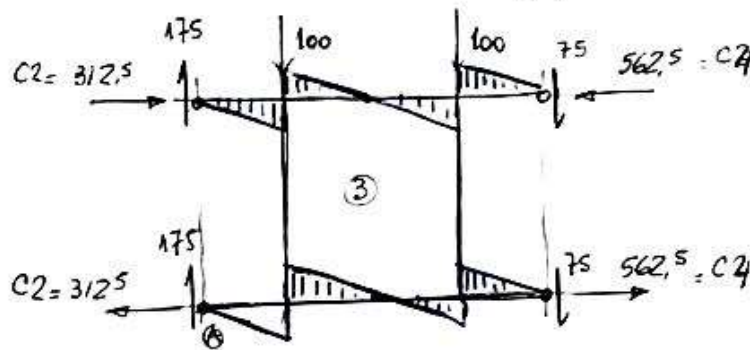




Resolver todos los cuadros y graficar

2



$$\sum X = 0$$

$$\sum Y = 0$$

$$\sum M_A = 0 = 100 \times 1 + 100 \times 3 + 75 \times 4 \times 2 + 312.5 \times 4.0 - 562.5 \times 4.0$$

$$400 + 600 + 1250 - 2250$$

Antes $V_u = 225t = 2250 \text{ kN}$ Corde

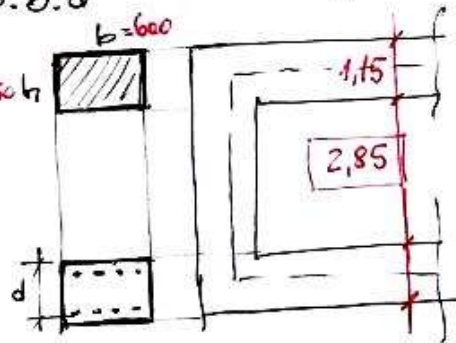
$$V_u = 112.5t = 1125 \text{ kN} = 1125 \times 10^3 \text{ N}$$

$$\text{Asumo } H-30 - f'_c = 30 \text{ MPa} = 30 \text{ N/mm}^2$$

$$\sigma_n = \frac{V_n}{(b_w \cdot d)} = \frac{V_u}{\phi \cdot b \cdot d} \leq \sigma_{lim} = \frac{5}{6} \sqrt{f'_c}$$

$$\text{Pruebo } b = 800 \text{ mm}$$

$$d = \frac{V_u}{\phi \cdot b \cdot \left[\frac{5}{6} \sqrt{f'_c} \right]}$$



$$d = \frac{2250 \times 10^3 \text{ N}}{0.75 \times 800 \text{ mm} \cdot 4.56 \text{ MPa}} = 822 \text{ mm}$$

Pruebo con otras secciones

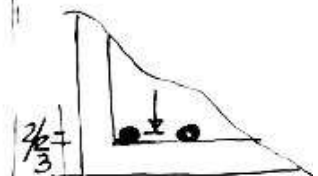
$$\text{Area nec} = \frac{2250 \times 10^3 \text{ N}}{0.75 \times 4.56 \text{ MPa}} = 657894 \text{ mm}^2 = (b \times d)$$

- $b \times d$
 1) 800×822
 2) 600×1096
 3) 400×1645
 4) 1000×658

$$\sigma_n \leq \phi \cdot \sigma_n$$

$$\sigma_n = \frac{N_u}{A_g} ?$$

$$V_n = \frac{V_u}{\phi}$$



$$d = h - 4 \text{ cm} =$$

para H-30

$$\sigma_{lim} = \frac{5}{6} \sqrt{f'_c} = 4.56$$



$$b = 600 \text{ mm} \quad d = 1150 \text{ mm.}$$

3

Montante

$$V_u = 112,5 \text{ t}$$

$$A_{nec} = \frac{112,5 \times 10^3 \text{ N}}{0,75 \times 4,56 \text{ MPa}} = 328947 \text{ mm}^2$$

