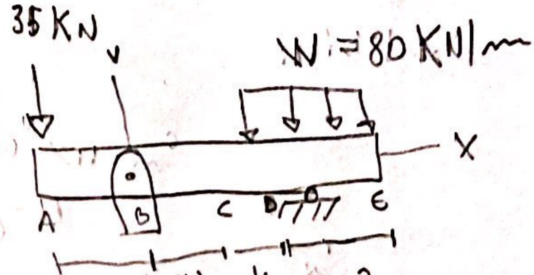
João Eduardo A. desbrots — Prova mec 3 — 03109



• $R_D = 407,5 KN$
• $R_B = 112,5 KN$

1- a) $P = 35 KN$ $E = 200 GPa$ ou $2 \times 10^8 KN/m^2$

$I_z = 351 \cdot 10^6 mm^4$ ou $3,51 \times 10^{-4} m^4$

• Fixo em B → $V_A = \frac{PL^3}{3EI}$ → Tabela.

Cargas em AB?

↳ $V_A = -\frac{PL^3}{3E.I_z}$ → $V_A = \frac{35 KN \cdot (4 m)^3}{3 \times (7.02 \times 10^4 KN \cdot m^2)} = -0,0106363$ (I)

$L = 8 m$ $M = 35 \times 4$

$\theta_B = \frac{ML}{3EI}$: $\frac{(35 \times 4) \cdot 8}{3 \cdot (7,02 \times 10^4)} = 0,0053181 rad$ → $V_A = -4(0,0053181 rad)$

↳ $V_A = -0,0212726 m$ (II)

(Cargas dist (Entre C e D))

$\theta_B = \frac{Wa^2}{24LEI}(2L^2 - a^2) = \frac{(80) \cdot (4)^2}{24 \cdot 8 \cdot (7,02 \cdot 10^4)} \cdot (2 \cdot (8)^2 - 4^2) = 0,0106363 rad$

↳ $V_A = (4 m) \cdot (0,016363) = 0,0425451 m$ (III)

(Defle A rot em B) carga Entre D e E)

$\theta_B = \frac{ML}{6EI}$: $\frac{160 \cdot (8)}{6 \cdot (7,02 \cdot 10^4)} = 0,0030389 rad$

↳ $V_A = -4(0,0030389 rad) = -0,0121557 m$ (IV)

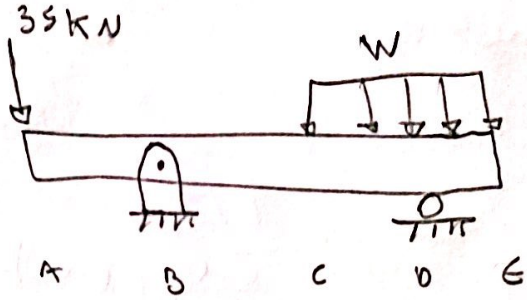
↳ O Deslocamento total vai ser a soma das deflexões : (I, II, III e IV)

$V_A = -0,016363 - 0,0212726 + 0,0425451 - 0,0121557$

↳ $V_A = -0,0015195$ → Logo, o deslocamento vertical em A será 1,5195 mm para baixo

b)

- $W = 80\ KN/m$
- $J_z = 3{,}51 \times 10^{-4}\ m^4$
- $E = 200\ GPa$ ou $2 \times 10^{8}\ N/m^2$
- Rotação em D

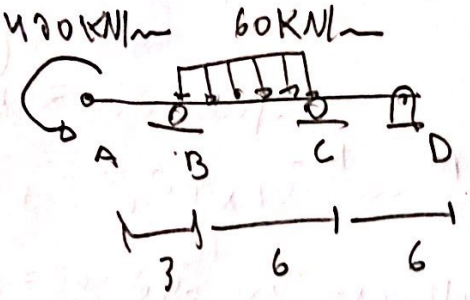


$$\to \theta D_{DE} = \frac{PL^3}{6EI} = \frac{80 \times 2 \times 2^3}{6 \times 3{,}51 \times 10^{-4} \times 2 \times 10^{8}} = 3{,}038936 \times 10^{-3}$$

$$\theta D_{CD} = \frac{3PL^3}{128EI} = \frac{3 \times 80 \times 4 \times 4^3}{128 \times 3{,}51 \times 10^{-4} \times 2 \times 10^{8}} = 6{,}837606 \times 10^{-3}$$

$$\theta D = \theta D_{DE} - \theta D_{CD} = -3{,}79867 \times 10^{-3}$$

2)



↳ Eqs de equilíbrio:

↳

$\Sigma F_y = 0 \Rightarrow R_B + R_C + R_D = -60 \cdot 6 = 0 \rightarrow R_C = 360 - R_D - R_B$ (I)

$\Sigma M_A = 0 \Rightarrow 420 + R_B \cdot 3 + R_C \cdot 9 + R_D \cdot 15 - 60 \cdot 6 \cdot 6 = 0$

$3R_B = -420 + 2160 - 15R_D - 9R_C$

$R_B = 580 - 5R_D - 3R_C$ (II)

(I) em (II):

$R_B = 580 - 5R_D - 3(360 - R_D - R_B) = 580 - 5R_D - 1080 + 3R_D + 3R_B$

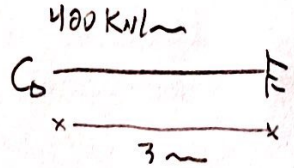
$R_B - 3R_B = -500 - 2R_D \Rightarrow \underline{R_B = 250 + R_D}$

↳ $R_C = 360 - R_D - (250 + R_D) \Rightarrow \underline{R_C = 110 - 2R_D}$

↳ C. Contorno:

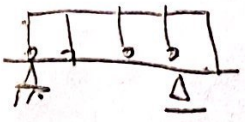
- $V(D) = 0$;
- $V(B) = 0$;
- $V(C) = 0$;

AB:



$V(A) = -\frac{420 \cdot 3^2}{2EI}$

BC:



$V = \frac{5 \cdot 60 \cdot 6^4}{384 \cdot 2EI}$

Usando o método das forças:

CO: