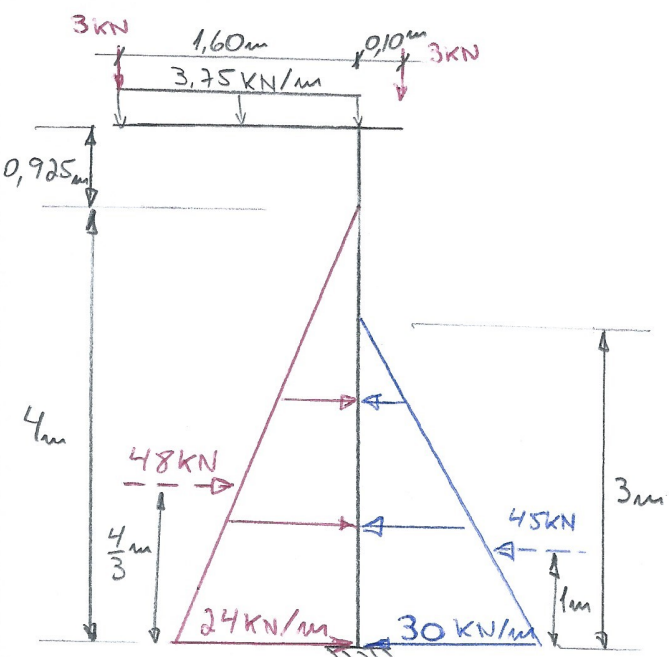


GABARITO EXERCÍCIO I (2016.2)

Esquema Estático (p/ 1m de Canal)



Carregamentos Permanentes:

- Empuxo Solo

$$E_{solo} = \gamma_{solo} \times K_a \times h \times 1,0m$$

$$E_{solo} = 18 \times \frac{1}{3} \times h = 6 \cdot h$$

- P.P. Laje Passarela

$$g_L = \gamma_{conc} \times h \times 1,0m$$

$$g_L = 25 \times 0,15 = 3,75 \text{ kN/m}$$

- P.P. Parede

$$g_P = \gamma_{conc} \times t \times 1,0m$$

$$g_P = 25 \times 0,2 = 5,0 \text{ kN/m}$$

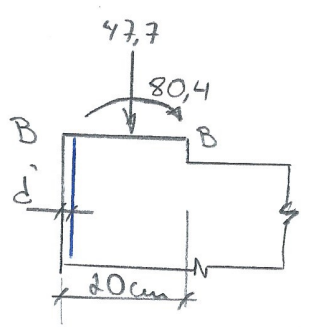
- Empuxo de Água

$$E_{\text{água}} = \gamma_{\text{água}} \times h \times 1,0m = 10 \times h$$

CASO A: Canal Vazio

$$M_d = \underbrace{1,4 \times 48 \times \frac{4}{3}}_{\text{Empuxo Solo}} + \underbrace{1,4 \times 3 \times 0,10}_{\text{Peitoril dir.}} - \underbrace{1,0 \times 3 \times 1,60}_{\text{Peitoril esq.}} - \underbrace{1,0 \times 3,75 \times \frac{1,60^2}{2}}_{\text{P.P. Laje}} = 80,4 \text{ kN.m}$$

$$N_d = \underbrace{1,4 \times 5,0 \times 4,925}_{\text{P.P. Parede}} + \underbrace{1,4 \times 3}_{\text{Peitoril dir.}} + \underbrace{1,0 \times 3}_{\text{Peitoril esq.}} + \underbrace{1,0 \times 3,75 \times 1,60}_{\text{P.P. Laje}} = 47,7 \text{ kN}$$