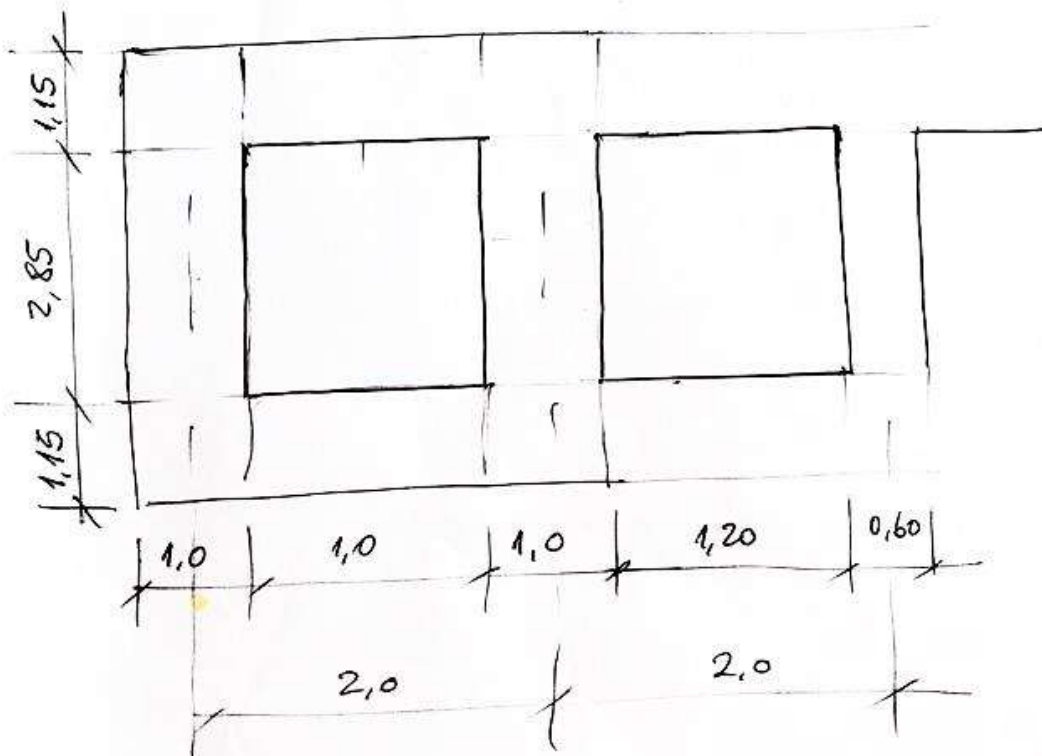
$b \times d$

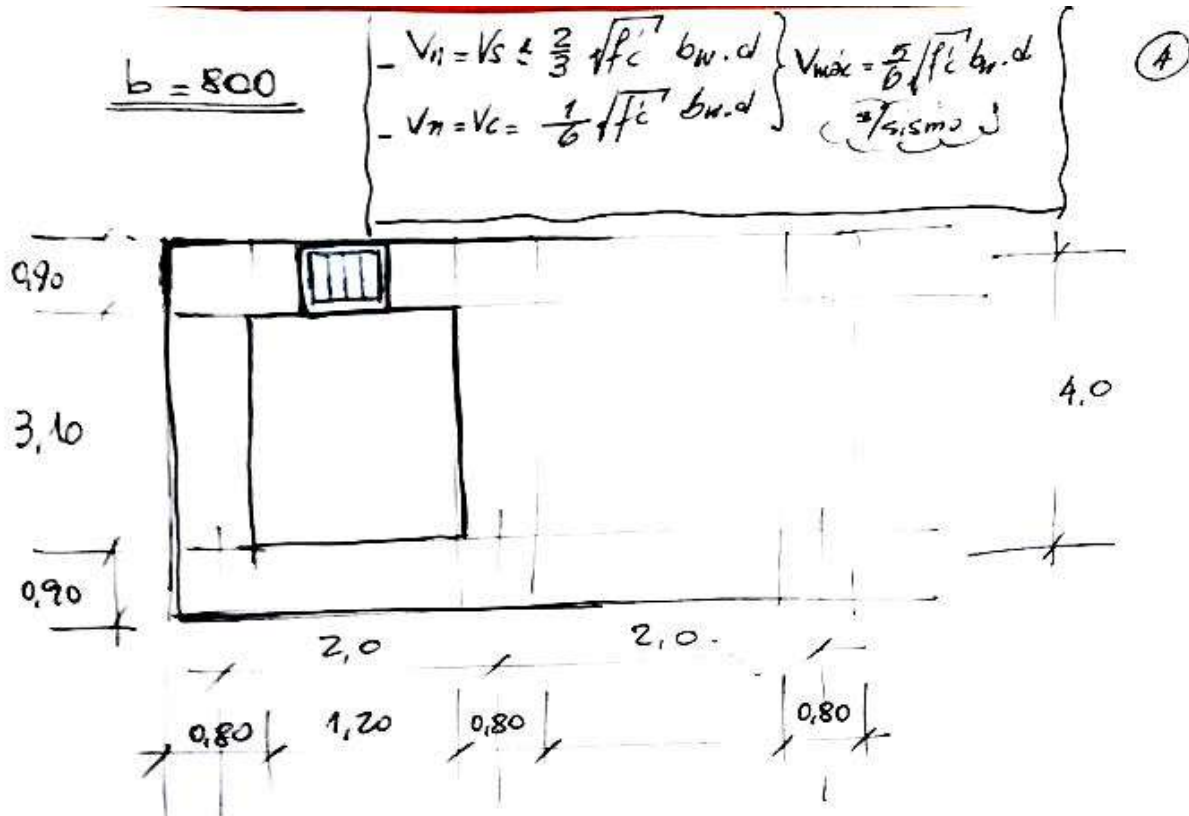
- 1) 400×823
- 2) 500×658
- 3) 600×548 600×600
- 4) 800×412
- 5) 1000×329

$$A_{nec} = \frac{2000 \times 10^3 \text{ N}}{0,75 \times 4,56 \text{ MPa}} = 584795 \text{ mm}^2$$

- 1) 400×1462
- 2) 500×1169
- 3) 600×975 600×1000
- 4) 800×730 800×770
- 5) 1000×585

$$b = 600$$





Dimensionando el corte ($V_u = 225t = 2250 \text{ kN}$)

$$V_u = \phi (V_c + V_s) \rightarrow V_s = \frac{V_u}{\phi} - V_c \quad \left| \begin{aligned} b &= 800 \\ h &= 900 \\ d &= 860 \end{aligned} \right.$$

$$V_c = \frac{1}{6} \sqrt{f'_c} \cdot b \cdot d = \frac{1}{6} \sqrt{30} \cdot 800 \cdot 860 = 628055 \text{ N}$$

$$P_u = 128t = 1280 \text{ kN}$$

$$V_c = \frac{1.13}{1 + \frac{1280 \times 10^3 \text{ N}}{14 \cdot 800 \cdot 860}} \cdot \frac{1}{6} \sqrt{30} \cdot 800 \cdot 860 = 711517 \text{ N}$$

