot Y_{max}}{I_z}$ / $M_{max} = -42187{,}5\ [lb \cdot ft]$

$Y_{max} = d/2$

$* I_z = \frac{\pi}{64}\left(d^4 - (d-2t)^4\right) = \frac{\pi}{64}\left(d^4 - \left(d - \frac{d}{5}\right)^4\right) = \frac{\pi}{64}\left(d^4 - \left(\frac{4d}{5}\right)^4\right)$

$= \frac{\pi}{64} \cdot \frac{369}{625} d^4 \Rightarrow \boxed{I_z = 0{,}02898\, d^4}$

$$\therefore \sigma_{max} = \frac{42187{,}5\,[lb \cdot ft] \cdot \frac{d}{2}}{0{,}02898\, d^4} = 7500 \left[\frac{lb}{ft^2}\right]$$

$$\Rightarrow \frac{727872{,}671}{d^3} = 7500 \qquad \boxed{\therefore d = 4{,}595\ [ft]}$$

b) Esfuerzo de corte debido a flexión : $\tau_{max} = \frac{V_{max} Q}{I \cdot b}$

$$V_{max} = 1875\,[lb] \ ; \ b = 2(d-(d-2t)) = 2\left(d-\left(d-\frac{d}{5}\right)\right) = 2\left(d - \frac{4d}{5}\right)$$

$$\boxed{\therefore b = \frac{2}{5} d}$$

$$\cancel{I_t = \frac{\pi}{64}\left(d^4 - (d-2t)^4\right)} = \quad \boxed{I_z = 0{,}02898\, d^4}$$

$$Q = \frac{2}{3}(r_2^3 - r_1^3) = \frac{2}{3} \cdot \frac{1}{8}\left(d^3 - (d-2t)^3\right) = \frac{1}{12}\left(d^3 - \left(\frac{4d}{5}\right)^3\right)$$

$$= \frac{1}{12} \cdot \frac{1}{125} d^3 = 6{,}667 \cdot 10^{-4} d^3$$

$$\Rightarrow \tau_{max} = \frac{1875 \cdot 6{,}667 \cdot 10^{-4} d^3}{0{,}02898\, d^4 \cdot \frac{2}{5} d} = \frac{107{,}83}{d^2} = 2000\ psi$$

$$\boxed{\therefore d = 0{,}232\ [ft]}$$