B2T4M0511B

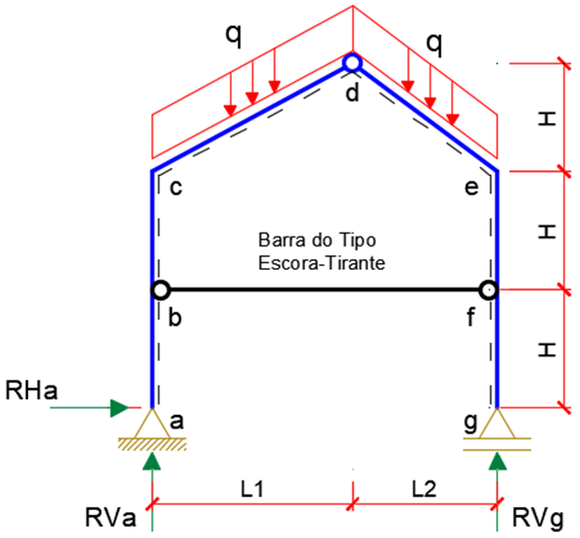
Considerando o modelo estrutural esboçado, responda os questionamentos.

$L1 := 4\ \text{m}$

$L2 := 3\ \text{m}$

$H := 3\ \text{m}$

$q := 20\ \frac{\text{kN}}{\text{m}}$



OBS: Todas as respostas devem ser dadas com sinal respeitando a convenção de diagramas

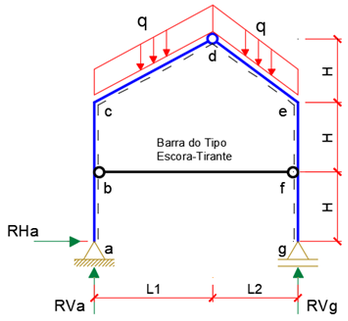
Q01) Qual o valor do esforço cortante no meio da barra "cd"? [em kN]

Q02) Qual o valor do esforço axial no meio da barra "cd"? [em kN]

Q03) Qual o valor do esforço cortante no meio da barra "de"? [em kN]

Q04) Qual o valor do esforço axial no meio da barra "de"? [em kN]

Reações de Apoio e Esforço na Barra "bf":



ΣFh = 0 (+) para direita $\quad RHa := 0$

ΣMa = 0 (+) giro antihorário

$Lcd := \sqrt{L1^2 + H^2} = 5\ \text{m} \qquad Lde := \sqrt{L2^2 + H^2} = 4{,}2426\ \text{m}$

$RVg \cdot (L1 + L2) - q \cdot Lcd \cdot \frac{L1}{2} - q \cdot Lde \cdot \left(L1 + \frac{L2}{2}\right) = 0$

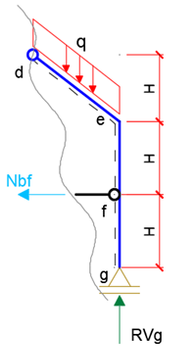
$RVg := \frac{1}{(L1 + L2)} \cdot \left(q \cdot Lcd \cdot \frac{L1}{2} + q \cdot Lde \cdot \left(L1 + \frac{L2}{2}\right)\right)$

$RVg = 95{,}241\ \text{kN}$

ΣFv = 0 (+) para cima

$RVa + RVg - q \cdot Lcd - q \cdot Lde = 0$

$RVa := -RVg + q \cdot Lcd + q \cdot Lde = 89{,}611\ \text{kN}$



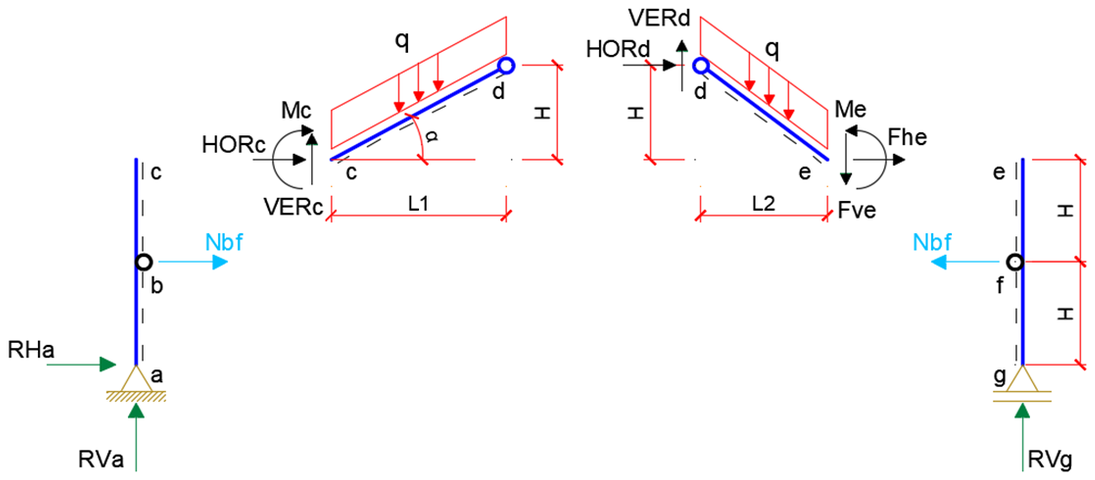
Cálculo do Esforço na Barra Escora/Tirante:

