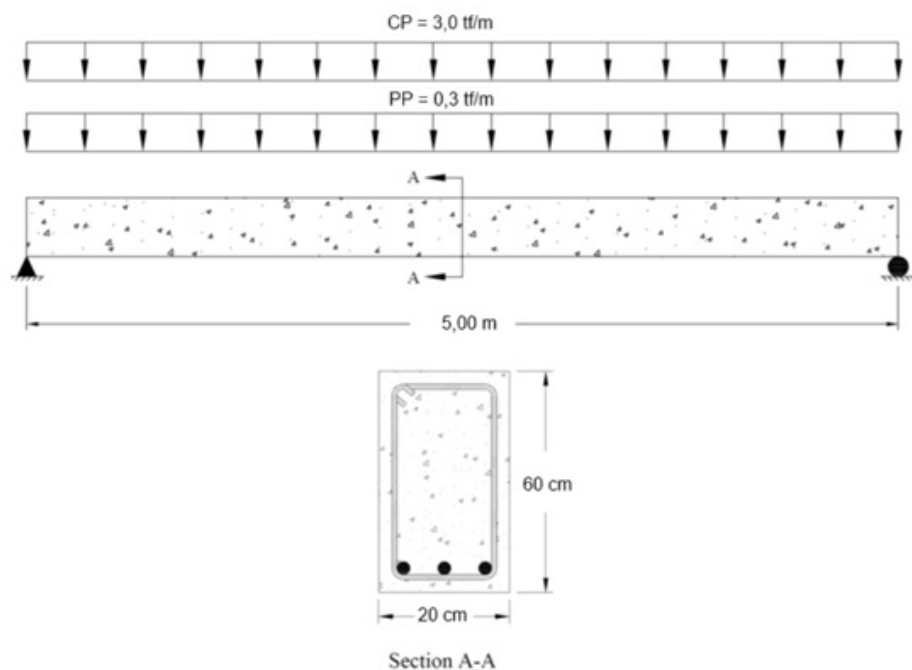


Vigas - Flexão Simples 4

FLEXÃO SIMPLES

Neste exemplo, será dimensionada a armadura longitudinal e transversal de uma viga submetida a Flexão Simples utilizando como base a Norma Cirsoc-2005, conforme dados abaixo:

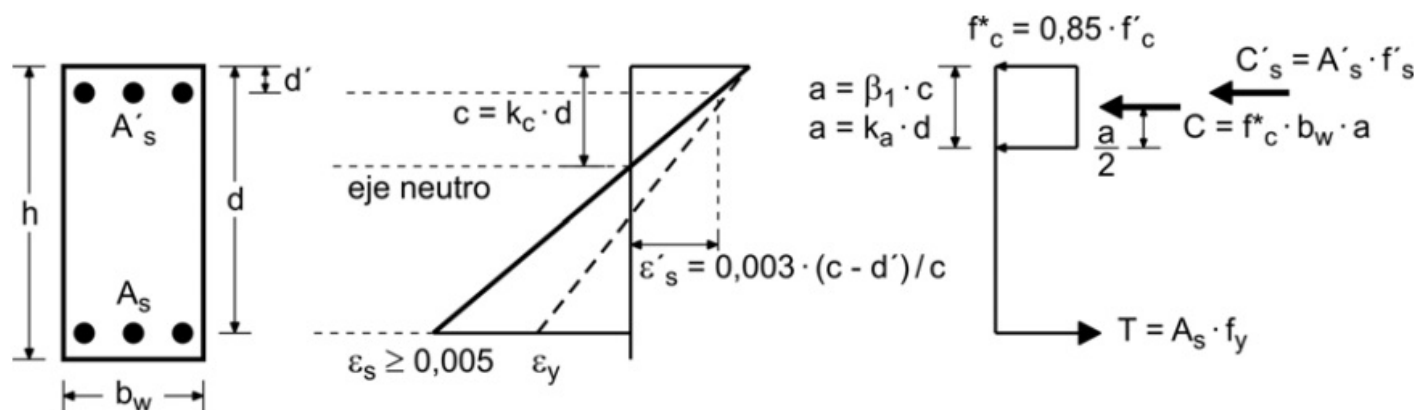


Concreto: H-25 / Aço: ADN420

bw: 20 cm / h: 60 cm

Mu:

TQS = 132,0 kN.m	Software B = 136,1 kN.m	Software C = 132,5 kN.m
------------------	-------------------------	-------------------------



