

Ejercicio 27

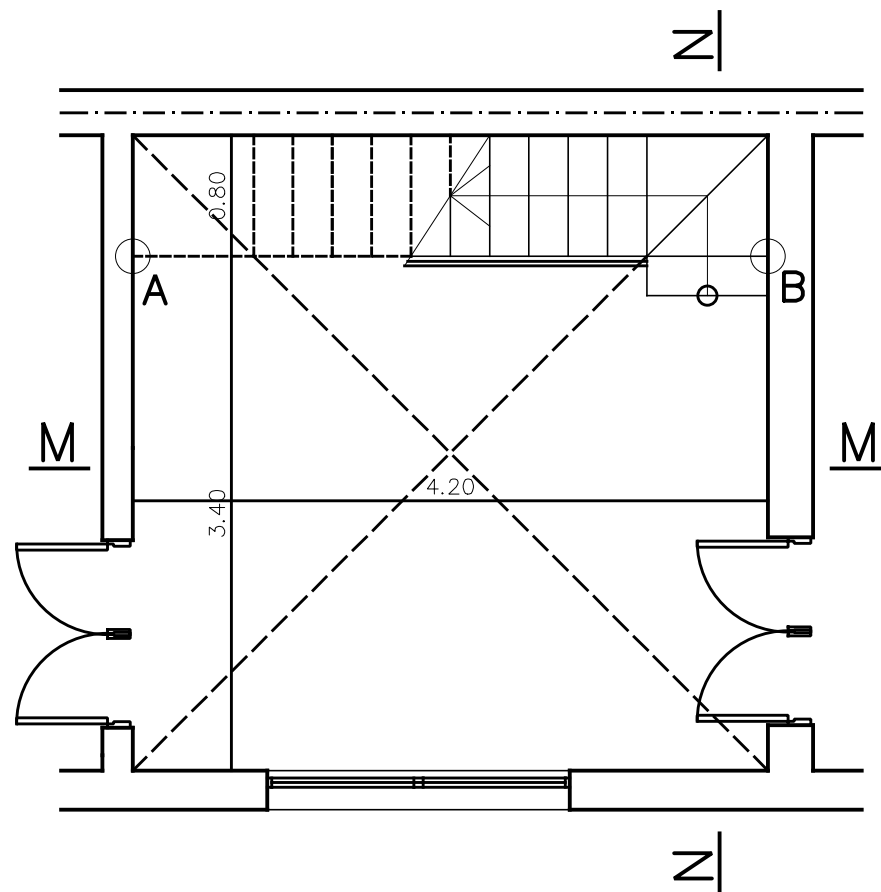
Dada la estructura expresada en el gráfico se pide:

1. Diseñar un entrepiso de madera proponiendo una sección para el entablonado superior y para las correas que lo sustentan, y una separación entre correas. Verificar la viabilidad del diseño propuesto.

2. Dimensionar un elemento AB de apoyo para las correas con un perfil normal doble T de acero.

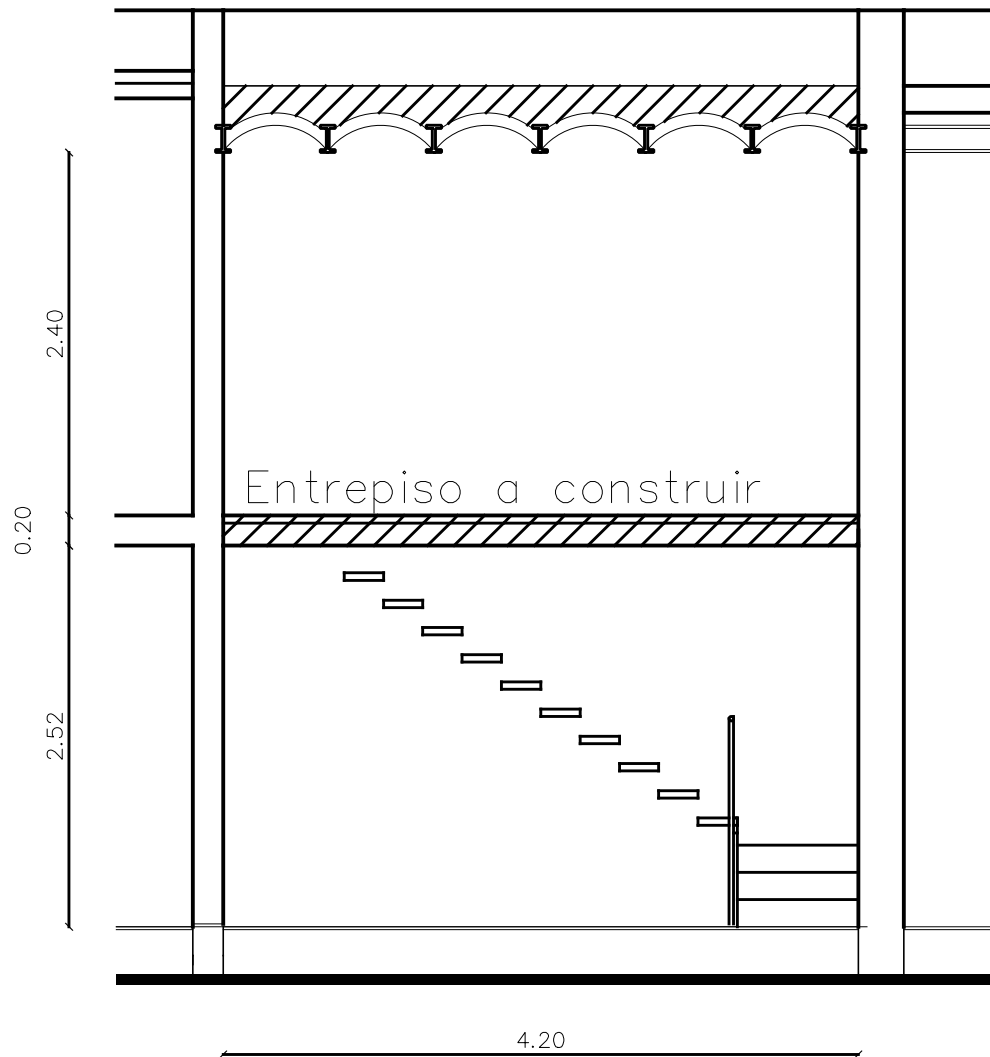
ACERO: $f_{sd}=1400 \text{ daN/cm}^2$, $T_{sd}=1120 \text{ daN/cm}^2$, $E=2100000 \text{ daN/cm}^2$.

