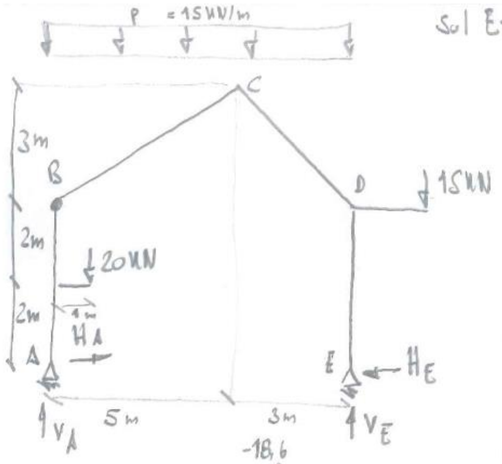
Sol Ej Resistencia 1 21 jul 2023



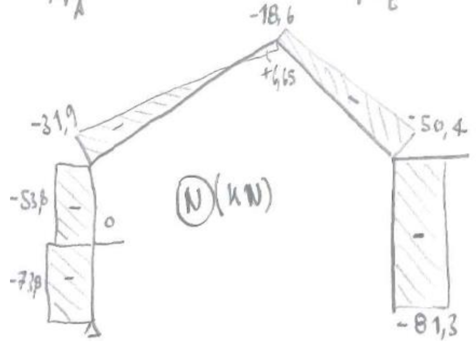
$\Sigma M_{B\,izq} = 0 \rightarrow 4 \times H_A - 20 \times 1 = 0 \rightarrow \boxed{H_A = 5\,kN}$

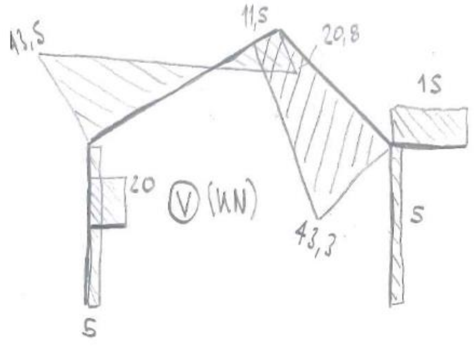
$\Sigma F_{hor} = 0 \rightarrow \boxed{H_E = 5\,kN}$

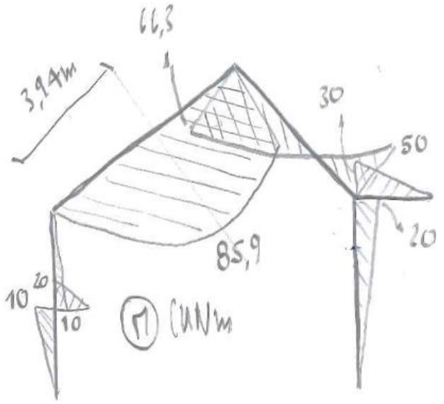
$\Sigma M_{A} = 0 \rightarrow V_E \times 8 = 15 \times 8 \times 4 + 15 \times 10 + 5 \times 4$

