

ETC 3

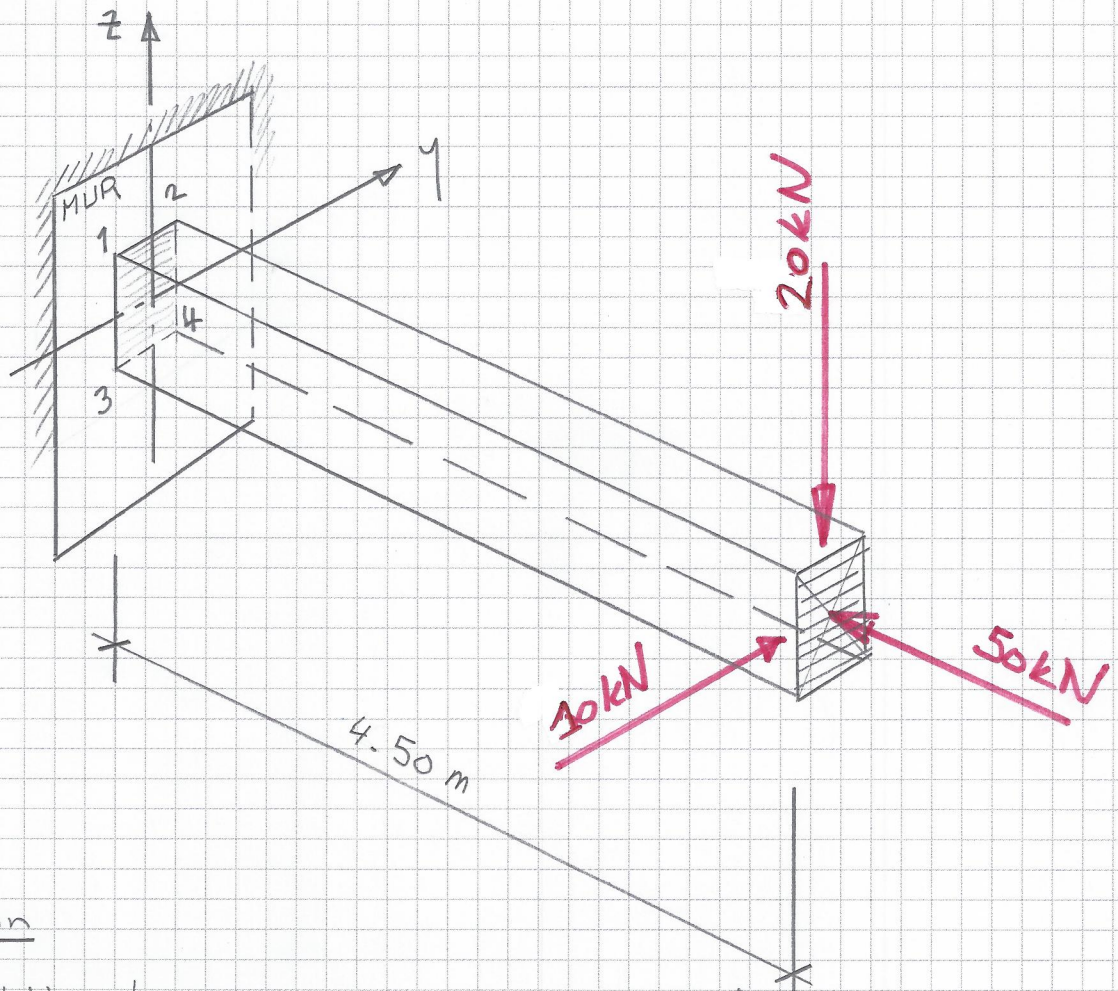
7.06.22

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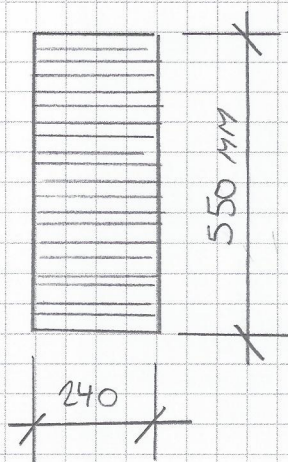
NOM : _____

DIMENSIONNEMENT

temps à dispo: 75'

Section

GL 24 H bois

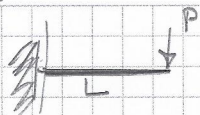
On vous demande:

$$f_q = 1.5$$

1. Tous les efforts à l'encastrement; M_{dy} ,
10' M_{dz} , N_d , V_{dy} , V_{dz} 10pts
2. Le contrôle au 1er ordre de la section
30' à l'encastrement 15pts
3. le contrôle au 2ème ordre 10pts
15'
4. La déformation de la poutre
10' sous l'effet de la 10pts
force de 20 kN
5. le raccourcissement de la poutre sous N
10' 5pts

$$M = PL$$

2

Efforts:

$$M_y = 20 \cdot 4.50 = -90 \text{ kNm}$$

$$M_z = 10 \cdot 4.50 = 45 \text{ kNm}$$

$$N = -50 \text{ kN}$$

$$V_y = 20 \text{ kN}$$

$$V_z = 10 \text{ kN}$$

Effort de dimension.

$$M_{yd} = 90 \cdot 1.5 = -135 \text{ kNm}$$

$$M_{zd} = 67.5 \text{ kNm}$$

$$N_d = -75 \text{ kN}$$

$$V_{yd} = 30 \text{ kN}$$

$$V_{zd} = 15 \text{ kN}$$

Caractéristique de la section

$$I_y = \frac{BH^3}{12} = 3327.5 \text{ E6 mm}^4$$

$$W_y = \frac{BH^2}{6} = 12.1 \text{ E6 mm}^3$$

$$W_z = \frac{B^2H}{6} = 5.28 \text{ E6 mm}^3$$

$$A = 240 \cdot 550 = 132000 \text{ mm}^2$$

$$i_y = 0.289 \cdot H \approx 159 \text{ mm}$$

$$i_z = 0.289 \cdot B = 69 \text{ mm}$$

$$E_{bois} = 11000 \text{ N/mm}^2$$

$$f_{md} = 16 \text{ N/mm}^2$$

$$f_{vd} \text{ ou } \tau_{vd} = 1.8 \text{ N/mm}^2$$

$$f_{cd} = 14.5 \text{ N/mm}^2$$

1er ordre

$$\frac{75 \text{ E3}}{14.5 - 132000} + \frac{135.0 \text{ E6}}{12.1 \text{ E6} \cdot 16} + \frac{67.5 \text{ E6}}{5.28 \cdot 16 \text{ E6}} \approx 1.54 < 1$$

$$0.039 + 0.70 + 0.80$$

Cisaillement:

$$\frac{3 \cdot 30 \text{ E3}}{2 \cdot 132000 \cdot 1.8} = 0.19 < 1 \checkmark$$

$$\frac{3 \cdot 15 \text{ E3}}{2 \cdot 132000 \cdot 1.8} = 0.10 < 1 \checkmark$$

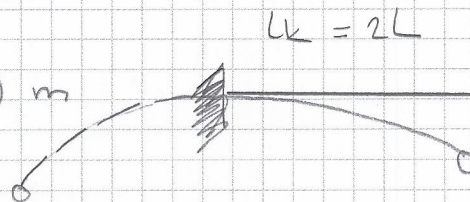
Pour être juste, il faudrait faire encore

$$\vec{f} = \sqrt{(0.19)^2 + (0.10)^2} \approx 0.22 < 1$$

2ème ordre

$$L_{ky} = 2 \cdot 4.50 = 9 \text{ m}$$

$$L_{kz} = 9 \text{ m}$$



$$\lambda_{ky} = \frac{9000}{159} \approx 57$$

$$f_{kyd} = 10 \text{ N/mm}^2$$

$$N_{kyd} = \frac{132000 \cdot 10}{100} = 1320 \text{ kN}$$

$$\lambda_{kz} = \frac{9000}{69} = 130$$

$$f_{kzd} = 2.7 \text{ N/mm}^2$$

$$N_{kzd} = 132000 \cdot 2.7 = 356.4 \text{ kN}$$

Axe y-y :

$$\frac{75 \text{ E3}}{132000 \cdot 10} + \frac{135 \text{ E6}}{12 \cdot 10^6 \cdot 16} \approx 0.76 \leq 1 \checkmark$$

0.057 + 0.70

Axe z-z :

$$\frac{75 \text{ E3}}{356.4} + \frac{67.5 \text{ E6}}{5.28 \cdot 16} = 1.01 \neq 1 \checkmark$$

0.21 0.80

Déformation

$$w = \frac{1}{3} \frac{PL^3}{EI} = \frac{1}{3} \cdot \frac{20 \text{ E3} \cdot 4500^3}{11000 \cdot 3327 \text{ E6}} = 16.6 \text{ mm} \leq \frac{L}{350}$$

$\rightarrow \left(\frac{L}{271} \right) \checkmark$

$$\Delta L = \frac{N \cdot L}{E \cdot A} = \frac{50 \text{ E3} \cdot 4500}{11000 \cdot 132000} = 0.15 \text{ mm} \checkmark$$