MADERA: $f_{md}=80 \text{ daN/cm}^2$, $T_{md}=6 \text{ daN/cm}^2$, $E=100000 \text{ daN/cm}^2$.

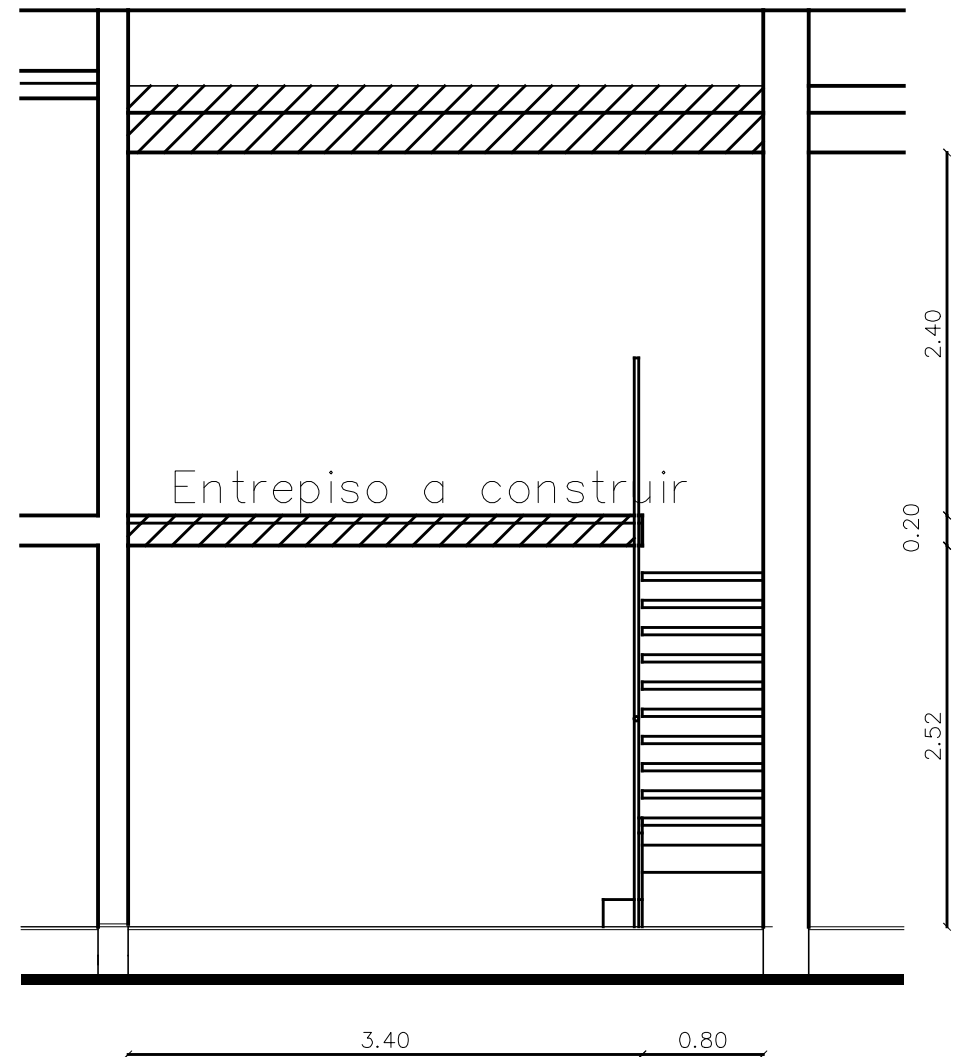


PLANTA

escala 1:50



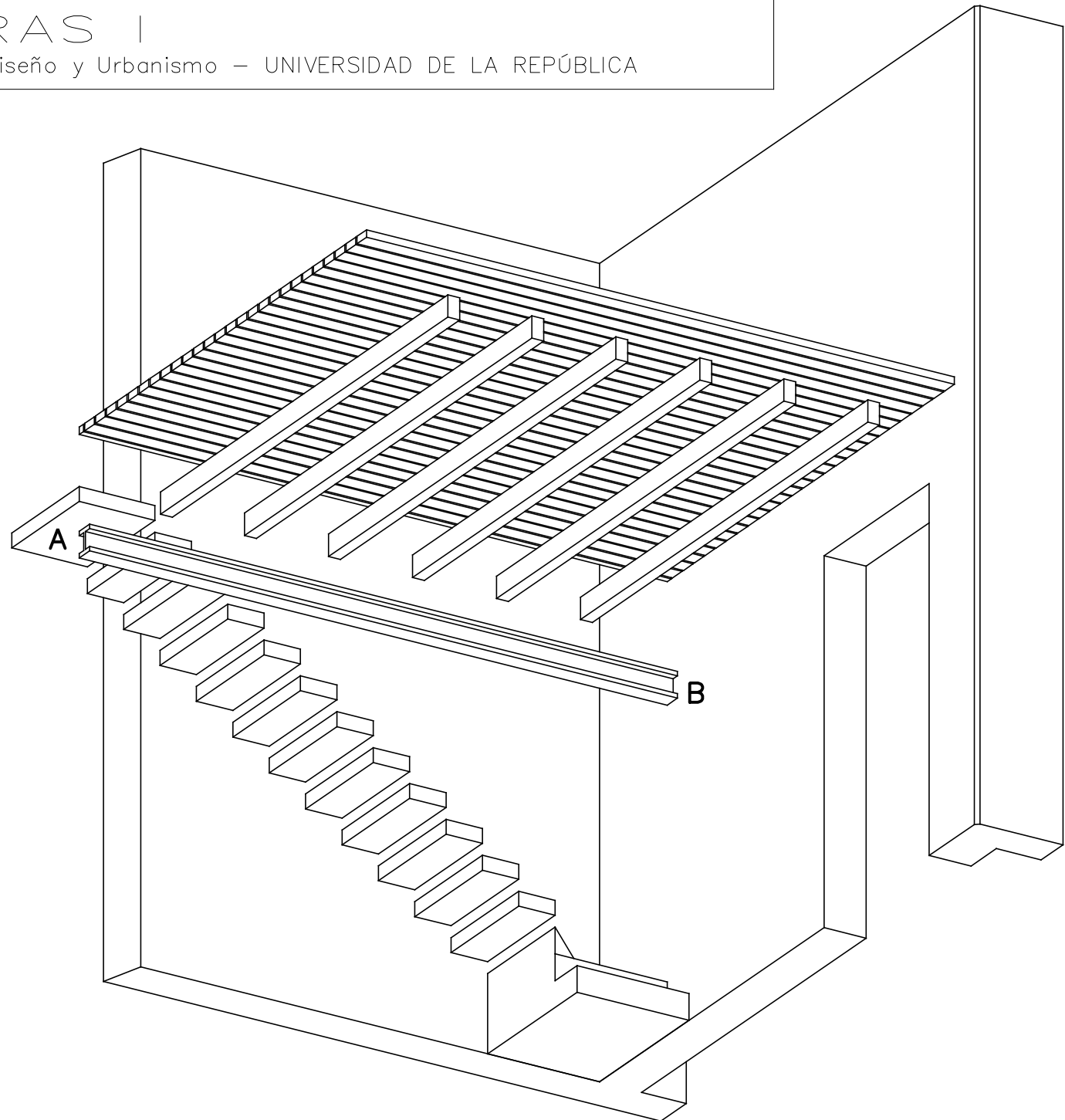
CORTE M-M escala 1:50



CORTE N-N escala 1:50

ESTRUCTURAS I

Facultad de Arquitectura, Diseño y Urbanismo – UNIVERSIDAD DE LA REPÚBLICA



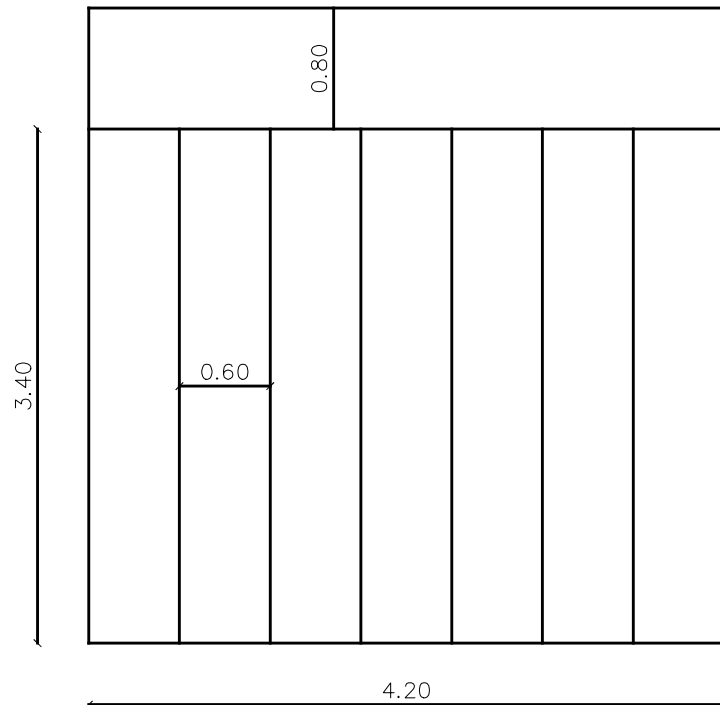
