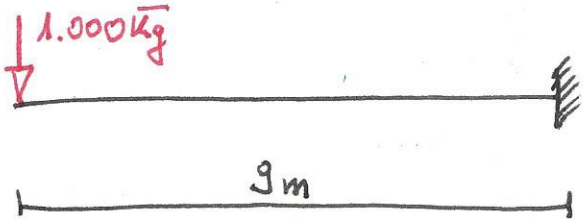
EJERCICIOS FLEXION



$\sigma_{adm} = 1.400\ Kg/cm^2$

IPB 400

$J_x = 57.680\ cm^4$ (I_x)

$W_x = 2.880\ cm^3$ (S_x)

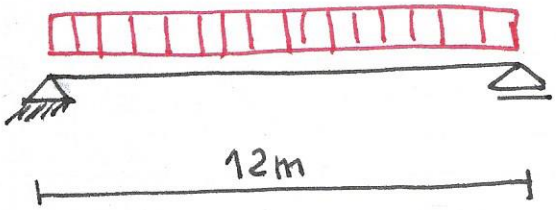
Verificar el perfil y determinar la flecha.

- Momento: $M = F.d = 1.000\ Kg \times 900\ cm$

$M = 900.000\ Kg\ cm$

- Tensión: $\sigma = \frac{M}{W} = \frac{900.000\ Kg\ cm}{2.880\ cm^3} = 312,50\ \frac{Kg}{cm^2} < \sigma_{adm}$

- Flecha: $f = \frac{F.l^3}{3.E.J} = \frac{1.000\ Kg\ (900\ cm)^3}{3.\ 2.100.000\ \frac{Kg}{cm^2}\ 57.680\ cm^4} = 2\ cm$



IPB 300

$J_x = 25170\ cm^4$

$W_x = 1.680\ cm^3$

$\sigma_{adm} = 1.600\ Kg/cm^2$

- Momento $M = \frac{q.l^2}{8} = \frac{200\ Kg/cm \times (1200\ cm)^2}{8} = 36.000.000\ Kg\ cm$

- Tensión $\sigma = \frac{M}{W} = \frac{36.000.000\ Kg\ cm}{1.680\ cm^3} = 21.428\ \frac{Kg}{cm^2} > \sigma_{adm}$

Dimensionado $W_{NEC} = \frac{M}{\sigma_{adm}} = \frac{36.000.000\ Kg\ cm}{1.600\ \frac{Kg}{cm^2}} = 22.500\ cm^3$

$W_{IPB\ 1000} = 12.890 < W_{NEC}$

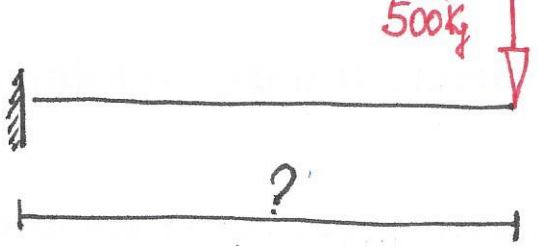
Tomo dos perfiles paralelos IPB 1.000

$\sigma = \frac{36.000.000\ Kg\ cm}{2 \times 12.890\ cm^3} = 1396,43\ \frac{Kg}{cm^2} < \sigma_{adm}$

- Flecha (Considero la mitad de la carga para c/u de los perfiles)

$f = \frac{5\ q\ l^4}{384\ E\ J_x} = \frac{5 \times 100\ Kg\ (1200\ cm)^4}{384\ cm\ 2.100.000\ \frac{Kg}{cm^2}\ 64.4700\ cm^4}$

$= 1,99\ cm$



IPN320

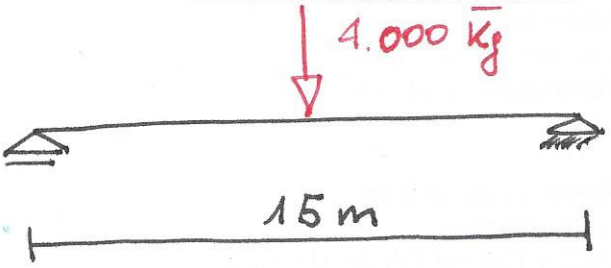
$J_x = 12510\ cm^4$

$W_x = 782\ cm^3$

$\sigma_{adm} = 1.500\ \frac{Kg}{cm^2}$

$$\sigma = \frac{M}{W} = \frac{F.l}{W} \rightarrow l_{max} = \frac{\sigma_{adm} \times W_x}{F}$$

$$l_{max} = \frac{1500 \times 782\ Kg\ cm^3}{500\ cm^2\ Kg} = 2.346\ cm - 23,46\ m$$