ΣMd = 0 (+) giro horário

$Nbf \cdot 2 \cdot H - RVg \cdot L2 + q \cdot Lde \cdot \frac{L2}{2} = 0$

$Nbf := \frac{1}{2 \cdot H} \cdot \left(RVg \cdot L2 - q \cdot Lde \cdot \frac{L2}{2}\right) = 26{,}408\ \text{kN}$

Equilíbrio Forças no Sistema HOR / VER nos pontos "c" e "d" e projeção no sistema PAR (N) / PER (V):



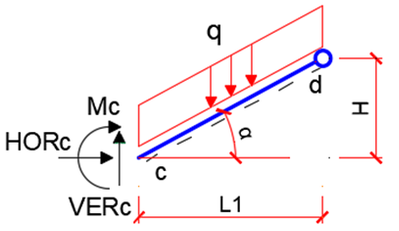
$HORc := RHa + Nbf = 26,4075\ kN$

$HORd := RHa + Nbf = 26,4075\ kN$

$VERc := RVa = 89,6113\ kN$

$VERd := RVa - q \cdot Lcd = -10,3887\ kN$

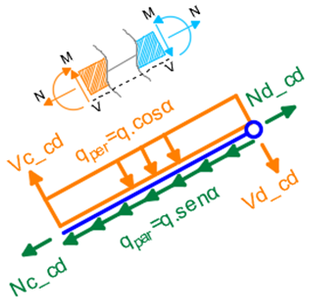
Na Barra "cd":



$cos\alpha := \frac{L1}{Lcd} = 0,8$ $sen\alpha := \frac{H}{Lcd} = 0,6$

$qcd_per := q \cdot cos\alpha = 16\ \frac{kN}{m}$

$qcd_par := q \cdot sen\alpha = 12\ \frac{kN}{m}$



$Vc_cd := VERc \cdot cos\alpha - HORc \cdot sen\alpha = 55,8445\ kN$

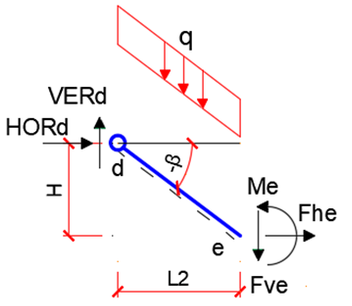
$Nc_cd := -VERc \cdot sen\alpha - HORc \cdot cos\alpha = -74,8928\ kN$

$Vcd(x) := Vc_cd - qcd_per \cdot x$

$Ncd(x) := Nc_cd + qcd_par \cdot x$

$Q01 := Vcd\left(\frac{Lcd}{2}\right) = 15,845\ kN$

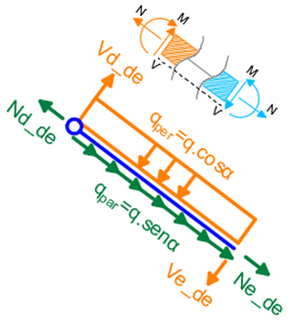
$Q02 := Ncd\left(\frac{Lcd}{2}\right) = -44,893\ kN$



$cos\beta := \frac{L2}{Lde} = 0,7071$ $sen\beta := \frac{H}{Lde} = 0,7071$

$qde_per := q \cdot cos\beta = 14,1421\ \frac{kN}{m}$

$qde_par := q \cdot sen\beta = 14,1421\ \frac{kN}{m}$



$Vd_de := VERd \cdot cos\beta + HORd \cdot sen\beta = 11,327\ kN$

$Nd_de := VERd \cdot sen\beta - HORd \cdot cos\beta = -26,0189\ kN$

$Vde(x) := Vd_de - qde_per \cdot x$

$Nde(x) := Nd_de - qde_par \cdot x$

$Q03 := Vde\left(\frac{Lde}{2}\right) = -18,673\ kN$

$Q04 := Nde\left(\frac{Lde}{2}\right) = -56,019\ kN$

$Q01 = 15,8445$ kN

$Q02 = -44,8928$ kN

$Q03 = -18,673$ kN

$Q04 = -56,0189$ kN