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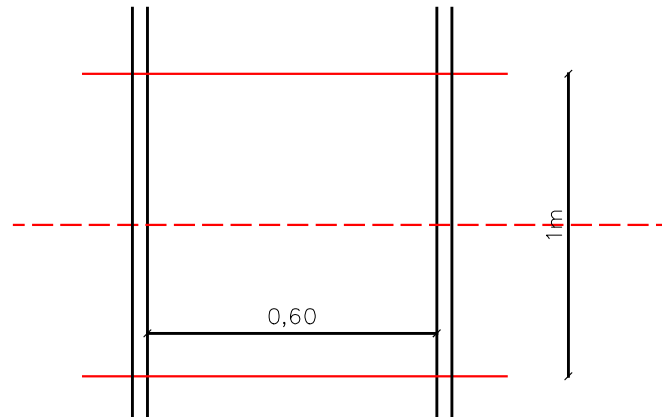
Carga a considerar

peso propio	50 daN/m ²
sobrecarga	150 daN/m ²
TOTAL	200 daN/m ²

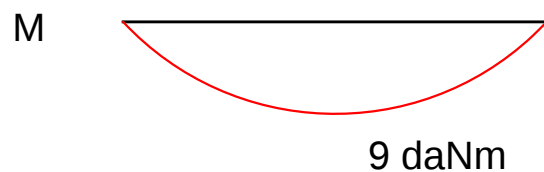
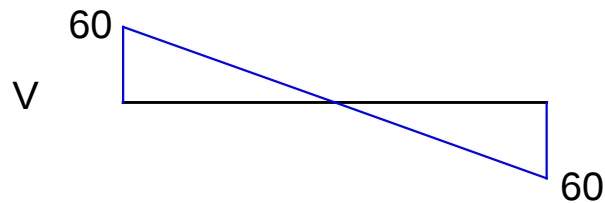
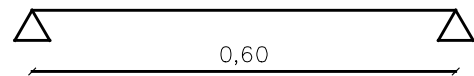
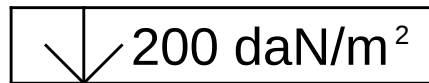
Opción 1

