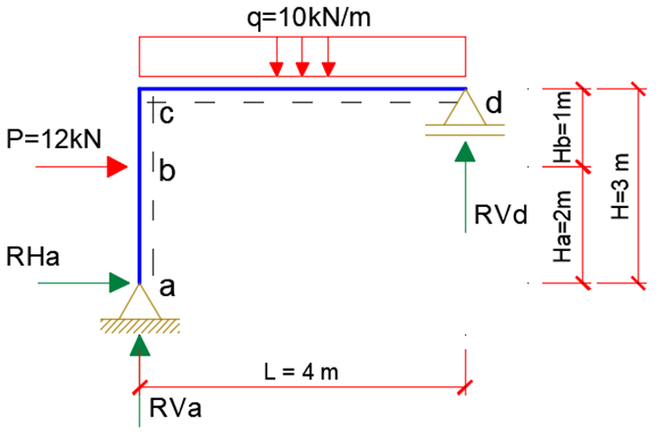
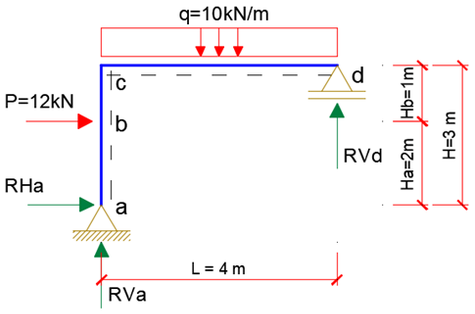
TE1_E04-01

Trace os diagramas de momento fletor, esforço cortante e esforço normal para o pórtico abaixo:



Cálculo das Reações de Apoio:



$L := 4$ m $\quad q := 10$ kN/m

$Ha := 2$ m $\quad P := 12$ kN

$Hb := 1$ m

$\Sigma Fh := 0$ (+) para direita

$P + RHa = 0 \quad$ ===> $\quad RHa := -P = -12$ kN

$\Sigma Ma := 0$ (+) giro antihorário

$$RVd \cdot L - P \cdot Ha - q \cdot L \cdot \frac{L}{2} = 0$$

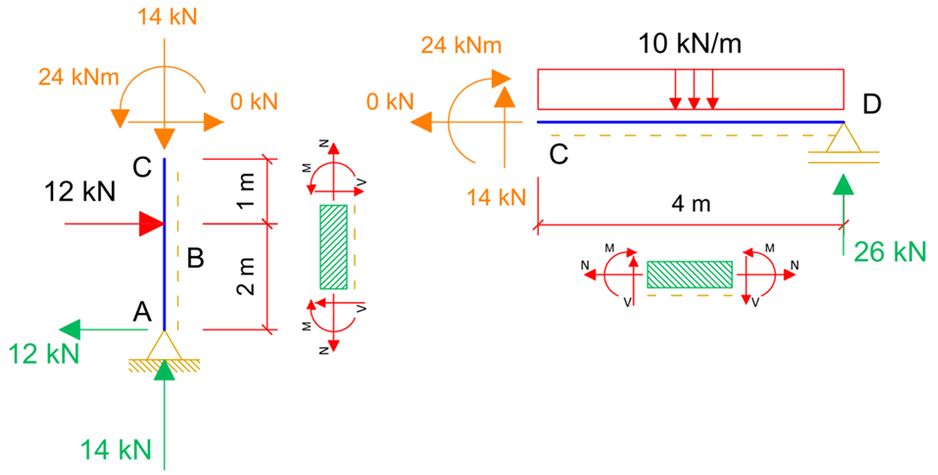
$$RVd := \frac{1}{L} \cdot \left(P \cdot Ha + \frac{q \cdot L^2}{2} \right) = 26 \text{ kN}$$

$\Sigma Fv := 0$ (+) para cima

$RVa + RVd - q \cdot L = 0$

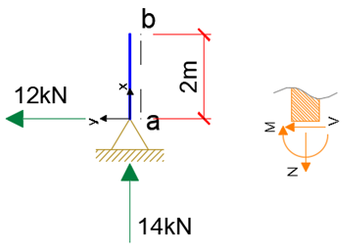
$RVa := -RVd + q \cdot L = 14$ kN

Equilíbrio Individual das Barras Componentes:



* No encontro entre barras ortogonais, o cortante na extremidade da barra vertical se transforma em esforço axial na extremidade da barra horizontal, e por sua vez, o esforço axial na extremidade da barra vertical se transforma em esforço cortante na extremidade da barra horizontal.