$\boxed{V_E = 81{,}25\,kN}$

$\Sigma F_{vert} = 0 \rightarrow \boxed{V_A = 73{,}75\,kN}$







b) Dimensiona punto de momento máximo entre B y C

$M = 85{,}9\,kNm \Rightarrow M/W \leq 140\,MPa$

$\Downarrow$

$\boxed{\text{PNI 30} \; (W = 653\,cm^3)} \Leftarrow W > 613{,}57\,cm^3$

c) $\tau_{max} = \dfrac{M\,V}{I\,b}$

PNI 30 → $M_{media\,secc} = 381\,cm^3$

$b_{esp.\,alma} = 1{,}08\,cm$

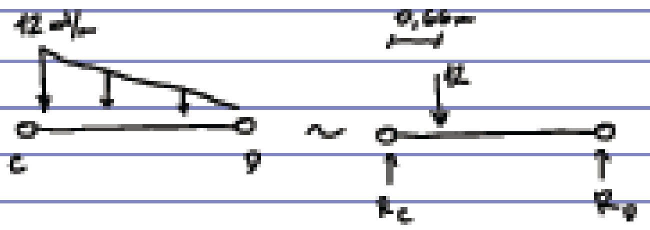
$I = 9800\,cm^4$

$V_{máx} = 43{,}5\,kN$

$\boxed{\tau_{max} = 15{,}7\,MPa}$

Solución viga Gerber

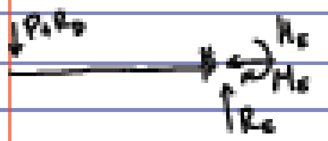
Comenzamos por el tramo flotante CD



$\sum M_D = 0 \rightarrow R_C = 8\ kN$

$\sum F_y = 0 \rightarrow R_D = 4\ kN$

Tramo DE

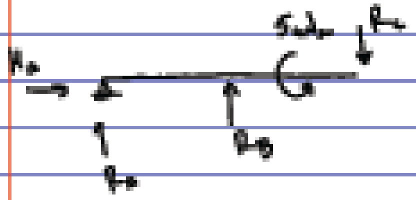


$\sum F_y = 0 \rightarrow R_E = 11\ kN$

$\sum F_x = 0 \rightarrow H_E = 0\ kN$

$\sum M_E = 0 \rightarrow M_E = 70\ kNm$

Tramo AC: barra FB actúa como apoyo deslizante (reacción vertical)



$\sum M_A = 0 \rightarrow R_B = 11,3\ kN$

$\sum F_y = 0 \rightarrow R_A = -6,3\ kN$

$\sum F_x = 0 \rightarrow H_A = 0\ kN$

(Parte c)

δ_C: el descenso del punto C se puede descomponer en 3 partes:

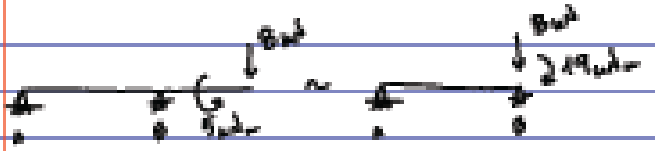
1) descenso del punto B por tracción en FB (u_B)
2) descenso rígido ocasionado por el giro en B ($\delta_C^{(2)} = \theta_B \cdot L_{BC}$)
3) descenso por flexión del tramo BC ($\delta_C^{(3)}$)

Barra FB traccionada → deformación = descenso

$$u_B = \frac{NL}{EA} = \frac{11,3\,kN \cdot 4\,m}{210\,GPa\left(\frac{\pi \phi^2}{4}\right)} = 5,43\ mm\ (\downarrow)$$

u_B genera giro en B: $\theta_B^{(1)} = \frac{u_B}{3\,m} = 1,8 \times 10^{-3}\ rad$

M y R_C también generan giro en B



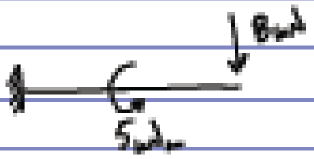
$$I = \frac{bh^3}{12} = \frac{0,15 \cdot 0,3^3}{12} = 3,38 \times 10^{-4}\ m^4$$

$EI = 3,54 \times 10^{6}\ kNm^2$

$\theta_B^{(2)} = \frac{ML}{3EI} = 5,4 \times 10^{-3}$ RAD ↻

$\theta_B = 5,4 \times 10^{-3} + 1,8 \times 10^{-3} = 7,2 \times 10^{-3}$ RAD ↻

$\delta_C^{(1)} = 3m \cdot \theta_B = 21,6$ mm ↓

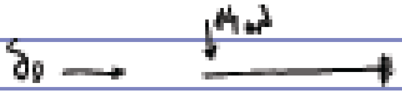


$\delta_C^{(2)} = \frac{PL^3}{3EI} - \frac{M\,a(2L-a)}{2EI} = \frac{8 \cdot 3^3}{3EI} - \frac{5 \cdot 1,5}{2EI}(4,5 - 1,5)$

$\delta_C^{(2)} = 15,6$ mm ↓

$\delta_C = \delta_B + \delta_C^{(1)} + \delta_C^{(2)} = 42,6$ mm ↓

θ_D^{TRA} :

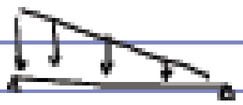


$\delta_D = \frac{PL^3}{3EI} = 164,6$ mm

GIRO EN D POR DESCENSOS DE LOS PUNTOS C Y D.

$\psi_D = \frac{\delta_D - \delta_C}{2m} = 0,061$ RAD ↻

GIRO POR FLEXIÓN



$\theta_D^{f} = \frac{7qL^3}{360EI} = 5,3 \times 10^{-4}$ RAD ↺

$\theta_D^{TRA} = 0,061 - 5,3 \times 10^{-4} = 0,060$ RAD ↻

(PARTE d)

$V_{MÁX} = 14 \text{ kN}$

$\mu = b \cdot \frac{h}{2} \cdot \frac{h}{4} = \frac{b h^2}{8} = 1.68 \times 10^{-3} \text{ m}^3$

$I = \frac{bh^3}{12} = \frac{0{,}15 \cdot 0{,}3^3}{12} = 3{,}38 \times 10^{-4} \text{ m}^4$

$\tau_{max} = \frac{V \cdot \mu}{b \cdot I} = 466.5 \text{ kPa}.$