Estimativa \hat{d} : $\hat{d} = c + \frac{\phi}{2} = 3 + \frac{1,25}{2} = 3,63 \text{ cm} [\phi = 12^{\circ} \text{ mm}]$

$$d = h - \hat{d} = 20 - 3,63 = 16,37 \text{ cm}$$

$$M_{sd} = 80,4 + 47,7(0,1 - 0,0363) = 83,5 \text{ kN.m}$$

$$x = 1,25 \times 16,37 \cdot \left[1 - \sqrt{1 - \frac{8350}{0,425 \cdot 100 \cdot 16,37^2 \cdot \frac{2,5}{1,4}}} \right] = 4,75 \text{ cm} \quad (\text{Domínio 3})$$

$$e = \frac{M_d}{N_d} = 168,7 \text{ cm}$$

(Grande Excentricidade)

$$A_s = \frac{1}{43,5} \left[\frac{8350}{(16,37 - 0,4)} - 47,7 \right] \therefore A_s = 12,16 \text{ cm}^2/\text{m} \Rightarrow \phi 12^{\circ} \text{ C } 10$$

$$M_d = \underbrace{1,4 \cdot 45 \cdot 1,0}_{\text{Empuxo Água}} + \underbrace{1,4 \cdot 3 \cdot 1,60}_{\text{Peitoril Esg.}} + \underbrace{1,4 \cdot (3,75 + 5) \cdot \frac{1,60^2}{2}}_{\text{Laje (p.p. + carga Acid)}} - \underbrace{1,0 \cdot 3 \cdot 0,10}_{\text{Peitoril Dir.}} - \underbrace{1,0 \cdot 48 \cdot \frac{4}{3}}_{\text{Empuxo Solo}}$$

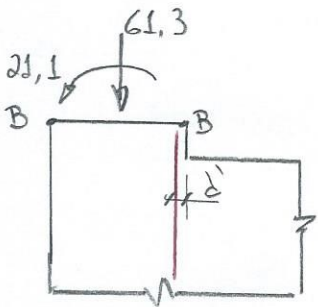
$$N_d = \underbrace{1,4 \cdot 5,0 \cdot 4,925}_{\text{p.p. Parede}} + \underbrace{1,4 \cdot 3}_{\text{Peitoril Esg.}} + \underbrace{1,0 \cdot 3}_{\text{Peitoril Dir.}} + \underbrace{1,4 \cdot (3,75 + 5) \cdot 1,60}_{\text{Laje (p.p. + carga Acid)}}$$

$$M_d = 21,1 \text{ kN.m}$$

Estimativa d' : $d' = c + \frac{\phi}{2} = 3 + \frac{1,0}{2} = 3,5 \text{ cm}$
 $[\phi = 10 \text{ mm}]$

$$N_d = 61,3 \text{ kN}$$

$$d = h - d' = 16,5 \text{ cm}$$



$$M_{sd} = 21,1 + 61,3(0,1 - 0,035) = 25,1 \text{ kN.m}$$

$$x = 1,25 \cdot 16,5 \left[1 - \sqrt{1 - \frac{2110}{0,425 \cdot 100 \cdot 16,5 \cdot \frac{2,5}{1,4}}} \right] = 1,3 \text{ cm}$$

$$e = \frac{21,1}{61,3} = 34,4 \text{ cm (Grande Excent.)}$$

$$\frac{x}{d} = 0,08 \Rightarrow \text{Domínio 2}$$

Detalhamento:

$$A_s = \frac{1}{43,5} \left[\frac{2110}{(16,5 - 0,4 \cdot 1,3)} - 61,3 \right] \therefore A_s = 2,23 \frac{\text{cm}^2}{\text{m}}$$

Armadura Mínima Flexão: $A_{s,min} = 0,15\% \cdot \underbrace{(20 \times 100)}_{A_c}$

$$A_{s,min} = 3,0 \text{ cm}^2 \Rightarrow \underline{\underline{\phi 8,0 \text{ C } 15}}$$

b) Desprezar a flexo-compressão resultaria em A_s maiores e, portanto, a um dimensionamento antieconômico. Além disso, poderia levar a uma interpretação equivocada do domínio no qual ocorrem os ELU's devido ao cálculo errado da posição da Linha Neutra (x).

$l_b = \text{Comprimento de ancoragem}$

$\phi 12^5 \rightarrow l_b \cong 50 \text{ cm}$

$\phi 8,0 \rightarrow l_b \cong 30 \text{ cm}$