IPN 600

$J_x = 139.000\ cm^4$

$W_x = 4630\ cm^3$

$\sigma_{adm} = 1.800\ Kg/cm^2$

Momento: $M = 2.000\ Kg \times 750\ cm$

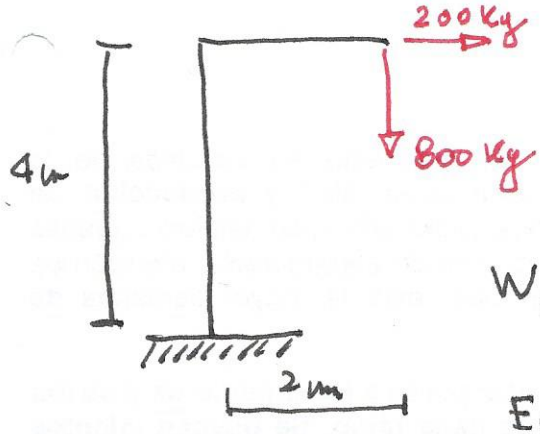
$= 1.500.000\ Kg\ cm$

TENSIÓN: $\sigma = \frac{M}{W_y} \leq \sigma_{adm}$ $\sigma = \frac{1.500.000\ Kg\ cm}{4630\ cm^3} = 323,94\ \frac{Kg}{cm^2} < \sigma_{adm}$

Flecha: $f = \frac{1}{48} \frac{F.l^3}{E J_x} = \frac{1}{48} \frac{4.000\ Kg\ (1500\ cm)^3}{2.100.000\ \frac{Kg}{cm^2}\ 139.000\ cm^4}$

$= 0,96\ cm$

DIMENSIONAR EL PERFIL $\sigma_{adm} = 1.400\ Kg/cm^2$



$M_{emp} = 800Kg \times 200\ cm + 200\ Kg \times 400\ cm$

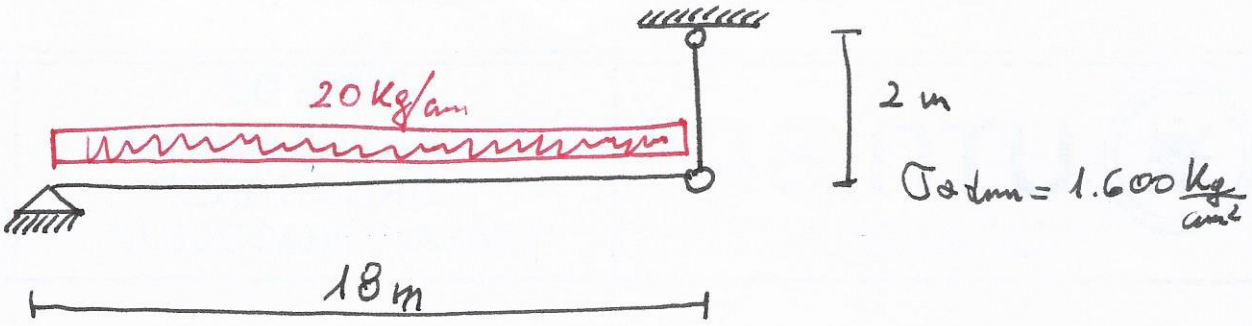
$= 240.000\ Kg\ cm$

$$\sigma = \frac{M}{W_y} \rightarrow W_{NEC} = \frac{M}{\sigma_{adm}}$$

$$W_{NEC} = \frac{240.000\ Kg\ cm}{1.400\ \frac{Kg}{cm^2}} = 171,43\ cm^3$$

Entrando en la tabla por $W_x \Rightarrow$ obtengo

$W = 214\ cm^3 \Rightarrow$ IPN 200



Dimensionar el perfil y el tensor que obra de apoyo movil, incluyendo para este, el peso propio del perfil

Momento $M = \frac{q \cdot l^2}{8} = \frac{20 \times (1800)^2}{8} = 8.100.000 \text{ Kg cm}$

