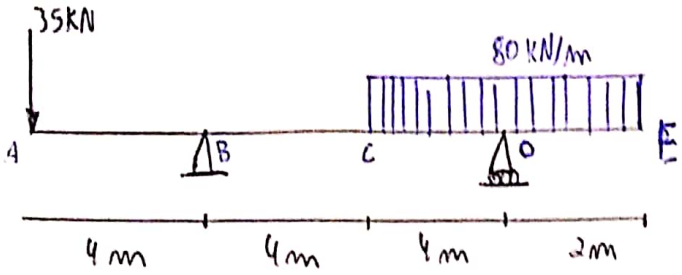
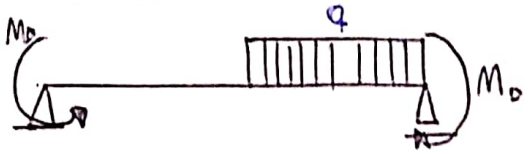
Paulo Henrique Laurindo Santos

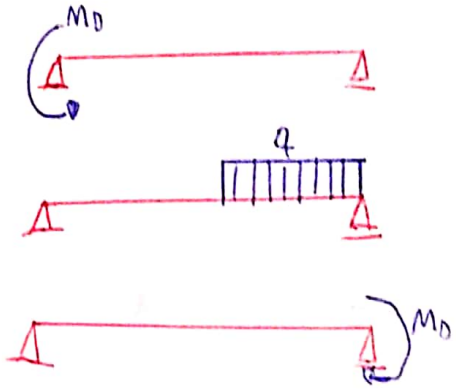
1.



$\theta_D = \theta_{D1} + \theta_{D2} + \theta_{D3}$



Separamos em 3 casos:



$M_B = 35.4$

$M_D = 80.2.1$

$q = 80 kN/m$

$$\theta_{D1} = \frac{M_B \cdot 8}{6 \cdot E \cdot I_z} = 0{,}0026 \text{ rad}$$

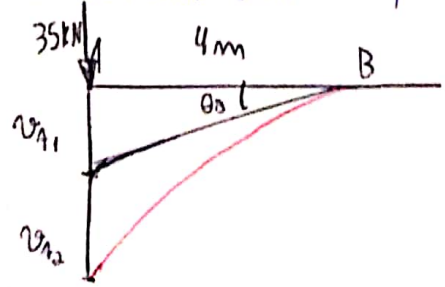
$$\theta_{D2} = -\frac{3 \cdot 80 \cdot 8^3}{128 \cdot E \cdot I_z} = -0{,}01367 \text{ rad}$$

$$\theta_{D3} = \frac{M_d \cdot 8}{3 \cdot E \cdot I_z} = 0{,}00607 \text{ rad}$$

Então através do método da superposição:

$\theta_D = -0{,}005 \text{ rad}$

O deslocamento em A pode ser visto como:



onde $v_{A1} = \theta_D \cdot 4$

e v_{A2} é o deslocamento causado pela carga concentrada

1.

$$\theta_B = \theta_{B_1} + \theta_{B_2} + \theta_{B_3}$$

$$\theta_{B_1} = -\frac{M_B \cdot 8}{3.E.I_z} = -0,005318 \text{ rad}$$

$$\theta_{B_2} = -\frac{M_d \cdot 8}{6.E.I_z} = -0,00303 \text{ rad}$$

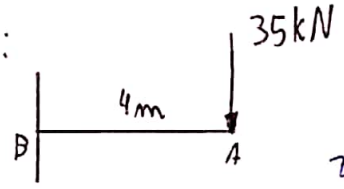
$$\theta_{B_3} = +\frac{7.q.8^3}{384.E.I_z} = +0,01063 \text{ rad}$$

$$\theta_B = +0,0023 \text{ rad}$$

$$v_A = v_{A1} + v_{A2}$$

$$v_{A1} = \theta_B \cdot 4 = 0,00911 \text{ m}$$

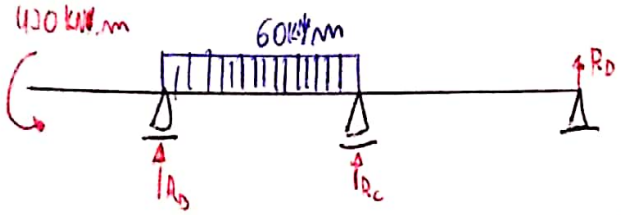
v_{A2}:



$$v_{A2} = -\frac{35 \cdot 4^3}{3.E.I_z} = -0,01063$$

$$v_A = 0,00911 - 0,01063 = -0,00151 \text{ m} \quad \text{ou} \quad 1,51 \text{ mm para baixo}$$

2.



Tomando R_D como redundante:

$\sum F_y = 0 \therefore R_B + R_C + R_D - 360 = 0 \therefore R_B + R_C = 360 - R_D$

$\sum M_A = 0 \therefore 420 + R_D \cdot 3 - 360 \cdot 6 + R_C \cdot 9 + R_D \cdot 15 = 0 \therefore R_B \cdot 3 + R_C \cdot 9 = -420 + 360 \cdot 6 - R_D \cdot 15$

$\delta_D = 0$

$\delta_D = \theta_C \cdot 6 + \frac{R_D \cdot 6^3}{3EI}$

$\theta_C = \theta_{C1} + \theta_{C2}$

$\theta_{C1} = \frac{60 \cdot 6^3}{24 \cdot 2EI} = \frac{270}{EI}$

$\theta_{C2} = -\frac{420 \cdot 6}{12EI} = -\frac{210}{EI}$

$\theta_C = \frac{60}{EI}$

$$\delta_D = \frac{360}{EI} + \frac{R_D \cdot 6^3}{3EI} = 0 \quad \therefore \quad R_D = -5\,kN$$

$$\left.\begin{aligned} R_B + R_C &= 365 \\ 3R_B + 9R_C &= -420 + 2160 + 75 = 1815 \end{aligned}\right\} \quad \begin{aligned} R_B &= 245\,kN \\ R_C &= 120\,kN \end{aligned}$$