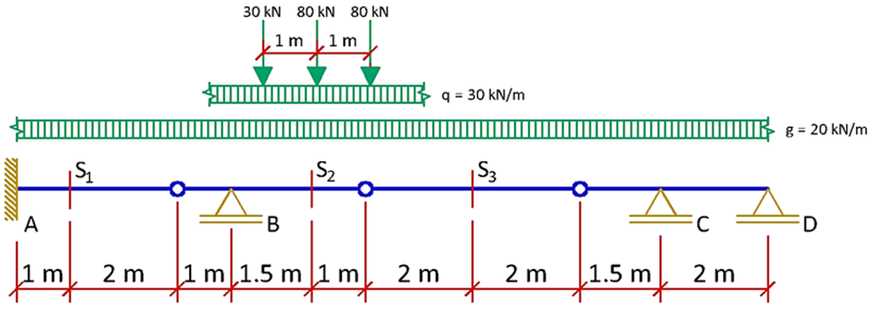
B1T4MA0817A

Trace as linhas de influência de momento fletor e esforço cortante para todas as seções indicadas e aplique o trem-tipo esboçado calculando:

Q01) Máximo cortante na seção S1 [em kN];

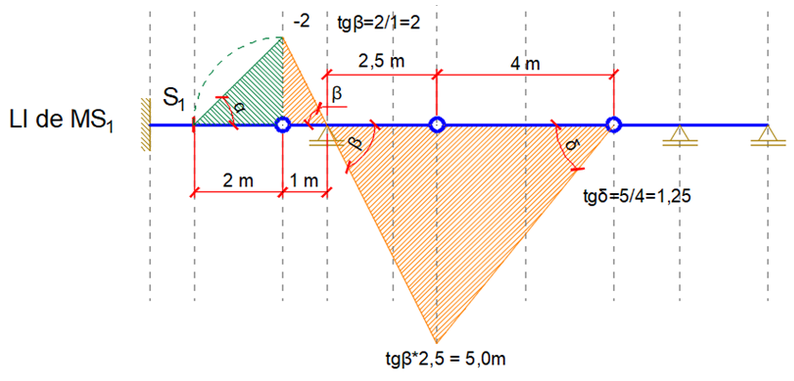
Q02) Máximo cortante na seção S2 [em kN]

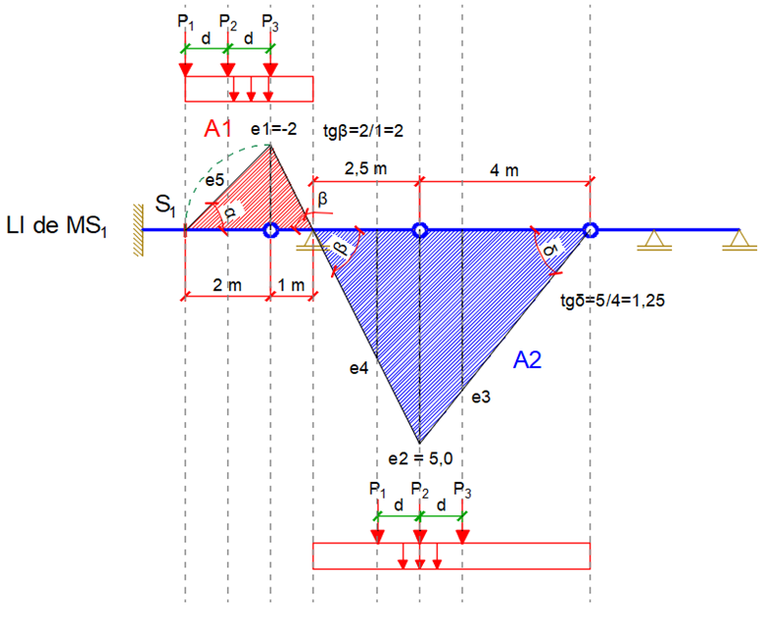
Q03) Minimo momento fletor na seção S3 [em kN];



$P1 := 30,0\ \text{kN}$ $P2 := 80,0\ \text{kN}$ $P3 := 80,0\ \text{kN}$ $d := 1,0\ \text{m}$ $q := 30\ \frac{\text{kN}}{\text{m}}$ $g := 20\ \frac{\text{kN}}{\text{m}}$

LI de Ms1:





$e1 := -2\ \text{m}$ $e2 := +5\ \text{m}$

$tg\alpha := 1$ $tg\beta := 2$ $tg\delta := \frac{5}{4} = 1,25$

$e3 := (4\ \text{m} - d) \cdot tg\delta = 3,75\ \text{m}$

$e4 := (2,5\ \text{m} - d) \cdot tg\beta = 3\ \text{m}$

$e5 := (2\ \text{m} - d) \cdot (-tg\alpha) = -1\ \text{m}$

Ms1_max:

$Ms1_max_roda := P1 \cdot e4 + P2 \cdot e2 + P3 \cdot e3$

$Ms1_max_roda = 790\ \text{kN m}$

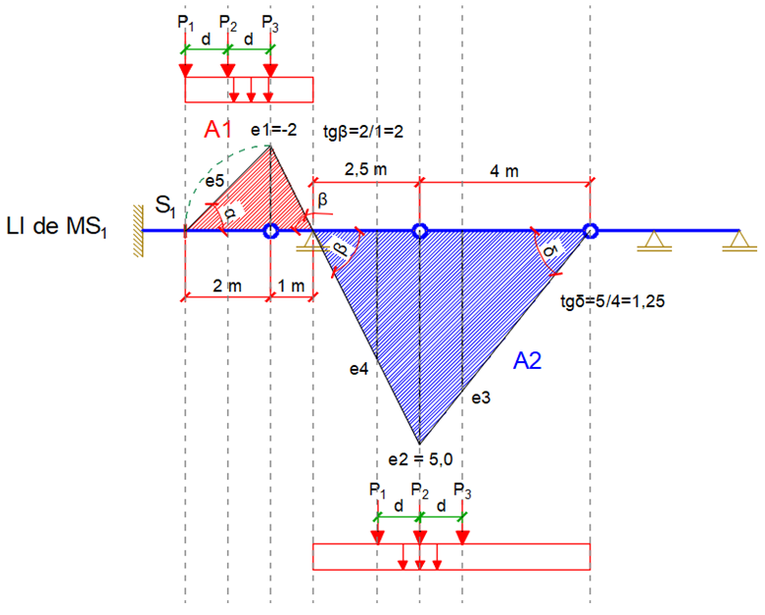
$A2 := (2,5\ \text{m} + 4\ \text{m}) \cdot \frac{e2}{2} = 16,25\ \text{m}^2$

$Ms1_max_mult := q \cdot A2 = 487,5\ \text{kN m}$

$A1 := (2\ \text{m} + 1\ \text{m}) \cdot \frac{e1}{2} = -3\ \text{m}^2$

$Ms1_max_perm := g \cdot (A1 + A2) = 265\ \text{kN m}$

$Ms1_max := Ms1_max_roda + Ms1_max_mult + Ms1_max_perm = 1542,5\ \text{kN m}$



Ms1_min:

$Ms1_min_roda := P1 \cdot 0 + P2 \cdot e5 + P3 \cdot e1$

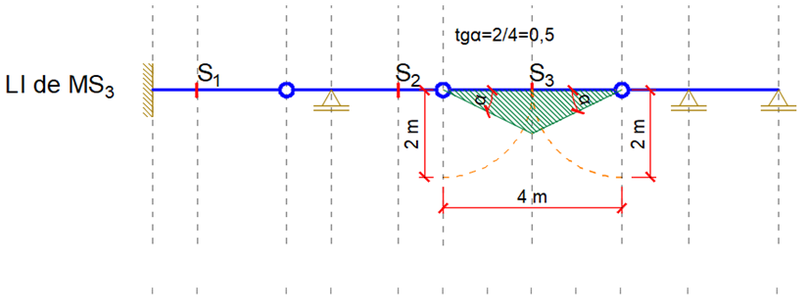
$Ms1_min_roda = -240\ \text{kN m}$

$Ms1_min_mult := q \cdot A1 = -90\ \text{kN m}$

$Ms1_min_perm := g \cdot (A1 + A2) = 265\ \text{kN m}$

$Ms1_min := Ms1_min_roda + Ms1_min_mult + Ms1_min_perm = -65\ \text{kN m}$

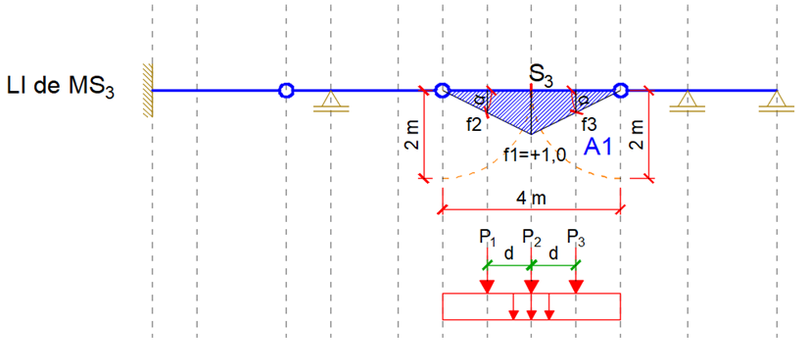
LI de Ms3:



