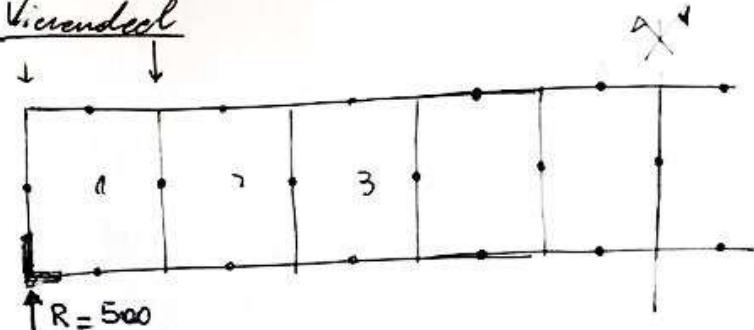




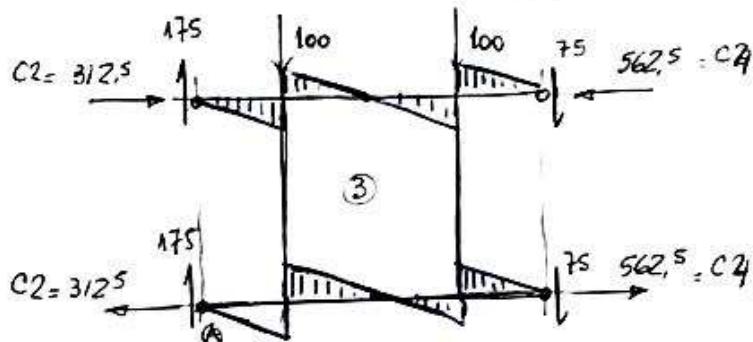
Vierendeel





Resolver todos los cuadros y graficar

(2)



$$\sum X = 0$$

$$\sum Y = 0 \dots$$

$$\sum M_A = 0 = \underbrace{100 \times 1 + 100 \times 3}_{400} + \underbrace{75 \times 4 \times 2}_{600} + \underbrace{312,5 \times 4,0}_{1250} - 562,5 \times 4,0 - 2250$$

Montantes $V_u = 225 t = 2250 \text{ kN}$ Cordon

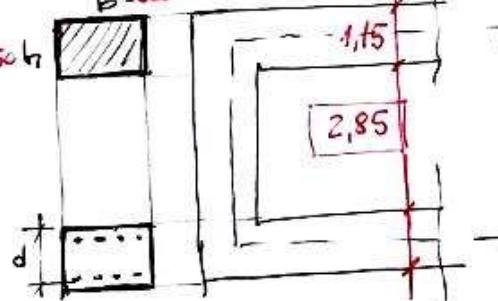
$$- V_u = 112,5 t = 1125 \text{ kN} = 1125 \times 10^3 \text{ N}$$

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

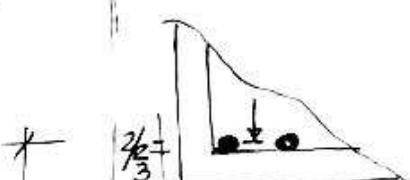
$$n_b = \frac{V_n}{(b_w \cdot d)} = \frac{V_n}{\phi \cdot b \cdot d} \leq n_{lim.} = \frac{5}{6} \sqrt{f'_c}$$

$$\text{Prueba } b = 800 \text{ mm. } 1150 \text{ h}$$

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



$$\begin{aligned} n_b &\leq \phi \cdot n_u \\ n_u &= \frac{n_u}{\phi} \\ V_n &= \frac{V_u}{\phi} \end{aligned}$$



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

para H-30

$$n_{lim} = \frac{5}{6} \sqrt{f'_c} = 4,56$$

$$d = \frac{2250 \times 10^3 \text{ N}}{0,75 \times 800 \text{ mm} \cdot 4,56 \text{ MPa}} = 822 \text{ mm.}$$

Prueba con otras secciones

$$\text{Area nec.} = \frac{2250 \times 10^3 \text{ N}}{0,75 \times 4,56 \text{ MPa}} = 657894 \text{ mm}^2 = (b \times d)$$

- (1) 800×822
- (2) 600×1096
- (3) 400×1645
- (4) 1000×658



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

(3)

Montante

$$V_U = 112,5 t$$

$$A_{nec} = \frac{1125 \times 10^3 \text{ N}}{0,75 \times 4,56 \text{ MPa}} = 328947 \text{ mm}^2$$

