B1T5TRPERU

Aço AR 350 $f_y = 35 kN/cm^2$ $f_u = 45 kN/cm^2$

$b = 10,16 cm$ $t_w = 0,813 cm$ $b_f = 4,37 cm$ $t_f = 0,75 cm$

$d = 12,5 mm$

$d_{pad} = 12,5 mm + 3,5 mm = 16 mm$

→ ÁREA BRUTA DA SEÇÃO TRANSVERSAL:

$$A_g = b \times t_w + 2 (b_f - t_w) \times t_f$$

$$A_g = 10,16 cm \times 0,813 cm + 2(4,37 cm - 0,813 cm) \times 0,75 cm$$

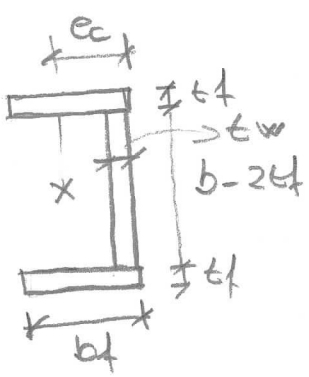
$$A_g = 13,596 cm^2$$

→ ÁREA LÍQUIDA DA SEÇÃO TRANSVERSAL:

$$A_n = A_g - 3 \times d_{pad} \times t_w$$

$$A_n = 13,596 cm^2 - 3 \times 1,6 cm \times 0,813 cm = \underline{9,6936 cm^2} \quad \boxed{Q01}$$

→ Cálculo da excentricidade e_c:



$$e_c = \frac{2 b_f \times t_f \times b_f/2 + (b - 2t_f) t_w \times t_w/2}{2 b_f \times t_f + (b - 2t_f) t_w}$$

$$e_c = \frac{2 \times (4,37 cm)^2 \times 0,75 cm/2 + (10,16 cm - 2 \times 0,75 cm) \times (0,813 cm)^2/2}{2 \times 4,37 cm \times 0,75 cm + (10,16 cm - 2 \times 0,75 cm) \times 0,813 cm}$$

$$e_c = \underline{1,2640 cm} \quad \boxed{Q02}$$

→ Cálculo do Ct: $L_c = 3d = 3 \times 12,5\,mm = 3,75\,cm$

$$C_t = 1 - e_c/L_c = 1 - 1,264/3,75 = 0,66293$$

$C_t = 0,66293 \in [0,6; 0,9]$ ok! Q03

→ Cálculo de A_{gv}:

$$A_{gv} = 2 \times (2d + 3d) \times t_w$$

$$A_{gv} = 2 \times (5 \times 1,25\,cm) \times 0,813\,cm = 10,163\,cm^2$$ Q04

→ Cálculo de A_{nv}:

$$A_{nv} = A_{gv} - (1,5\,d_{pad} \times t_w) \times 2$$

$$A_{nv} = 10,163\,cm^2 - 2 \times 1,5 \times 1,6\,cm \times 0,813\,cm$$

$$A_{nv} = 6,2606\,cm^2$$ Q05

→ Cálculo de A_{nt}:

$$A_{nt} = [(2,5d + 2,5d) - 2\,d_{pad}] \times t_w$$

$$A_{nt} = [5 \times 1,25\,cm - 2 \times 1,6\,cm] \times 0,813\,cm = 2,4797\,cm^2$$ Q06

→ Força de Tração Resistente ESB:

$$N_{t,Rd\,ESB} = A_g \cdot f_y / \gamma_{a1}$$

$$= 13,596\,cm^2 \times 35\,kN/cm^2 / 1,1 = 432,6\,kN$$ Q07

→ Força de Tração Resistente RSL:

↳ A_e: área líquida efetiva:

$$A_e = C_t \cdot A_n = 0,66293 \times 9,6936\,cm^2 = 6,4262\,cm^2$$

$$N_{t'Rd_{RSC}} = \frac{A_e \cdot f_u}{\gamma_{a2}} = \frac{6{,}4262\,cm^2 \times 45\,kN/cm^2}{1{,}35}$$

$$= 214{,}21\,kN \quad \boxed{Q08}$$

→ FORÇA RESISTENTE AO CISALHAMENTO DE BLOCO:

$$N_{tRdcis1} = \frac{1}{\gamma_{a2}}(0{,}6\, f_u A_{nv} + C_{ts} f_u A_{nt})$$

$$= \frac{1}{1{,}35}\left(0{,}6 \times 45\frac{kN}{cm^2} \times 6{,}2606\,cm^2 + 1 \times \frac{45\,kN}{cm^2} \times 2{,}4797\,cm^2\right)$$

$$= 207{,}86\,kN$$

$$N_{tRdcis2} = \frac{1}{\gamma_{a2}}(0{,}6 f_y A_{gv} + C_{ts} f_u A_{nt})$$

$$= \frac{1}{1{,}35}\left(0{,}6 \times 35\frac{kN}{cm^2} \times 10{,}163\,cm^2 + 1 \times \frac{45\,kN}{cm^2} \times 2{,}4797\,cm^2\right)$$

$$= 240{,}75\,kN$$

N_{tRdcis} = mínimo(312,19 kN ; 332,43 kN)

$N_{tRdcis} = 207{,}86\,kN$ // $\boxed{Q09}$

$N_{tRdFINAL}$ = MÍNIMO(432,6 kN ; 214,21 kN ; 207,86 kN)

$N_{tRdFINAL} = 207{,}86\,kN$ // $\boxed{Q10}$

* A VERIFICAÇÃO DE CISALHAMENTO DE BLOCO É DETERMINANTE DA CAPACIDADE RESISTENTE;