7 espacios de 0.60 m de distancia entre correas





Entablonado



$$W_x = \frac{bh^2}{6} = 26,04 \text{ cm}^3$$

$$I_x = \frac{bh^3}{12} = 32,6 \text{ cm}^4$$

$$S_{\max} = \frac{M_{\max}}{W_x} = \frac{900 \text{ daNcm}}{26,04 \text{ cm}^3} = 34,56 \text{ daN/cm}^2 < 80$$

$$T_{\max} = \frac{V_{\max}}{\frac{2}{3} A} = \frac{3 \times 60 \text{ daN}}{2 \times 100 \times 1,25} = 0,72 \text{ daN/cm}^2 < 6$$

$$F_{\max} = \frac{5 \times 2 \text{ daN/cm}^2 \times 60^4 \text{ cm}}{384 \times 100.000 \times 32,6 \text{ cm}^4} = 0,10 \text{ cm} < 0,2 \text{ cm}$$

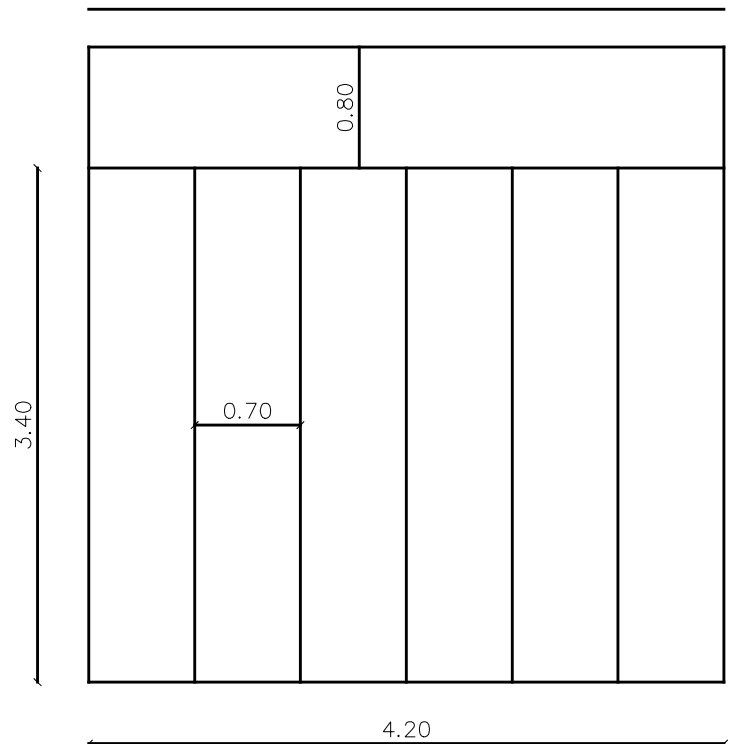
$$F_{\text{adm}} = \frac{60 \text{ cm}}{300} = 0,20 \text{ cm}$$

cumple

Ejercicio 27

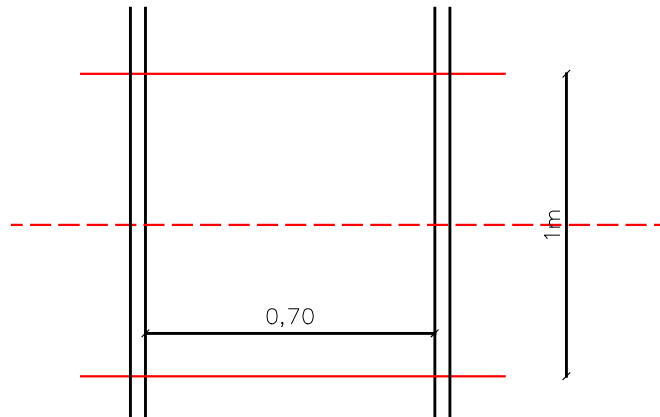
Carga a considerar

peso propio	50 daN/m ²
sobrecarga	150 daN/m ²
TOTAL	200 daN/m ²

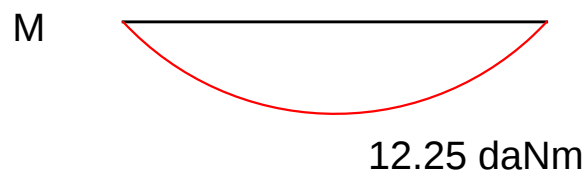
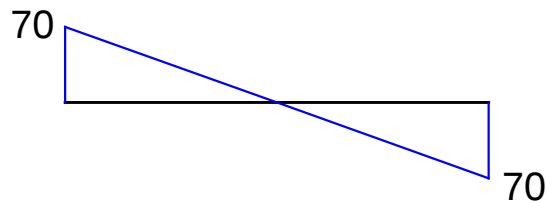
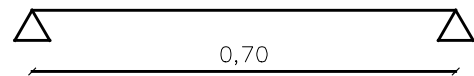
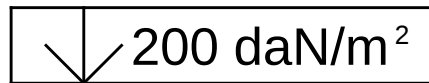


Opción 2

6 espacios de 0.70 m de distancia entre correas



Entablonado



$$W_x = \frac{bh^2}{6} = 26,04 \text{ cm}^3$$

$$I_x = \frac{bh^3}{12} = 32,6 \text{ cm}^4$$

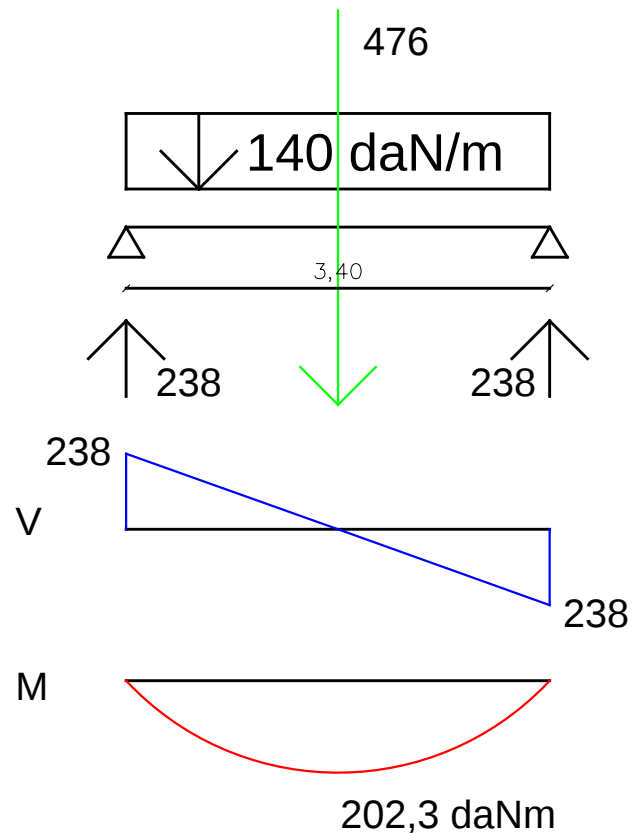
$$S_{\max} = \frac{M_{\max}}{W_x} = \frac{1225 \text{ daNcm}}{26,04 \text{ cm}^3} = 47,04 \text{ daN/cm}^2$$

$$T_{\max} = \frac{V_{\max}}{\frac{2}{3} A} = \frac{3 \times 70 \text{ daN}}{2 \times 100 \times 1,25} = 0,84 \text{ daN/cm}^2$$

$$F_{\max} = \frac{5 \times 2 \text{ daN/cm}^2 \times 70^4 \text{ cm}}{384 \times 100.000 \times 32,6 \text{ cm}^4} = 0,19 \text{ cm}$$

$$F_{\text{adm}} = \frac{70 \text{ cm}}{300} = 0,23 \text{ cm}$$

cumple



Correa de tramo

$$W_{\min} = \frac{M_{\max}}{f_d} = \frac{20230 \text{ daNcm}}{80 \text{ daN/cm}^2} = 252,9 \text{ cm}^3$$

$$1 \frac{1}{2} \times 9 : W_x = 276,58 \text{ cm}^3$$

$$2 \times 7 \frac{1}{2} : W_x = 259,79 \text{ cm}^3$$

$$3 \times 6 \frac{1}{2} : W_x = 297 \text{ cm}^3$$

$$3 \times 6 : W_x = 251 \text{ cm}^3$$

3 x 6 1/2 pulgadas

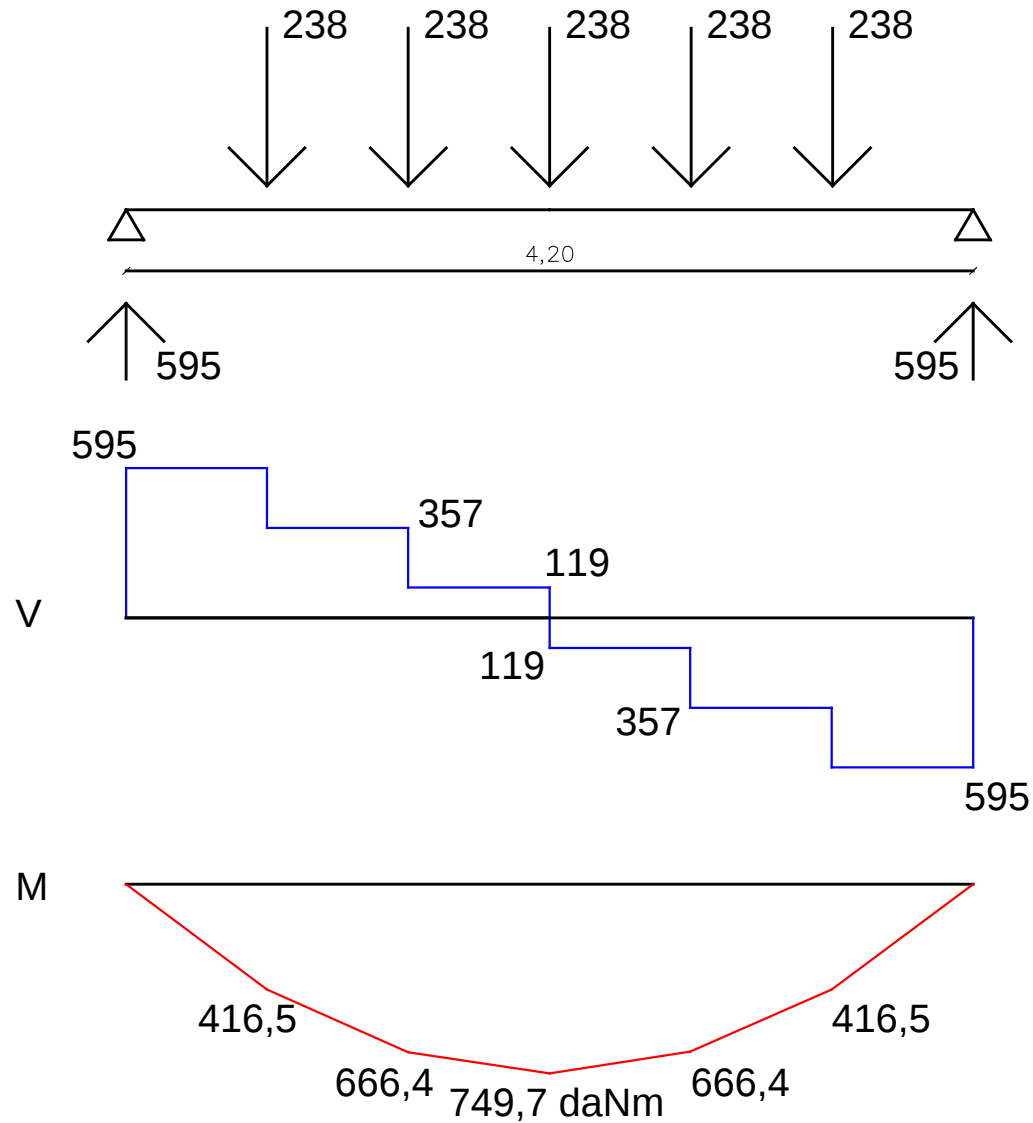
$$S_{\max} = \frac{M_{\max}}{W_x} = \frac{20230 \text{ daNcm}}{297 \text{ cm}^3} = 68 \text{ daN/cm}^2 < 80 \text{ OK}$$

