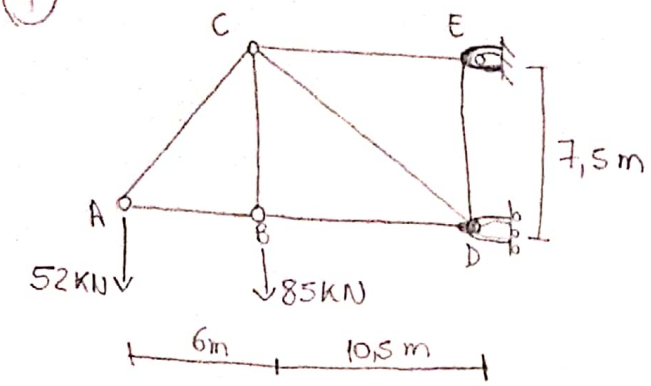
AB2 P2 Mecânica 3

Aluna: Beatriz da Silva Lima

Data: 24/09/21 Nº de matrícula: 17212164

①

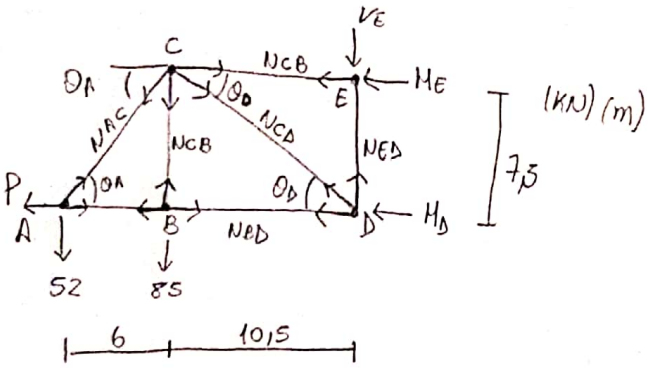


Dados: $A = 0,0016 m^2$

$E = 200 \cdot 10^6 \ KN/m^2$

$EA = 3,2 \cdot 10^5 \ KN$

- Pelo Método dos nós temos:



$\theta_A = \text{arctg}\left(\frac{7,5}{6}\right) \Rightarrow \theta_A = 0,896$

$\theta_D = \text{arctg}\left(\frac{7,5}{10,5}\right) \Rightarrow \theta_D = 0,62$

ΣF_{HA}

$N_{AB} - P + N_{AC} \cdot \cos\theta_A = 0$

ΣF_{VA}

$-52 + N_{AC} \cdot \text{Sen}\,\theta_A = 0$

ΣF_{HB}

$-N_{AB} + N_{BD} = 0$

ΣF_{VB}

$N_{CB} - 85 = 0 \Rightarrow N_{CB} = 85$

ΣF_{HC}

$-N_{AB} \cdot \cos\theta_A + N_{CE} + N_{CD} \cdot \cos\theta_D$

ΣF_{VC}

$-N_{CB} - N_{AC} \cdot \text{Sen}\,\theta_A - N_{CD} \cdot \text{Sen}\,\theta_D = 0$

ΣF_{HD}

$-N_{BD} - N_{CD} \cdot \cos\theta_D - H_B = 0$

ΣF_{VD}

$N_{ED} + N_{CD} \cdot \text{Sen}\,\theta_D = 0$

ΣF_{HE}

$-H_E - N_{CB} = 0$

ΣF_{VE}

$-V_E - N_{ED} = 0$

① Continuação

Portanto,

$H_E = 233,4\ kN\ (\rightarrow)$

$V_E = 137\ kN\ (\uparrow)$

$M_D = P + 233,4\ (\leftarrow)$

Trecho	N (kN)	$\partial N/\partial P$	N (p/p=0)	L (m) - Comprimento
AB	$-P - 41,6$	-1	$-41,6$	6
AC	66,5925	0	66,5925	9,6
CB	85	0	85,0	7,5
CE	233,4	0	233,4	10,5
CD	$-235,7037$	0	$-235,7037$	12,9
BD	$-P - 41,6$	-1	$-41,6$	10,5
ED	137	0	137	7,5

Pelo Teorema de Castigliano:

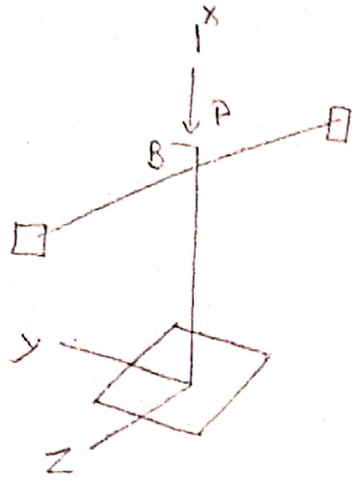
$$\Delta_A = \frac{1}{AE} \cdot \Sigma N \cdot \frac{\partial N}{\partial P} \cdot L$$

$$\Delta_A = \frac{1}{AE}\left(N_{AB} \cdot \frac{\partial N_{AB}}{\partial P} \cdot L_{AB} + N_{BD} \cdot \frac{\partial N_{BD}}{\partial P} \cdot L_{BD}\right)$$

$$\Delta_A = \frac{1}{3,2 \cdot 10^5}\left((-41,6).(-1).(6) + (-41,6).(-1).(10,5)\right)$$

$$\Delta_A = 0,002145\ m$$

②



Dados: $\sigma_{adm} = 250\ MPa$

$E = 200\ GPa = 200 \cdot 10^9\ Pa$

$I_z = 128 \cdot 10^6\ mm^4 = 1{,}28 \cdot 10^{-4}\ m^4$

$I_y = 18{,}4 \cdot 10^6\ mm = 1{,}84 \cdot 10^{-5}\ m^4$

$I_z = 130\ mm = 0{,}13\ m$

$n_F = 2$

- P/o plano xy temos $K = 2$

$$P_{cr} = \frac{\pi^2 \cdot E \cdot I_z}{(K \cdot L)_z^2}$$

$$P_{cr} = \frac{\pi^2 \cdot 200 \cdot 10^9 \cdot 1{,}28 \cdot 10^{-4}}{(2 \cdot 9)^2}$$

$$P_{cr} = 779820{,}59\ N$$

- P/o plano xz e $K = 0{,}7$ temos:

$$P_{cr} = \frac{\pi^2 \cdot E \cdot I_y}{(K \cdot L)_y^2}$$

$$P_{cr} = \frac{\pi^2 \cdot 200 \cdot 10^9 \cdot 1{,}84 \cdot 10^{-5}}{(9 \cdot 0{,}7)^2}$$

$$P_{cr} = 919095{,}59\ N$$

Sabendo que P_{cr} tem que ser o menor dos dois então

$$P_{cr} = 779820{,}59\ N$$

- Tensão crítica

$$\sigma_{cr} = \frac{\pi^2 \cdot E}{(KL/r_z)^2}$$

$$\sigma_{cr} = \frac{\pi^2 \cdot 200 \cdot 10^9}{\left(\frac{2 \cdot 9}{0{,}13}\right)^2}$$

$$\sigma_{cr} = 102968687{,}89\ Pa$$

$$\sigma_{cr} = 102{,}96\ MPa$$

Sendo $\sigma_{adm} = 250\ MPa$ temos $\sigma_{adm} > \sigma_{crítico}$

$$\cdot\ \sigma \leq \frac{\sigma_{crítico}}{n_F}$$

$$\frac{P}{A} \leq \frac{P_{cr}}{A \cdot n_F}$$

$$P \leq \frac{779820{,}59}{2}$$

$$P \leq 389910{,}29\ N$$

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