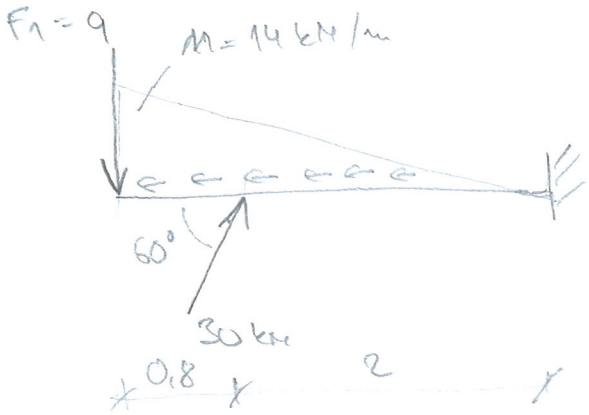



$F_{2x} = 30 \cos 60 = 15$

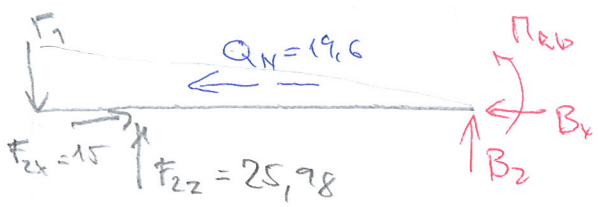
$F_{2z} = 30 \sin 60 = 25{,}98$

$Q_N = \frac{14 \cdot 2{,}8}{2} = 19{,}6$

$\Sigma F_{xi} = 0 \quad F_{2x} - Q_N - B_x = 0 \quad B_x = -4{,}6$

$\Sigma F_{zi} = 0 \quad F_1 - F_{2z} - B_2 = 0 \quad B_2 = -16{,}98$

$\Sigma M_{Bi} = 0 \quad -F_1 \cdot 2{,}8 + F_{2z} \cdot 2 - M_{Rb} = 0 \quad M_{Rb} = 26{,}76$