$$T_{\max} = \frac{V_{\max}}{\frac{2}{3} A} = \frac{3 \times 238 \text{ daN}}{2 \times 113,43 \text{ cm}^2} = 3,15 \text{ daN/cm}^2 < 6 \text{ OK}$$

$$F_{\max} = \frac{5 \times 1,4 \text{ daN/cm}^2 \times 340^4 \text{ cm}}{384 \times 100.000 \times 2332,84 \text{ cm}^4} = 0,19 \text{ cm}$$

$$F_{adm} = \frac{340 \text{ cm}}{300} = 1,13 \text{ cm}$$

cumple



Viga de acero

$$W_{\min} = \frac{M_{\max}}{f_{sd}} = \frac{74970 \text{ daNcm}}{1400 \text{ daN/cm}^2} = 53,55 \text{ cm}^3$$

PNI N° 12 $W_x = 54,7 \text{ cm}^3$

PNI N° 12 $W_x = 54,7 \text{ cm}^3$ $I_x = 328 \text{ cm}^4$ $h = 12 \text{ cm}$ $b = 0,51 \text{ cm}$ $d = 0,77 \text{ cm}$

$$S_{\max} = \frac{M_{\max}}{W_x} = \frac{74970 \text{ daNcm}}{54,7 \text{ cm}^3} = 1370,56 \text{ daN/cm}^2 < 1400 \text{ OK}$$

$$T_{\max} = \frac{V_{\max}}{A \text{ alma}} = \frac{595 \text{ daN}}{0,51 (12 - 2 \times 0,77)} = 111,53 \text{ daN/cm}^2 < 1120 \text{ OK}$$

$$F_{\max} = \frac{P \times L^3}{8 \times E \times I \times B} = \frac{238 \times 420^3}{8 \times 2,1 \times 10^6 \times 328 \times 1,64} = 1.95 \text{ cm} \quad B = 1,64 \text{ para seis espacios}$$

$$F_{\text{adm}} = \frac{420 \text{ cm}}{500} = 0,84 \text{ cm} \quad \text{no cumple}$$

$$\begin{array}{l} 328 \text{ cm}^4 - 1,95 \text{ cm} \\ I_x \quad \quad - 0,84 \text{ cm} \end{array}$$

$$I_x = \frac{328 \text{ cm}^4 \times 1,95 \text{ cm}}{0,84} = 761.4 \text{ cm}^4$$

PNI N° 16 : $I_x = 935 \text{ cm}^4$

$$\begin{array}{l} 328 \text{ cm}^4 - 1,95 \text{ cm} \\ 935 \text{ cm} - F_{\max} \end{array}$$

$$F_{\max} = \frac{328 \text{ cm}^4 \times 1,95 \text{ cm}}{935 \text{ cm}^4} = 0,68 \text{ cm} \quad \text{cumple}$$

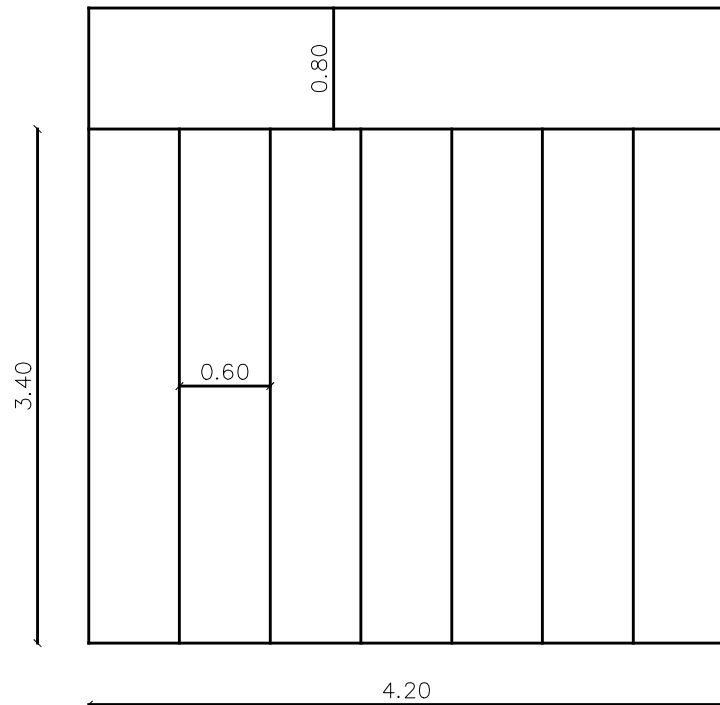
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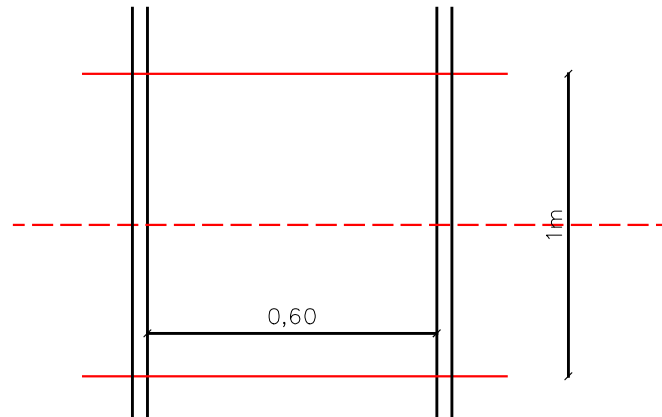
Carga a considerar