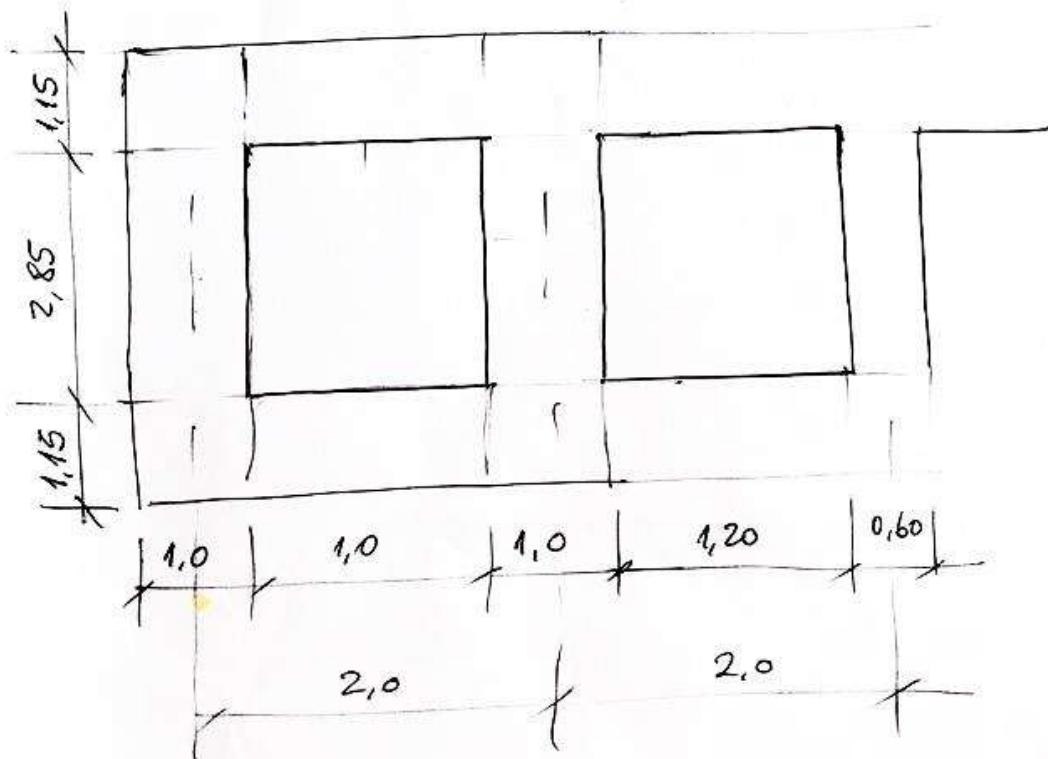
$$\left. \begin{array}{l} b \times d \\ 1) 400 \times 823 \\ 2) 500 \times 658 \\ 3) 600 \times 548 \\ 4) 800 \times 412 \\ 5) 1000 \times 329 \end{array} \right\} 600 \times 600$$

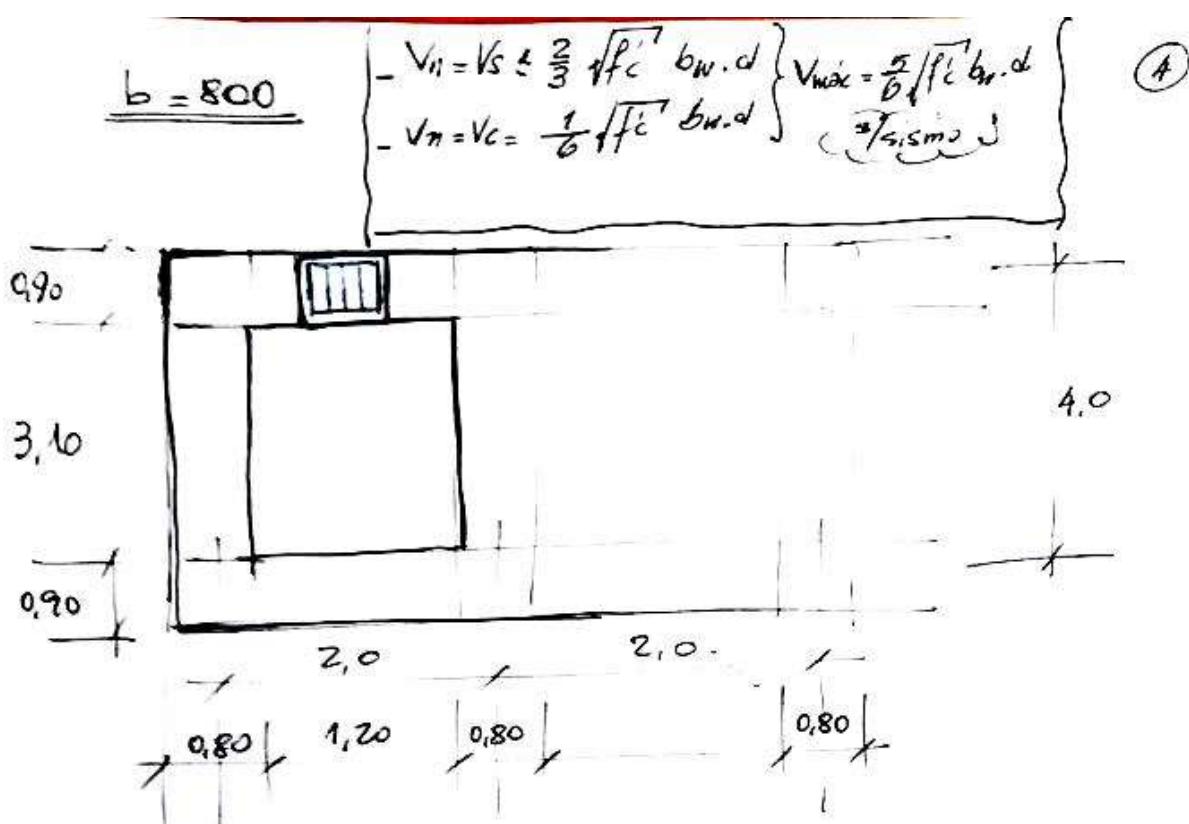
$$A_{nec} = \frac{2000 \times 10^3 \text{ N}}{0,75 \times 4,56 \text{ MPa}} = 584795 \text{ mm}^2$$

