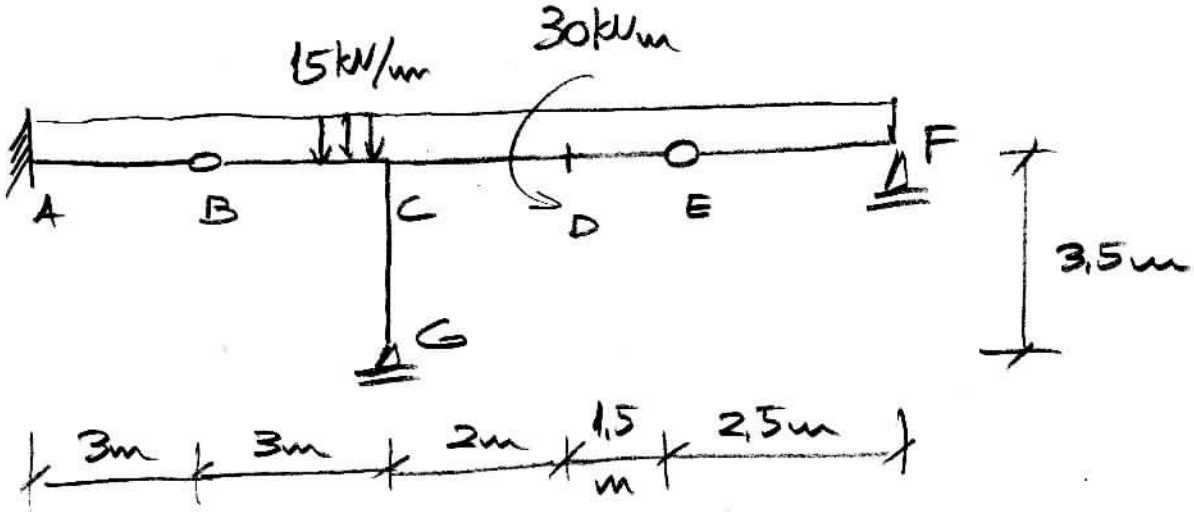
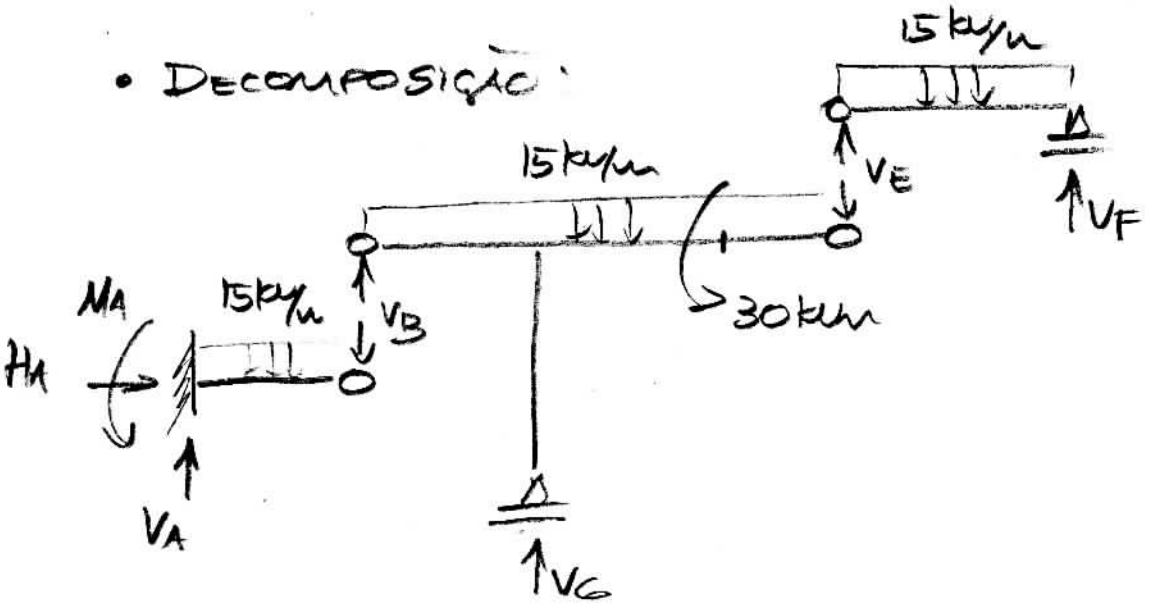
TE1-5.3



- DECOMPOSIÇÃO:



TRECHO EF:

$\circlearrowright_{+} \sum M_E^{EF} = 0 \quad V_F \times 2{,}5m - 15kN/m \times \frac{(2{,}5m)^2}{2} = 0 \quad V_F = 18{,}75kN \uparrow$

POR SIMETRIA $V_E = V_F = 18{,}75kN \uparrow$

TRECHO BCDEG:

$\circlearrowright_{+} \sum M_B = 0 \quad V_G \times 3m + 30kNm - 18{,}75kN \times 6{,}5m - 15\frac{kN}{m} \times \frac{(6{,}5m)^2}{2} = 0$

$V_G = \frac{1}{3}(-30 + 121{,}875 + 15 \times 21{,}125) = 136{,}25kN \uparrow$

$\Sigma F_V = 0 \uparrow\oplus \quad V_B - 15\,kN/m \times 6{,}5\,m - 18{,}75\,kN + 136{,}25\,kN = 0$

$V_B = 15 \times 6{,}5 + 18{,}75 - 136{,}25 = \underline{-20\,kN} \downarrow$

TRECHO AB

$M_A = -15\,kN/m \times (3\,m)^2/2 + 20\,kN \times 3\,m = \underline{-7{,}5\,kN\,m}$ ↺