Dimensionado

$\sigma = \frac{M}{W} \rightarrow W_{NEC} = \frac{M}{\sigma_{adm}} = \frac{8.100.000 \text{ Kg cm}}{1600 \text{ Kg/cm}^2} = 5.062,50 \text{ cm}^3$

No hay ningún IPN con ese W, entro a la tabla de IPB

$W_x (S_x)$

IPB

600 ← 5700 cm³

$\sigma = \frac{M}{W} = \frac{8.100.000 \text{ Kg cm}}{5700 \text{ cm}^3} = 1.421 \frac{\text{Kg}}{\text{cm}^2} < \sigma_{adm}$

Verifico la tensión

TENSOR

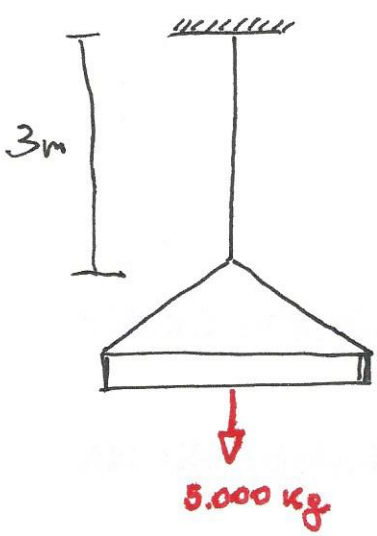
Carga $\frac{20 \frac{\text{Kg}}{\text{cm}} \times 1800 \text{ cm}}{2} = 18.000 \text{ Kg}$

Peso del perfil $212 \frac{\text{Kg}}{\text{m}}$

Carga $\frac{2,12 \frac{\text{Kg}}{\text{cm}} \times 1800 \text{ cm}}{2} = 1.908 \text{ Kg}$

19.908 Kg

Dimensiono $\sigma = \frac{F}{A} \quad A = \frac{F}{\sigma_{adm}} = \frac{19.908 \text{ Kg}}{1600 \frac{\text{Kg}}{\text{cm}^2}} = 12,44 \text{ cm}^2$

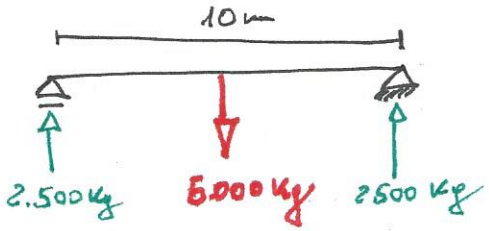


1) Dimensionar el perfil como viga.

2) " " cable incl. el peso del perfil.

$\sigma_{adm} = 1.400 \frac{kg}{cm^2}$

1)



① Determino el momento máximo.

$$M_{max} = 2.500\ kg \times 500\ cm = 1.250.000\ kg\,cm$$

$$\sigma = \frac{M}{W_x} \longrightarrow W_{x\,NEC} = \frac{M}{\sigma_{adm}} = \frac{1.250.000\ kg\,cm}{1400\ \frac{kg}{cm^2}} = 892,86\ cm^3$$

Busco en la tabla de IPN. el primer $W_x (S_x)$ que supere $893\ cm^3$

IPN 340 $\longrightarrow$ $W_x (S_x) = 923\ cm^3$

Determino la tensión de trabajo $\sigma = \frac{1.250.000\ kg\,cm}{923\ cm^3} = 1.354,28 \frac{kg}{cm^2} < \sigma_{adm}$

Peso del perfil $68 \frac{kg}{m}$ IPN 340

Peso total $68 \frac{kg}{m} \times 10\ m = 680\ kg$

② Cable: Peso total = $5.000\ kg + 680\ kg = 5.680\ kg$

$$\sigma = \frac{F}{A} \longrightarrow A_{NEC} = \frac{F}{\sigma_{adm}} = \frac{5.680\ kg}{1.400 \frac{kg}{cm^2}} = 4,06\ cm^2 = \pi \lambda^2$$

$$\lambda = \sqrt{4,06\ cm^2 / \pi} = \sqrt{1,2914} \Rightarrow \lambda = 1,1364 \quad \phi = 2,27\ cm$$

$$\Delta l = \frac{F \cdot l_0}{A \cdot E} = \frac{5.680\ kg \cdot 300\ cm}{4,06\ cm^2 \times 2.100.000 \frac{kg}{cm^2}} = 0,1999 \cong 0,2\ cm$$