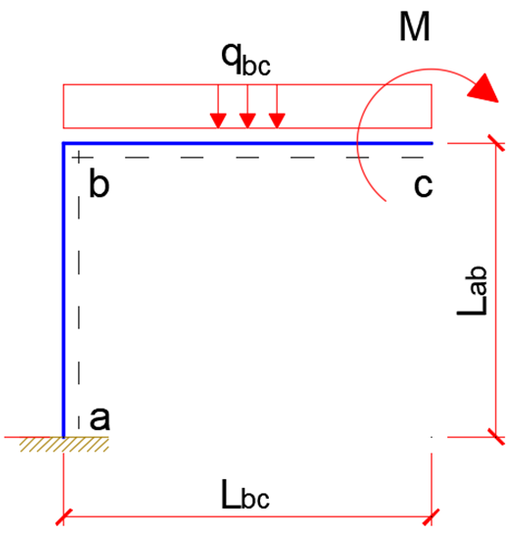
B2T4N0616B

- Calcular o deslocamento vertical do ponto "c".



$Lbc := 4,0$ m $qbc := 10,0$ kN/m

$Lab := 6,0$ m

$M := 30$ kNm

- Barra "bc": seção transversal retangular:

$b_bc := 0,20$ m $h_bc := 0,50$ m

- Barra "ab": seção transversal retangular:

$b_ab := 0,20$ m $h_ab := 0,20$ m

- Módulo de elasticidade e coef. de Poisson para todas as barras:

$E := 20 \cdot 10^{6}$ kN/m² $\nu := 0,2$

OBS. b_bc e b_ab são entrantes no plano do papel e h_bc e h_ab são assentes aos plano do papel.

Q01 - Qual o valor do deslocamento vertical do ponto "c" devido aos efeitos de esforço cortante [em "mm" com positivo para cima] ?
Q02 - Qual o valor do deslocamento vertical do ponto "c" devido aos efeitos de esforço axial [em "mm" com positivo para cima] ?
Q03 - Qual o valor do deslocamento vertical do ponto "c" devido aos efeitos de momento fletor [em "mm" com positivo para cima] ?

Efeitos de Momentos Fletores:

$G := \frac{E}{2 \cdot (1 + \nu)} = 8,3333 \cdot 10^{6}$

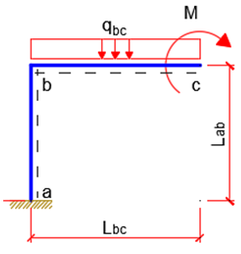
$A_bc := b_bc \cdot h_bc = 0,1$

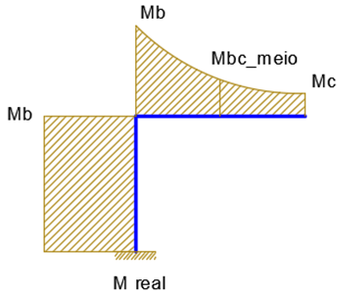
$A_ab := b_ab \cdot h_ab = 0,04$

$\chi := \frac{6}{5}$

$I_bc := \frac{b_bc \cdot h_bc^{3}}{12} = 0,0021$

$I_ab := \frac{b_ab \cdot h_ab^{3}}{12} = 0,0001$

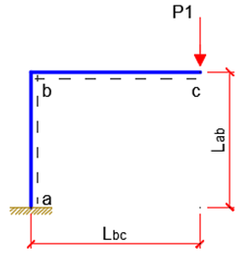


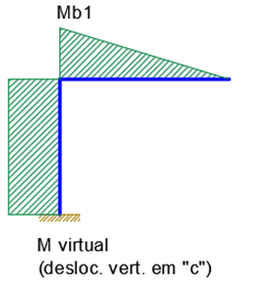


$Mb := -M - \frac{qbc \cdot Lbc^{2}}{2} = -110$

$Mc := -M = -30$

$Mbc_meio := \frac{Mb + Mc}{2} + \frac{qbc \cdot Lbc^{2}}{8} = -50$

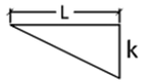




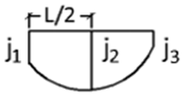
$P1 := 1$

$Mb1 := (-P1) \cdot Lbc = -4$

Barra "bc":



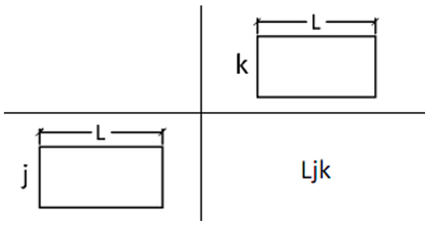
$k := Mb1 = -4$ $j2 := Mbc_meio$ $j3 := Mb$ $j1 := Mc$