$V_A = +15\,kN/m \times 3\,m - 20\,kN = \underline{25\,kN} \uparrow$

$\Sigma F_H = 0 \rightarrow\oplus \quad H_A = 0$

(a) $V_A = 25\,kN \uparrow \quad H_A = 0 \quad M_A = 7{,}5\,kN\,m$ ↺

$V_G = 136{,}25\,kN \uparrow \quad V_F = 18{,}75\,kN \uparrow$

(b) $M_{BC}(x_1) = -20 \times x_1 - 15 x_1^2/2 = -20x_1 - 7{,}5x_1^2$

$M_{DE}(x_2) = ?$

$M_D^{DIR} = -20 \times 5 - 15 \times 5^2/2 + 136{,}25 \times 2 - 30 = -45\,kN\,m$ ↺

$Q_D^{DIR} = -20 - 15 \times 5 + 136{,}25 = +41{,}25\,kN \uparrow$

$M_{DE}(x_2) = -45 + 41{,}25 x_2 - 15 \times x_2^2/2$

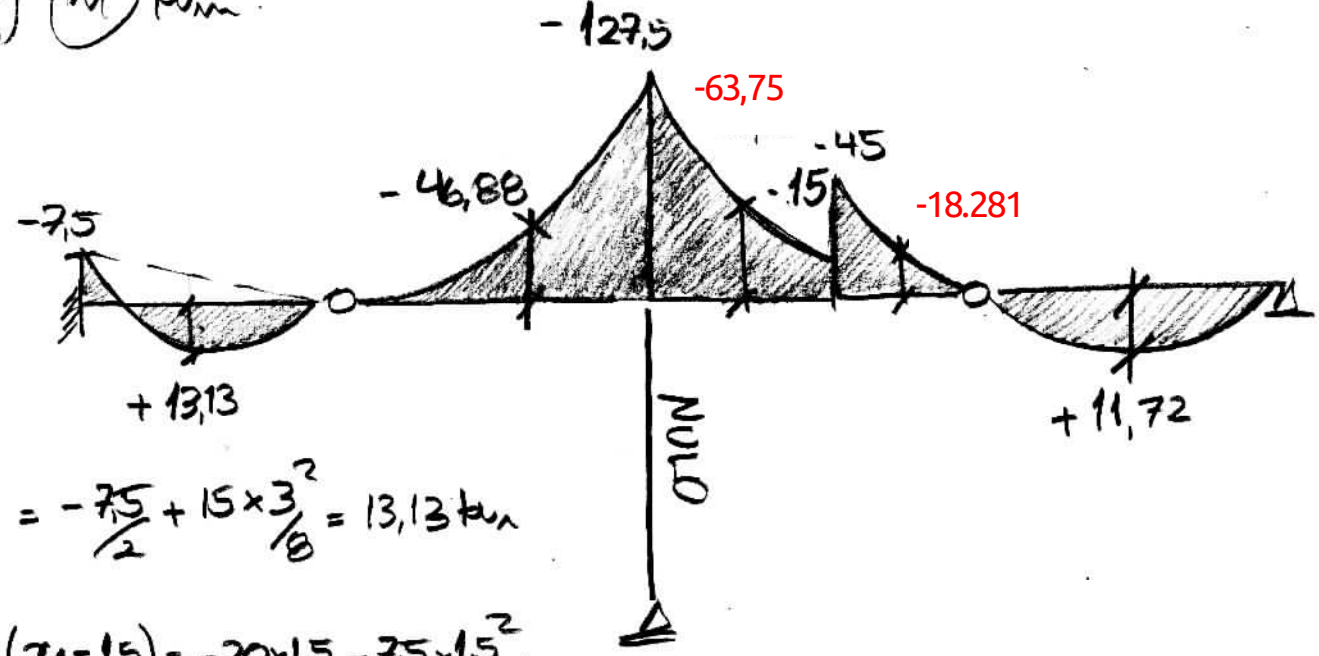
$\underline{M_{BC}(x_1) = -20x_1 - 7{,}5x_1^2}$

$\underline{M_{DE}(x_2) = -45 + 41{,}25x_2 - 7{,}5x_2^2}$

(c) $Q_{BC}(x_1) = \dfrac{d M_{BC}(x_1)}{dx_1} = \underline{-20 - 15x_1}$

$Q_{DE}(x_2) = \dfrac{d M_{DE}(x_2)}{dx_2} = \underline{41{,}25 - 15x_2}$

(d) (M) kNm



$$M_{\overline{AB}} = -\frac{7,5}{2} + 15 \times \frac{3^2}{8} = 13,13 \text{ kNm}$$

$$M_{BC}(x_1 = 1,5) = -20 \times 1,5 - 7,5 \times 1,5^2$$

$$M_{BC}(x_1 = 1,5) = -46,88 \text{ kNm}$$

$$M_{BC}(x_1 = 3) = -20 \times 3 - 7,5 \times 3^2$$

$$M_{BC}(x_1 = 3) = -127,5 \text{ kNm}$$

MDE (x2=0.75) = -45 + 41.25 * 0.75 - 7.5 * 0.75 = -18.281

$$M_{\overline{CD}} = \frac{-127,5 - 30}{2} + 15 \times \frac{2^2}{8} = -63.75 \text{ kNm}$$

$$M_{\overline{EF}} = 15 \text{ kN/m} \times \frac{(2,5 \text{ m})^2}{8} = 11,72 \text{ kNm}$$