Flexão:

$$M_n = \frac{Mu}{\phi} = \frac{132,00}{0,9} = \mathbf{151,22 \text{ kN.m}}$$

$$d = h - C_c - d_{be} - \frac{d_b}{2} = 60 - 2 - 0,6 - 0,8 = \mathbf{56,6 \text{ cm}}$$

$$m_n = \frac{M_n}{0,85 \cdot f'_c \cdot b_w \cdot d^2} = \frac{151,22}{0,85 \cdot 25000 \cdot 0,20 \cdot 0,566^2} = \mathbf{0,1077}$$

$$k_a = 1 - (1 - 2 \cdot m_n)^{\frac{1}{2}} = 1 - (1 - 2 \cdot 0,1077)^{\frac{1}{2}} = \mathbf{0,1176}$$

$$x = \frac{k_a \cdot d}{0,85} = \mathbf{7,61 \text{ cm}}$$

$$A_s = \frac{k_a \cdot f'_c \cdot b_w \cdot d}{f_y} = \frac{0,1176 \cdot 21,25 \cdot 20 \cdot 56,6}{420} = \mathbf{6,54 \text{ cm}^2}$$

$$A_s \geq A_{s,min}$$

$$A_{s1,min} = \frac{0,25 \cdot \sqrt{f'_c}}{f_y} \cdot b_w \cdot d = \frac{0,25 \cdot \sqrt{25}}{420} \cdot 20 \cdot 56,6 = \mathbf{3,36 \text{ cm}^2}$$

$$A_{s2,min} = \frac{1,4 \cdot b_w \cdot d}{f_y} = \frac{1,4 \cdot 20 \cdot 56,6}{420} = \mathbf{3,65 \text{ cm}^2}$$

$$A_{s,req} = A_s \cdot 1,33 = \mathbf{8,98 \text{ cm}^2}$$

TQS = 6,54 cm ²	Software B = 6,66 cm ²	Software C = 6,36 cm ²
----------------------------	-----------------------------------	-----------------------------------

$$8,04 \text{ cm}^2 \geq 6,54 \text{ cm}^2 \rightarrow \mathbf{OK!!}$$

$$4\phi 16 \text{ mm} \rightarrow \mathbf{8,04 \text{ cm}^2}$$

$$\phi M_n (159,94 \text{ KN.m}) \geq Mu (136,10 \text{ KN.m}) \rightarrow \mathbf{OK!!}$$

Cortante:

TQS	Software B	Software C
Vu = 11,57 t	Vu = 11,09 t	Vu = 11,53 t
Vu,design = 8,48 t	Vu,design = 8,46 t	Vu,design = 8,40 t

$$\beta_w = \frac{A_s}{b_w \cdot d}$$

$$V_n = V_c + V_s$$

$$V_u = \mathbf{11,57 \text{ t}}$$

$$V_{u,design} = \mathbf{8,48 \text{ t}}$$

$$V_c = \left(1 + \frac{N_u}{14 \cdot A_g}\right) \sqrt{f'_c} \cdot \frac{1}{6} \cdot b_w \cdot d = \left(1 + \frac{0}{14 \cdot 0,12}\right) \sqrt{25} \cdot \frac{1}{6} \cdot 2 \cdot 5,67 = 9,45 \text{ t}$$

$$V_{c,lim} = 0,3 \cdot \sqrt{f'_c} \cdot b_w \cdot d \times \sqrt{1 + \frac{0,3 \cdot N_u}{A_g}} = 23,01 \text{ t}$$

$$V_c \leq V_{c,lim} \rightarrow OK!!$$

$$V_n = \frac{V_{u,design}}{\phi_{0,75}} = V_c + V_s \rightarrow V_s = 1,85 \text{ t} \rightarrow V_n = 11,31 \text{ t}$$

$$V_{s,lim} = \frac{2}{3} \cdot \sqrt{f'_c} \cdot b_w \cdot d = 51,13 \text{ t}$$

$$\phi_{0,75} \rightarrow \phi V_n \geq V_u \rightarrow 8,48 \geq 8,48 \rightarrow OK!!$$

Área de Aço:

$$A_v = \frac{V_s \cdot s}{f_{yt} \cdot d} = \frac{1,85 \cdot 100}{4,2 \cdot 56,7} = 0,78 \text{ cm}^2/\text{m}$$

$$A_{v,min} = \frac{1}{16} \cdot \sqrt{f'_c} \cdot \frac{b_w \cdot s}{f_{yt}} \geq 0,33 \cdot \frac{b_w \cdot s}{f_{yt}} = 1,55 \text{ cm}^2/\text{m}$$

$$A_v \geq A_{v,min} \rightarrow 0,78 \leq 1,55 \rightarrow \text{Adotado } A_{v,min}!!$$

Espaçamento:

$$s \leq s_{max} \rightarrow s_{max} = \text{menor valor entre } s_1 \text{ e } s_2$$

$$s_1 = \frac{d}{2} = 28,3 \text{ cm ou } s_2 = 400 \text{ mm} \rightarrow \text{Adotado: } 28 \text{ cm!}$$

$$\phi_t = 6 \text{ mm} \rightarrow A_v = 2,00 \text{ cm}^2/\text{m} \rightarrow \phi 6 \text{ c/ } 28 \text{ cm}$$

$$\phi_t = 6 \text{ mm} \rightarrow A_v = 2,00 \text{ cm}^2/\text{m} \rightarrow \phi 6 \text{ c/ } 28 \text{ cm}$$

$$\phi V_n (10,66 \text{ t}) \geq V_u (8,48 \text{ t}) \rightarrow OK!!$$