P2 Auxiliar 1 2009

Datos gemétricos de la viga

$h := 914 \cdot mm$ $L := 14 \cdot m$

$b := 305 \cdot mm$ $hft := 152mm$

Propiedades geométricas:

$Ac := 238100mm^2$

$yb := 402mm$

$yt := h - yb$

$Ic := 21.2 \cdot 10^9 mm^4$

$r := \sqrt{\frac{Ic}{Ac}}$ $r = 298.393 \cdot mm$

$Wt := \frac{Ic}{yt}$ $Wt = 4.141 \times 10^7 \cdot mm^3$

$Wb := \frac{Ic}{yb}$ $Wb = 5.274 \times 10^7 \cdot mm^3$

Materiales:

Hormigón: $fc := 40 \cdot MPa$

$Ec := 25GPa$ $\gamma c := 25 \cdot \frac{kN}{m^3}$

$\varepsilon cu := 0.003$

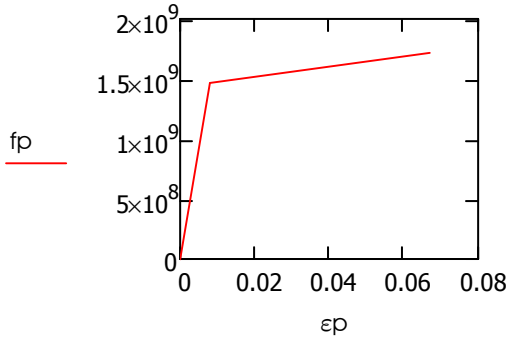
$$\beta 1 := \begin{cases} 0.85 & \text{if } fc \le 30MPa \\ 0.85 - 0.008 \cdot \left(\frac{fc}{MPa} - 30 \right) & \text{if } 30MPa \le fc \le 55MPa \\ 0.65 & \text{if } fc \ge 55MPa \end{cases} \qquad \beta 1 = 0.77$$

Cables: $fpu := 1720 \cdot MPa$ $fpy := 1470 \cdot MPa$

$\varepsilon pu := 0.067$ $\varepsilon py := 0.008$

$Ep := \frac{fpy}{\varepsilon py}$ $Ep = 1.838 \times 10^{5} \cdot MPa$

$\varepsilon p := \begin{pmatrix} 0 \\ \varepsilon py \\ \varepsilon pu \end{pmatrix}$ $fp := \begin{pmatrix} 0 \\ fpy \\ fpu \end{pmatrix}$



Tensado:

$Pi := 1700 \cdot kN$ $ex := 300 \cdot mm$

$R := 0.82$ $Ap := 600 \cdot mm^2$ $dp := yt + ex$

$Pe := R \cdot Pi$ $Pe = 1.394 \times 10^{3} \cdot kN$ $dp = 812 \cdot mm$

Cargas:

$qo := \gamma c \cdot Ac$ $qo = 5.952 \frac{kN}{m}$

$qd := 4 \frac{kN}{m}$

$ql := 12 \frac{kN}{m}$

$qu := 1.2 \cdot (qo + qd) + 1.6 \cdot ql$ $qu = 31.143 \frac{kN}{m}$

$Mu := \frac{qu \cdot L^2}{8}$ $Mu = 763.004 \cdot kN \cdot m$

Deformaciones

$c := 118mm$

$\varepsilon 1 := \frac{Pe}{Ap \cdot Ep}$ $\varepsilon 1 = 0.013$

$\varepsilon 2 := \frac{Pe}{Ac \cdot Ec} \cdot \left(1 + \frac{ex^2}{r^2}\right)$ $\varepsilon 2 = 4.709 \times 10^{-4}$

$\varepsilon 3 := \varepsilon cu \cdot \left(\frac{dp - c}{c}\right)$ $\varepsilon 3 = 0.018$

$\varepsilon ps := \varepsilon 1 + \varepsilon 2 + \varepsilon 3$

$mp := \frac{fpu - fpy}{\varepsilon pu - \varepsilon py}$ $np := fpy - mp \cdot \varepsilon py$

$fps := \begin{cases} (\varepsilon ps \cdot Ep) & \text{if } \varepsilon ps \le \varepsilon py \\ (mp \cdot \varepsilon ps + np) & \text{if } \varepsilon ps > \varepsilon py \end{cases}$ $fps = 1.566 \times 10^3 \cdot MPa$

$Ver1 := if(fps > fpu, \text{"fps>fpu modificar diseño cable"}, \text{"diseño cable OK"})$

$Ver1 = \text{"diseño cable OK"}$

$a := \frac{Ap \cdot fps}{0.85 \cdot fc \cdot b}$ $a = 90.633 \cdot mm$

$Ver2 := if(a > hft, \text{"viga T"}, \text{"viga rectangular"})$

$Ver2 = \text{"viga rectangular"}$

$Mn := Ap \cdot fps \cdot \left(dp - \frac{a}{2}\right)$ $Mn = 720.577\,kN \cdot m$

$c := \frac{a}{\beta 1}$ $c = 117.705 \cdot mm$

$Ver3 := if(0.9 \cdot Mn \ge Mu, \text{"diseño Ok"}, \text{"modificar diseño"})$

$Ver3 = \text{"modificar diseño"}$

$MPa := 10^6 \cdot Pa$

$kN := 10^3 \cdot N$