$f1 := 1,0\ \text{m} \qquad tg\alpha := \frac{2}{4} = 0,5$

$f2 := (2\ \text{m} - d) \cdot tg\alpha = 0,5\ \text{m}$

$f3 := (2\ \text{m} - d) \cdot tg\alpha = 0,5\ \text{m}$



Ms3_max:

$Ms3_max_roda := P1 \cdot f2 + P2 \cdot f1 + P3 \cdot f3$

$Ms3_max_roda = 135\ \text{kN m}$

$A1 := (4\ \text{m}) \cdot \frac{f1}{2} = 2\ \text{m}^2$

$Ms3_max_mult := q \cdot A1 = 60\ \text{kN m}$

$Ms3_max_perm := g \cdot (A1) = 40\ \text{kN m}$

$Ms3_max := Ms3_max_roda + Ms3_max_mult + Ms3_max_perm = 235\ \text{kN m}$

Ms3_min:

$Ms3_min_roda := P1 \cdot 0 + P2 \cdot 0 + P3 \cdot 0 = 0$

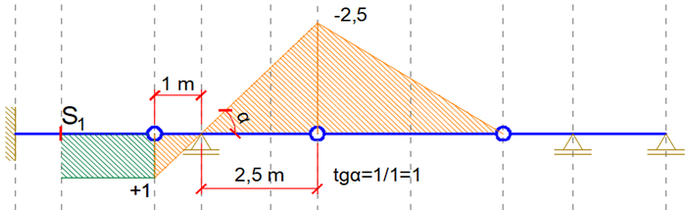
$Ms3_min_mult := q \cdot 0 = 0\ \text{kN m}$

$Ms3_min_perm := g \cdot (A1) = 40\ \text{kN m}$

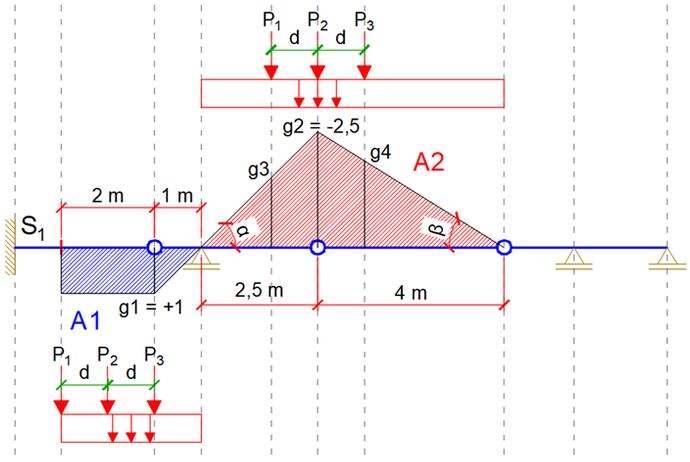
$Ms3_min := Ms3_min_roda + Ms3_min_mult + Ms3_min_perm = 40\ \text{kN m}$

LI de Vs1:

LI de VS_1



LI de VS_1



$g1 := 1 \qquad g2 := -2,5$

$tg\alpha := \frac{2,5}{2,5} = 1 \qquad tg\beta := \frac{2,5}{4} = 0,625$

$g3 := (2,5\ \text{m} - d) \cdot \frac{-tg\alpha}{\text{m}} = -1,5$

$g4 := (4\ \text{m} - d) \cdot \frac{-tg\beta}{\text{m}} = -1,875$

Vs1_max:

$Vs1_max_roda := P1 \cdot g1 + P2 \cdot g1 + P3 \cdot g1$

$Vs1_max_roda = 190\ \text{kN}$

$A1 := 2\ \text{m} \cdot 1 + \frac{g1 \cdot 1\ \text{m}}{2} = 2,5\ \text{m}$

$A2 := (2,5\ \text{m} + 4\ \text{m}) \cdot \frac{g2}{2} = -8,125\ \text{m}$

$Vs1_max_mult := q \cdot A1 = 75\ \text{kN}$

$Vs1_max_perm := g \cdot (A1 + A2) = -112,5\ \text{kN}$

$Vs1_max := Vs1_max_roda + Vs1_max_mult + Vs1_max_perm = 152,5\ \text{kN}$

Vs1_max:

$Vs1_min_roda := P1 \cdot g3 + P2 \cdot g2 + P3 \cdot g4$

$Vs1_min_roda = -395\ \text{kN}$

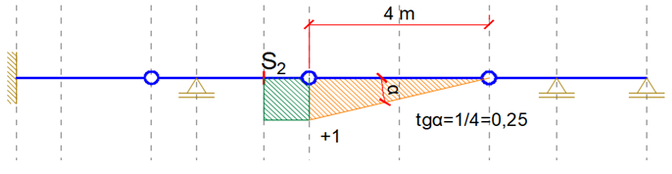
$Vs1_min_mult := q \cdot A2 = -243,75\ \text{kN}$

$Vs1_min_perm := g \cdot (A1 + A2) = -112,5\ \text{kN}$

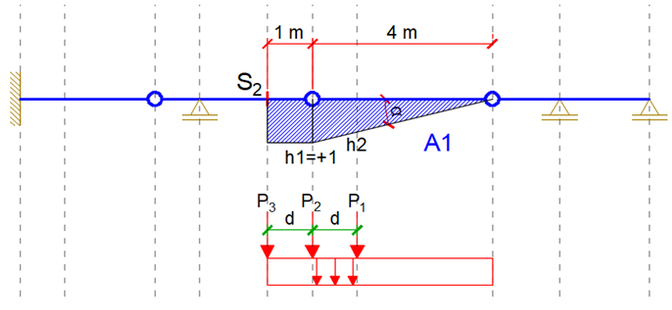
$Vs1_min := Vs1_min_roda + Vs1_min_mult + Vs1_min_perm = -751,25\ \text{kN}$

LI de Vs2:

LI de VS_2



LI de VS_2



$h1 := 1$

$tg\alpha := \frac{1}{4} = 0,25$

$A1 := 1\ \text{m} \cdot h1 + 4\ \text{m} \cdot \frac{h1}{2} = 3\ \text{m}$

$h2 := (4\ \text{m} - d) \cdot \frac{tg\alpha}{\text{m}} = 0,75$

Vs2_max:

$Vs2_max_roda := P3 \cdot h1 + P2 \cdot h1 + P1 \cdot h2$

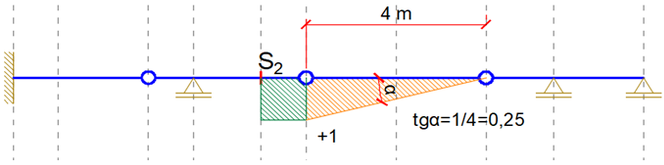
$Vs2_max_roda = 182,5\ \text{kN}$

$Vs2_max_mult := q \cdot A1 = 90\ \text{kN}$

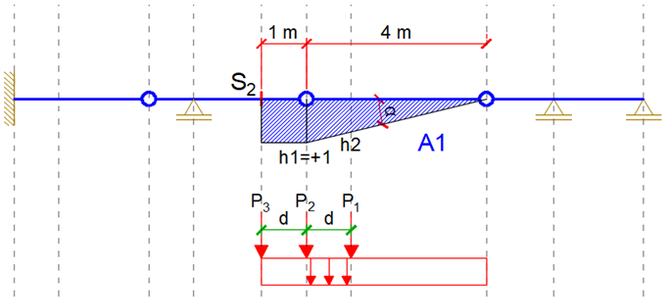
$Vs2_max_perm := g \cdot A1 = 60\ \text{kN}$

$Vs2_max := Vs2_max_roda + Vs2_max_mult + Vs2_max_perm = 332,5\ \text{kN}$

LI de VS_2



LI de VS_2



Vs2_min:

$Vs2_min_roda := P3 \cdot 0 + P2 \cdot 0 + P1 \cdot 0$

$Vs2_min_roda = 0\ kN$

$Vs2_min_mult := q \cdot 0 = 0\ kN$

$Vs2_min_perm := g \cdot A1 = 60\ kN$

$Vs2_min := Vs2_min_roda + Vs2_min_mult + Vs2_min_perm = 60\ kN$

$Ms1_max = 1542,5\ kN\ m$ $Ms3_max = 235\ kN\ m$ $Vs1_max = 152,5\ kN$ $Vs2_max = 332,5\ kN$

$Ms1_min = -65\ kN\ m$ $Ms3_min = 40\ kN\ m$ $Vs1_min = -751,25\ kN$ $Vs2_min = 60\ kN$

$Q01 := Vs1_max = 152,5\ kN$

$Q02 := Vs2_max = 332,5\ kN$

$Q03 := Ms3_min = 40\ kN\ m$