peso propio	50 daN/m ²
sobrecarga	150 daN/m ²
TOTAL	200 daN/m ²

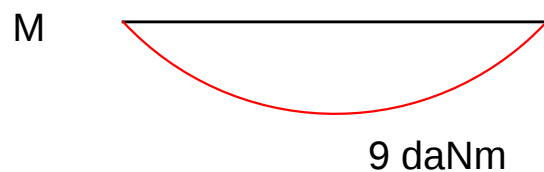
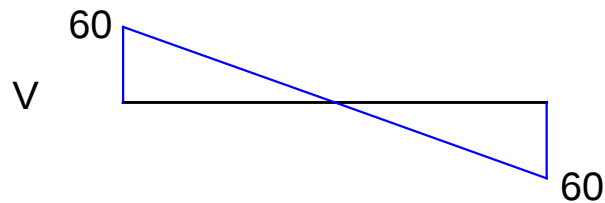
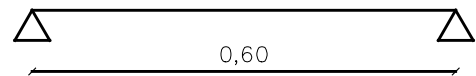
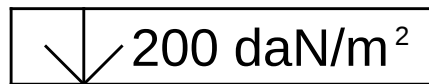
Opción 1

7 espacios de 0.60 m de distancia entre correas





Entablonado



$$W_x = \frac{bh^2}{6} = 26,04 \text{ cm}^3$$

$$I_x = \frac{bh^3}{12} = 32,6 \text{ cm}^4$$

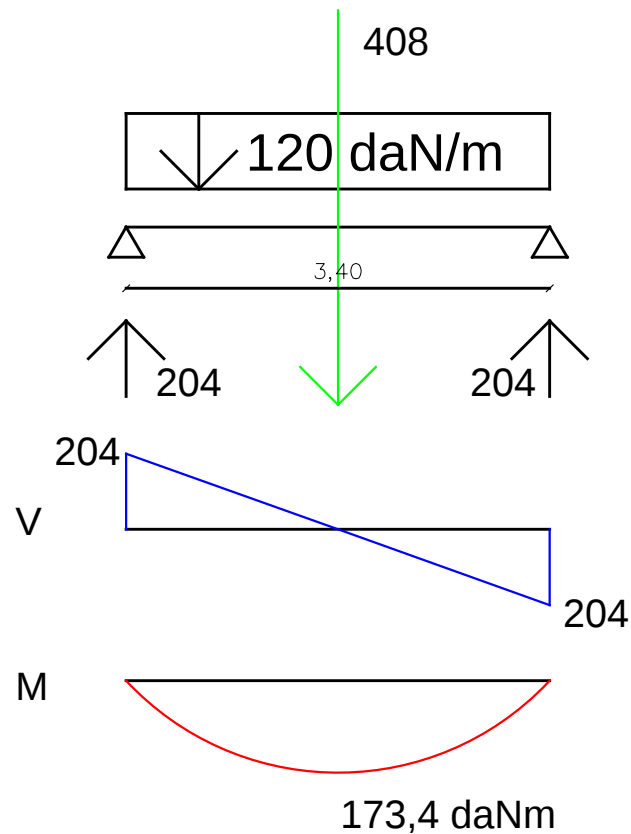
$$S_{\max} = \frac{M_{\max}}{W_x} = \frac{900 \text{ daNcm}}{26,04 \text{ cm}^3} = 34,56 \text{ daN/cm}^2 < 80$$

$$T_{\max} = \frac{V_{\max}}{\frac{2}{3} A} = \frac{3 \times 60 \text{ daN}}{2 \times 100 \times 1,25} = 0,72 \text{ daN/cm}^2 < 6$$

$$F_{\max} = \frac{5 \times 2 \text{ daN/cm}^2 \times 60^4 \text{ cm}}{384 \times 100.000 \times 32,6 \text{ cm}^4} = 0,10 \text{ cm} < 0,2 \text{ cm}$$

$$F_{\text{adm}} = \frac{60 \text{ cm}}{300} = 0,20 \text{ cm}$$

cumple



Correa de tramo

$$W_{\min} = \frac{M_{\max}}{f_d} = \frac{17340 \text{ daNcm}}{80 \text{ daN/cm}^2} = 216,75 \text{ cm}^3$$