$$V_c = \left(1 + \frac{P_u}{1449}\right) \frac{1}{6} \sqrt{f'_c}$$

ojo tracción!

$$V_s = \frac{2250 \times 10^3 \text{ N}}{0.75} - 628055 \text{ N} = 2372 \times 10^3 \text{ N}$$

$$\frac{A_v}{s} = \frac{V_s}{f_y \cdot d} = \frac{2372 \times 10^3 \text{ N}}{420 \frac{\text{N}}{\text{mm}^2} \cdot 860 \text{ mm}} = 6.57 \frac{\text{mm}^2}{\text{mm}} \Rightarrow 0.657 \frac{\text{cm}^2}{\text{cm}} \cdot \frac{\text{cm}^2}{10 \frac{\text{mm}^2}{\text{cm}^2}} \cdot \frac{10 \text{ mm}}{\text{cm}}$$

$$\frac{A_v}{s} = 0.657 \frac{\text{cm}^2}{\text{cm}}$$

$$A_v = 5 \text{ ramas} = \begin{cases} 1) \text{ sep} = 40 \text{ cm} - A_v = 5.25 \\ 2) \text{ sep} = 30 \text{ cm} - A_v = 3.94 \\ 3) \text{ sep} = 20 \text{ cm} - A_v = 2.63 \end{cases}$$