1/6 Lk(2j2+j3)

$$mbc := \frac{1}{6} \cdot Lbc \cdot k \cdot (2 \cdot j2 + j3) \cdot \frac{1}{E \cdot I_bc} = 0,0134$$

Barra "ab":

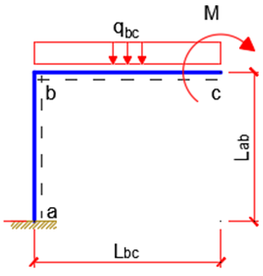


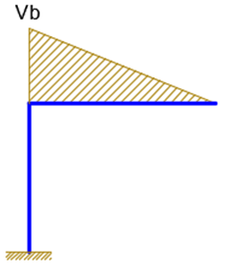
$k := Mb1$ $j := Mb$

$$mab := Lab \cdot j \cdot k \cdot \frac{1}{E \cdot I_ab} = 0,99$$

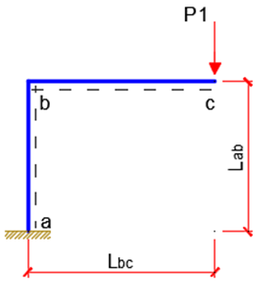
$\delta_hc_mom := -1000 \cdot (mbc + mab) = -1003,4$

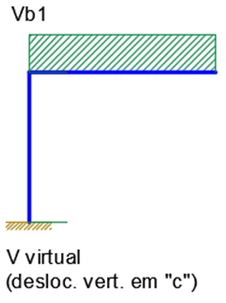
Efeitos de Esforços Cortantes:





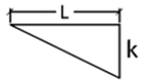
$Vb := qbc \cdot Lbc = 40$



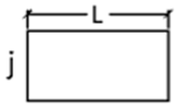


$Vb1 := P1 = 1$

Barra "bc":



$k := Vb1 = 1$ $j := Vb = 40$

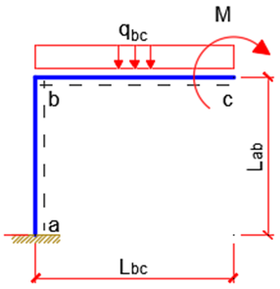


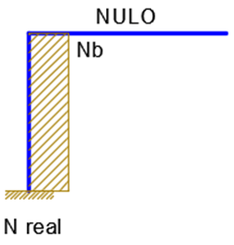
1/2 Ljk

$$vbc := \chi \cdot \frac{1}{2} \cdot Lab \cdot j \cdot k \cdot \frac{1}{G \cdot A_ab} = 0,0004320$$

$\delta_hc_cor := -1000 \cdot (vbc) = -0,432$

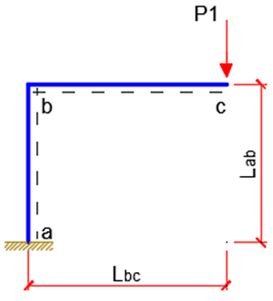
Efeitos de Esforços Axiais:

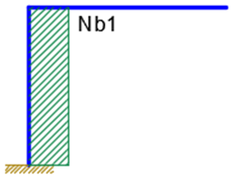




N real

$Nb := -qbc \cdot Lbc = -40$

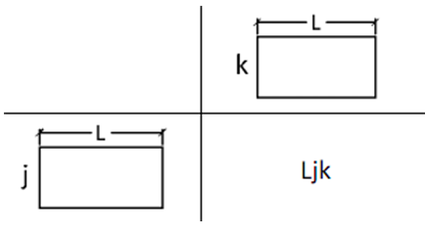




N virtual
(desloc. vert. em "c")

$Nb1 := -P1 = -1$

Barra "ab":



$k := Nb1$ $j := Nb$

$$nab := Lab \cdot j \cdot k \cdot \frac{1}{E \cdot A_ab} = 0,0003$$

$\delta_hc_axi := -1000 \cdot (nab) = -0,3$

$Q01 := \delta_hc_cor = -0,43200$
$Q02 := \delta_hc_axi = -0,30000$
$Q03 := \delta_hc_mom = -1003,4$

OBS : 1 m de deslocamento vertical já não pode ser considerado um "deslocamento pequeno" o que implica em alteração do posicionamento da carga e eventual invalidação da sobreposição de efeitos. Conclusão: as dimensões da seção transversal da barra "ab" precisam ser aumentadas de modo a garantir um momento fletor bem maior.