$$1 \frac{1}{2} \times 8 : W_x = 216,55 \text{ cm}^3$$

$$1 \frac{1}{2} \times 8 \frac{1}{2} : W_x = 245,65 \text{ cm}^3$$

$$2 \times 7 : W_x = 224,89 \text{ cm}^3$$

$$3 \times 6 : W_x = 250,91 \text{ cm}^3$$

2 x 7 pulgadas

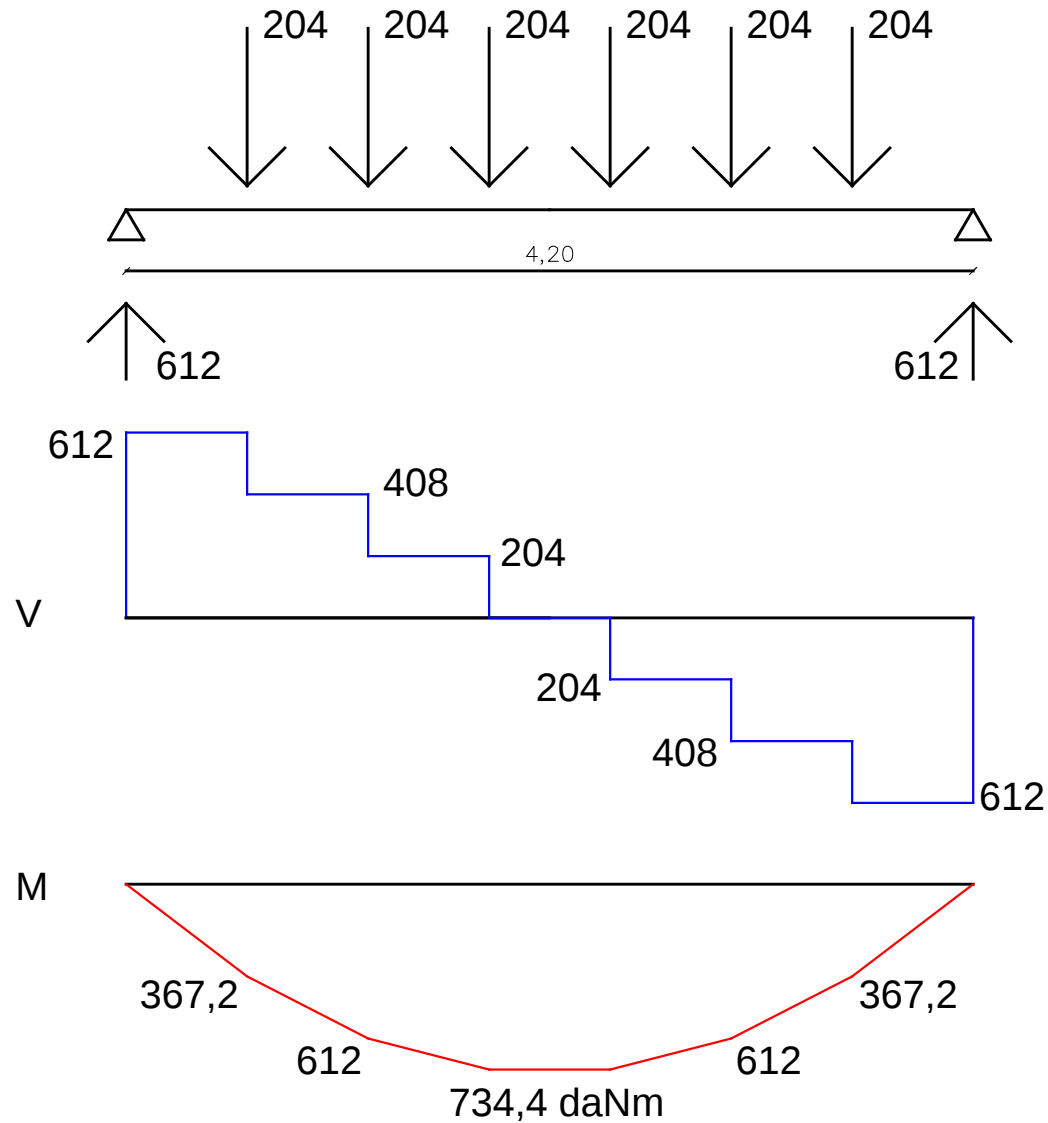
$$S_{\max} = \frac{M_{\max}}{W_x} = \frac{17340 \text{ daNcm}}{224,89 \text{ cm}^3} = 77,10 \text{ daN/cm}^2 < 80 \text{ OK}$$

$$T_{\max} = \frac{V_{\max}}{\frac{2}{3} A} = \frac{3 \times 204 \text{ daN}}{2 \times 79,47 \text{ cm}^2} = 3,85 \text{ daN/cm}^2 < 6 \text{ OK}$$

$$F_{\max} = \frac{5 \times 1,2 \text{ daN/cm}^2 \times 340^4 \text{ cm}}{384 \times 100.000 \times 1909,32 \text{ cm}^4} = 0,19 \text{ cm} < 1,13 \text{ OK}$$

$$F_{adm} = \frac{340 \text{ cm}}{300} = 1,13 \text{ cm}$$

cumple



Viga de acero

$$W_{\min} = \frac{M_{\max}}{f_{sd}} = \frac{73440 \text{ daNcm}}{1400 \text{ daN/cm}^2} = 52,46 \text{ cm}^3$$

$$\text{PNI N}^\circ 12 \quad W_x = 54,7 \text{ cm}^3$$

$$\text{PNI N}^\circ 12 \quad W_x = 54,7 \text{ cm}^3 \quad I_x = 328 \text{ cm}^4 \quad h = 12 \text{ cm} \quad b = 0,51 \text{ cm} \quad d = 0,77 \text{ cm}$$

$$S_{\max} = \frac{M_{\max}}{W_x} = \frac{73440 \text{ daNcm}}{54,7 \text{ cm}^3} = 1342,60 \text{ daN/cm}^2 < 1400 \text{ OK}$$

$$T_{\max} = \frac{V_{\max}}{A_{\text{alma}}} = \frac{612 \text{ daN}}{0,51 (12 - 2 \times 0,77)} = 114,80 \text{ daN/cm}^2 < 1120 \text{ OK}$$

$$F_{\max} = \frac{P \times L^3}{8 \times E \times I \times B} = \frac{204 \times 420^3}{8 \times 2,1 \times 10^6 \times 328 \times 1,39} = 1,97 \text{ cm} \quad B = 1,39 \text{ para siete espacios}$$

$$F_{\text{adm}} = \frac{420 \text{ cm}}{500} = 0,84 \text{ cm} \quad \text{no cumple}$$

$$\begin{array}{l} 328 \text{ cm}^4 - 1,97 \text{ cm} \\ I_x \quad - 0,84 \text{ cm} \end{array}$$

$$I_x = \frac{328 \text{ cm}^4 \times 1,97 \text{ cm}}{0,84} = 769 \text{ cm}^4$$

$$\text{PNI N}^\circ 16 : \quad I_x = 935 \text{ cm}^4$$

$$\begin{array}{l} 328 \text{ cm}^4 - 1,97 \text{ cm} \\ 935 \text{ cm} - F_{\max} \end{array}$$

$$F_{\max} = \frac{328 \text{ cm}^4 \times 1,97 \text{ cm}}{935 \text{ cm}^4} = 0,69 \text{ cm} \quad \text{cumple}$$