Equacionamento da Trecho "ab" [a;b[:

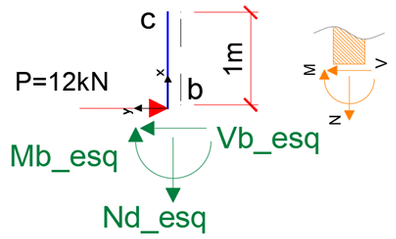


$Mab(x) := 12 \cdot x$

$Vab(x) := 12$

$Nab(x) := -14$

Equacionamento da Trecho "bc" [b;c[:



$Mb_esq := Mab(2) = 24$ kN.m

$Vb_esq := Vab(2) = 12$ kN

$Nd_esq := -14$ kN

$Mbc(x) := Mb_esq + (Vb_esq - P) \cdot x = 24$

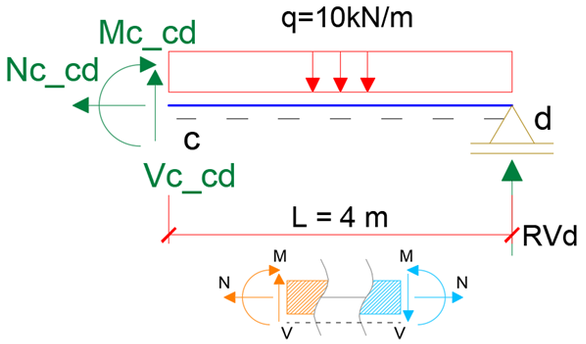
$Mb_esq = 24 \qquad Vb_esq - P = 0$

$Vbc(x) := (Vb_esq - P) = 0$

$Nbc(x) := -14$

$Nc_bc := -14$ kN

Equacionamento da Trecho "cd" [c;d[:



$Mc_cd := Mbc(1) = 24$

$Vc_cd := -Nc_bc = 14$

$Nc_cd := Vbc(1) = 0$

$Mcd(x) := Mc_cd + Vc_cd \cdot x - \frac{q \cdot x^2}{2}$

$Mcd(x) := 24 + 14 \cdot x - \frac{10 \cdot x^2}{2}$

$Vcd(x) := 14 - 10 \cdot x$

$Mcd(4) = 0$

$Vcd(4) = -26 \qquad RVd = 26$

Traçado do Diagrama de Momentos Fletores [kN.m]:

$Ma := Mab(0) = 0$

$Mb := Mab(2) = 24$

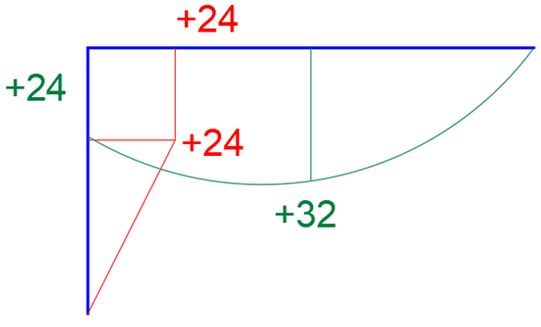
$Mb := Mbc(0) = 24$

$Mc_abc := Mbc(1) = 24$

$Mc_cd := Mcd(0) = 24$

$Mcd_meio := Mcd\left(\frac{4}{2}\right) = 32$

$Md := Mcd(4) = 0$



Traçado do Diagrama de Esforços Cortantes [kN]:

$Va := Vab(0) = 12$

$Vb_esq := Vab(2) = 12$

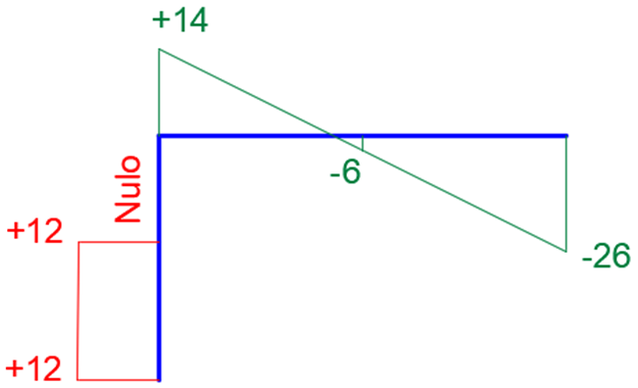
$Vb_dir := Vbc(0) = 0$

$Vc_abc := Vbc(1) = 0$

$Vc_cd := Vcd(0) = 14$

$Vcd_meio := Vcd\left(\frac{4}{2}\right) = -6$

$Vd := Vcd(4) = -26$



Traçado do Diagrama de Esforços Axiais [kN]:

$Nab(x) = -14$

$Nbc(x) = -14$

$Ncd(x) := 0$

