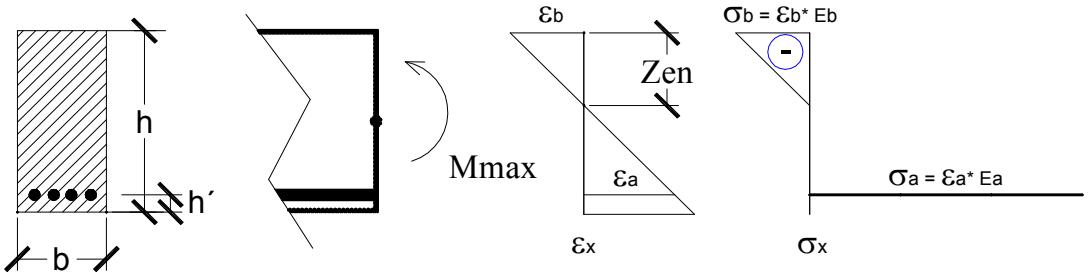
Calcular la carga por metro que soporrta una viga de hormigón armado, con una armadura de 4 Φ12 mm, considerando que el hormigón no trabaja a la tracción. Trazar los diagramas σ y ε de la sección analizada.

$\sigma_{adm\ b} \leq 94\ kg/cm^2$ (H°) **$Eb = 0{,}25 \times 10^6\ kg/cm^2$**

$\sigma_{adm\ a} \leq 2400\ kg/cm^2$ (ADN 420) **$Ea = 2{,}1 \times 10^6\ kg/cm^2$**



$E_b := .25 \cdot 10^6 \frac{kg}{cm^2}$ $E_a := 2.1 \cdot 10^6 \frac{kg}{cm^2}$ $F_a := 4 \frac{\pi \cdot (1.2cm)^2}{4}$ $F_a = 4.524 cm^2$

$\sigma_{admb} := 94 \frac{kg}{cm^2}$ $\sigma_{adma} := 2400 \frac{kg}{cm^2}$ $b := 20cm$ $h := 35cm$ $h' := 3cm$

$L := 4m$

$$\frac{\varepsilon_b}{z_{EN}} = \frac{\varepsilon_a}{h - h' - z_{EN}}$$

$$D = \frac{-\varepsilon_b \cdot E_b \cdot z_{EN} \cdot b}{2}$$

$$Z = \varepsilon_a \cdot E_a \cdot F_a$$

$$\frac{-\varepsilon_b \cdot E_b \cdot z_{EN} \cdot b}{2} + \frac{\varepsilon_b}{z_{EN}} \cdot (h - h' - z_{EN}) \cdot E_a \cdot F_a = 0 \text{ solve}, z_{EN} \rightarrow \begin{pmatrix} 9.289798946976797432cm \\ -13.089869420759011332cm \end{pmatrix}$$

$\varepsilon_b := \frac{\sigma_{admb}}{E_b}$ $\varepsilon_b = 3.76 \times 10^{-4}$ $z_{EN} := 9.289798946976797432cm$

$D := \frac{-\varepsilon_b \cdot E_b \cdot z_{EN} \cdot b}{2}$ $D = -8.732 \times 10^3\ kg$

$\varepsilon_a := \frac{\varepsilon_b}{z_{EN}} \cdot (h - h' - z_{EN})$ $\varepsilon_a = 9.192 \times 10^{-4}$ $\sigma_a := \varepsilon_a \cdot E_a$ $\sigma_a = 1.93 \times 10^3 \frac{kg}{cm^2}$

$Z := \varepsilon_a \cdot E_a \cdot F_a$ $Z = 8.732 \times 10^3\ kg$

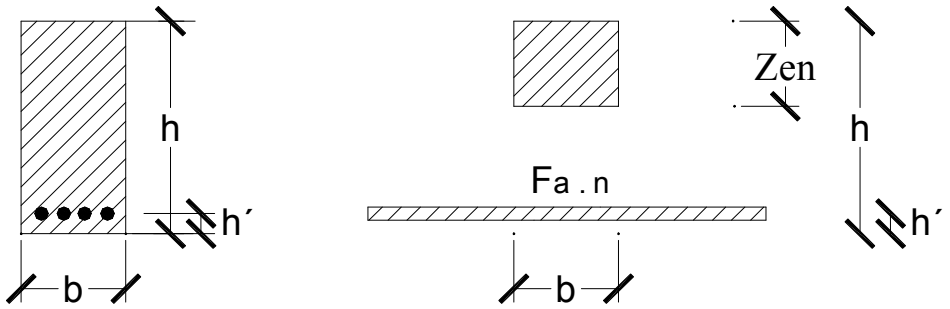
$$M_{max} := -D\cdot\left(h - h' - \frac{z_{EN}}{3}\right) \qquad M_{max} = 2.524\times 10^{3}\ m\cdot kg$$

$$M_{max} = \frac{q\cdot L^{2}}{8} \qquad q := \frac{M_{max}\cdot 8}{L^{2}} \qquad \boxed{q = 1.262\times 10^{3}\ \frac{kg}{m}}$$

Resolvemos aplicando la SECCION TRANSFORMADA

Transformamos la sección de acero en una equivalente de hormigón

$$n := \frac{E_a}{E_b} \qquad n = 8.4$$



Momento estático con respecto a la fibra superior

$$S_s = 20cm\,Z_{EN}\frac{Z_{EN}}{2} + F_a\cdot n\cdot(h - h')$$

$$S_s = \left(20cm\cdot Z_{EN} + F_a\cdot n\right)\cdot Z_{EN}$$

$$20cm\,Z_{EN}\frac{Z_{EN}}{2} + F_a\cdot n\cdot(h - h') - \left(20cm\cdot Z_{EN} + F_a\cdot n\right)\cdot Z_{EN} = 0\ \text{solve}, Z_{EN} \rightarrow \begin{pmatrix} 9.289798946976797432cm \\ -13.089869420759011332cm \end{pmatrix}$$

$$\boxed{Z_{EN} := 9.289798946976797432cm}$$

$$J_{EN} := \frac{b\cdot Z_{EN}^{3}}{3} + F_a\cdot n\cdot\left(h - h' - Z_{EN}\right)^{2} \qquad J_{EN} = 2.494\times 10^{-4}\ m^{4}$$

$$\sigma_{admb} = \frac{M_{Max}\cdot Z_{EN}}{J_{EN}}\ \text{solve}, M_{Max} \rightarrow 252396.37145615001957m\cdot kg$$

$$\boxed{M_{Max} := 252396.37145615001957m\cdot kg}$$

$$\sigma_A := \frac{M_{Max}\cdot\left(h - h' - Z_{EN}\right)}{J_{EN}}\cdot n \qquad \boxed{\sigma_A = 1.93\times 10^{3}\ \frac{kg}{cm^{2}}}$$