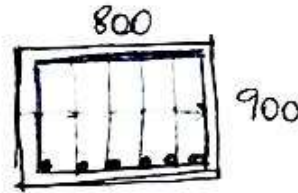
$$A_v = 6.1314 \frac{\text{cm}^2}{\text{rama}}$$

$$\begin{aligned} \text{sep} - \\ \cdot \frac{d}{2} &= \frac{860}{2} = 430 \\ \cdot 400 \text{ mm} \end{aligned}$$



6 ramas

$$\frac{A_v}{s} = 0,657 \frac{\text{cm}^2}{\text{cm.}}$$



$$\frac{A_v}{s} = \frac{0,657}{6} = 0,1095 \frac{\text{cm}^2}{\text{cm}} \quad (\text{por rama})$$

$$s = 40 \text{ cm} \quad A_v = 4,38 \text{ cm}^2 \rightarrow \phi$$

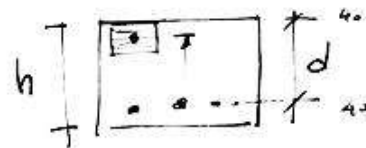
$$s = 20 \text{ cm} \quad A_v = 2,19$$

$$s = 15 \text{ cm} \quad A_v = 1,64 \text{ cm}^2 \rightarrow \phi = \phi_b = 16 \text{ mm.}$$

$$M_u = 225 \text{ tm.} \quad (0,85 \cdot d)$$

$$M_u = \phi \cdot M_n = \phi \cdot A_s \cdot z \cdot f_y$$

$$A_s = \frac{M_u}{\phi \cdot (0,85 \cdot d) \cdot f_y}$$

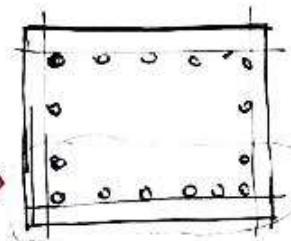


$$h = 900 \quad d = 860.$$

$$M_n = A_s \cdot z \cdot f_y$$

$$A_s = \frac{2250 \times \text{KNm} \times 10^6}{0,9 \left(0,85 \times 860 \right) \times 420 \frac{\text{N}}{\text{mm}^2}} = 8143 \text{ mm}^2$$

$$A_s = 81,4 \text{ cm}^2 \rightarrow \begin{array}{l} 26 \phi 20 \\ 17 \phi 25 \\ 11 \phi 32 \end{array}$$

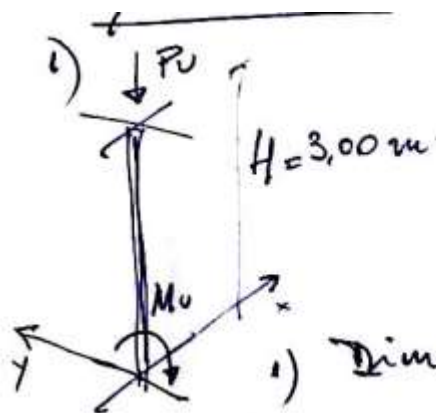


Verificar flexocompresión
y flexo-tracción

$$sep = \frac{A_s \cdot f_y \cdot d}{V_s} = \frac{A_s \cdot 420 \cdot 870}{2285} = \frac{0,28 \text{ cm}^2}{28} \cdot \frac{0,16}{\text{mm}} = 4,48 \text{ mm.}$$



EJERCITACIÓN:
Esfuerzos combinados



Solicitaciones

	P	M
D	-3,5	0,50
L	-2,0	0,25

1) Dimensionar en acero (F-24) y en madera

2) Dimensionar en H·A° (H-25)

a) Armadura distribuida

b) Armadura concentrada

3) Columna H·A° $H = 3.00\text{ m}$, $P_0 = -12\text{ t}$, $M_0 = 20\text{ tm}$. H-25

4) Pórtico H·A° (H-25)