$$\left. \begin{array}{l} 1) 400 \times 1462 \\ 2) 500 \times 1169 \\ 3) 600 \times 975 \\ 4) 800 \times 730 \\ 5) 1000 \times 585 \end{array} \right\} \begin{array}{l} 600 \times 1000 \\ 800 \times 770 \end{array}$$

$$b = 600$$

— o —





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

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

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

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

$$V_c = \frac{1,13}{1 + \frac{1280 \times 10^3 \text{ N}}{74 \cdot 860 \cdot 860}} \cdot \frac{1}{6} \sqrt{30} \cdot 800 \cdot 860 = 711517 \text{ N}$$

$$V_s = \frac{2250 \times 10^3 \text{ N}}{0,75} - 628055 \text{ N} = 2372 \times 10^3 \text{ N}$$

$$\frac{Av}{s} = \frac{V_s}{f_y \cdot d} = \frac{2372 \times 10^3 \text{ N}}{420 \frac{\text{N}}{\text{mm}^2} \cdot 860 \text{ mm}} = 6,57 \frac{\text{mm}^2}{\text{mm}} \Rightarrow \frac{0,657 \frac{\text{cm}^2}{\text{cm}}}{\frac{10 \text{ mm}^2}{\text{cm}}} \cdot \frac{10 \text{ mm}}{\text{cm}}$$

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

$$Av = 5 \text{ ramas} = \left\{ \begin{array}{l} 1) sep = 40 \text{ cm} - Av = 5,25 \\ 2) sep = 30 \text{ cm} - Av = 3,94 \\ 3) sep = 20 \text{ cm} - Av = 2,63. \end{array} \right.$$

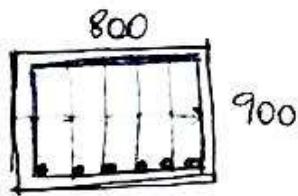
$$Av = 0,1314 \frac{\text{cm}^2}{\text{rama}}$$

sep-
 $\frac{d}{2} = \frac{860}{2} = 430$
 400 mm



Granos

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



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

$$s = 40 \text{ cm} \quad A_v = 1,38 \text{ cm}^2 \rightarrow \phi$$

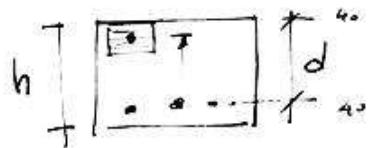
$$s = 20 \text{ cm} \quad A_v = 2,19$$

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

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

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

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

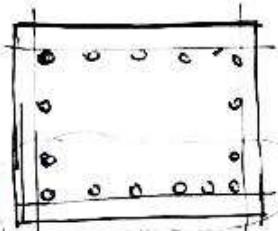


$$h = 900 \quad d = 860.$$

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

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

$$A_s = 81,4 \text{ cm}^2 \rightarrow \frac{26 \phi 20}{17 \phi 25} \quad \text{---} \quad 11 \phi 32$$



Verificar flexocompresión

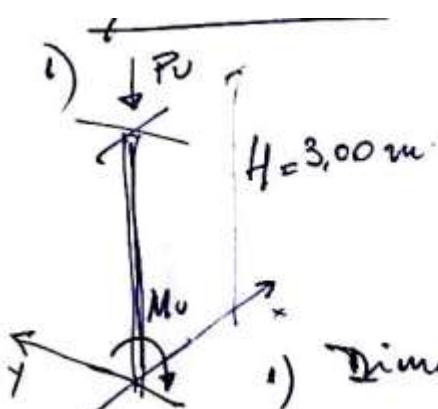
y flexo-tracción

$$s_{ep} = \frac{a_s \cdot f_y \cdot d}{V_s} = \frac{a_s \cdot 420870}{2285} \cdot \frac{28}{a_s \cdot 0,16} \quad 4,48 \text{ mm.}$$

$0,28 \text{ cm}^2$



EJERCITACIÓN:
Esfuerzos combinados



Solicitudes

	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)

- Armadura distribuida
- Armadura concentrada

3) Columna H·A° H=3.00 m, P_U = -12 t, M_U = 20 tm. H-25

4) Portico. H·A° (H-25)