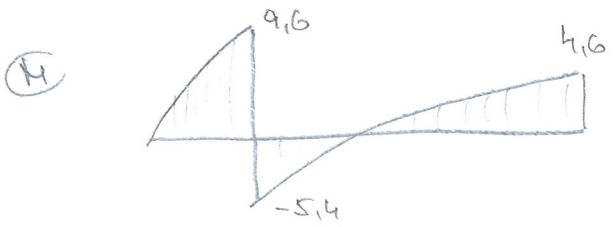


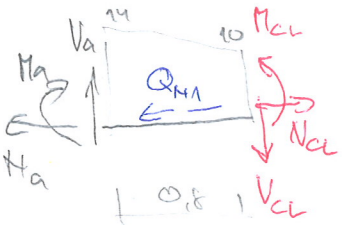


$H_a = 0$

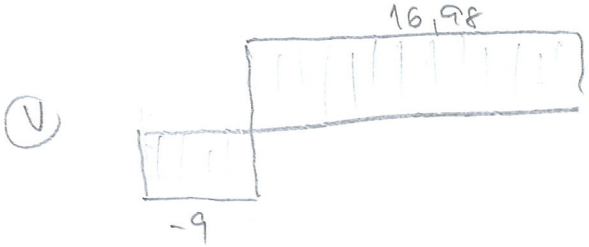
$F_1 + V_a = 0 \quad V_a = -9$

$M_a = 0$



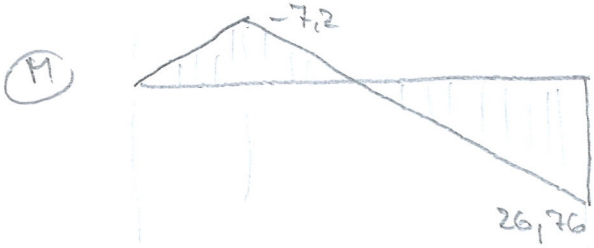

$Q_{H1} = \frac{(14+10) \cdot 0{,}8}{2} = 9{,}6$

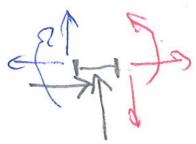



$M_a + Q_{H1} + N_{CL} = 0 \quad M_{CL} = 9{,}6$

$V_a - V_{CL} = 0 \quad V_{CL} = -9$

$M_a + V_a \cdot 0{,}8 - M_{CL} = 0 \quad M_{CL} = -7{,}2$



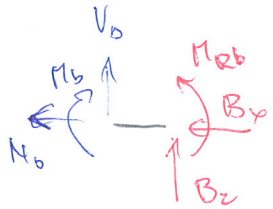
$M_{CL} - F_{2x} - M_{CP} = 0$

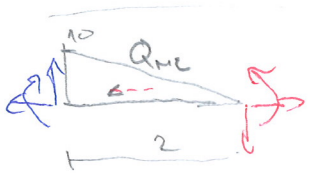
$M_{CP} = -5{,}4$

$V_{CL} + F_{2z} - V_{CP} = 0 \quad V_{CP} = 16{,}98$

$M_{CL} - M_{CP} = 0 \quad M_{CP} = -7{,}2$

KONTROLA




$Q_{H2} = \frac{10 \cdot 2}{2} = 10$

$N_b + B_x = 4{,}6 - 4{,}6 = 0$

$M_{CP} + Q_{H2} - M_b = 0$

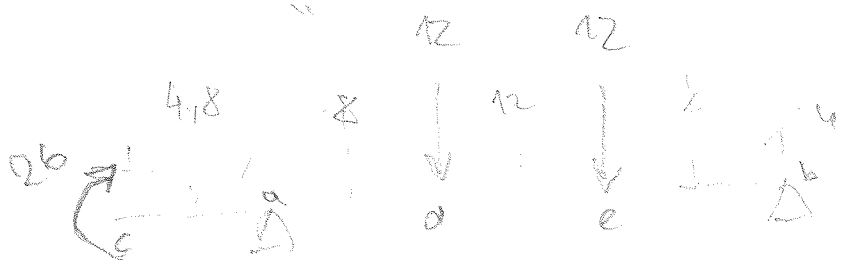
$M_b = 4{,}6$

$V_b + B_2 = 16{,}98 - 16{,}98 = 0$

$V_{CP} - V_b = 0 \quad V_b = 16{,}98$

$M_b - M_{Rb} = 26{,}76 - 26{,}76 = 0$

$M_{CP} + V_{CP} \cdot 2 - M_b = 0 \quad M_b = 26{,}76$



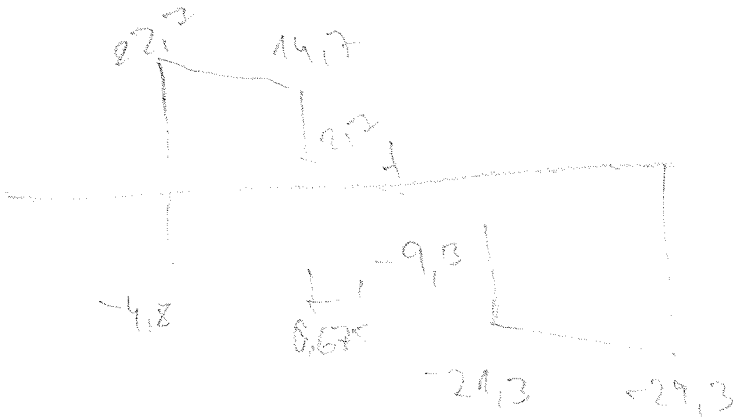

$$B = \frac{26 + 32,8 \cdot 2,9 + 12(5+2)}{7}$$

$$B = \frac{26 - 4,8 \cdot 1,6 + 12 \cdot 12 + 28 \cdot 3,5}{7}$$

$$= 29,3026$$

$$A = \frac{-26 + 4,8 \cdot 7,6 + 12 \cdot 12 + 28 \cdot 3,5}{7}$$

$$= 27,4971$$




$$Q = \frac{-26 + 32,8 \cdot 4,1 + 12 \cdot (5+2)}{2}$$

$$V_c = 0$$

$$V_{dl} = V_c - Q_1 = -4,8$$

$$V_{dp} = V_{dl} + 27,5 = 22,7$$

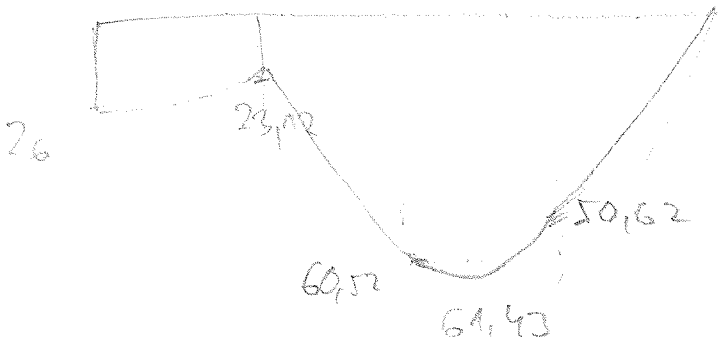
$$V_{el} = V_{dp} - Q_2 = 14,7$$

$$V_{ep} = V_{el} - F_1 = 2,7$$

$$V_{bl} = V_{ep} - Q_3 = -9,3$$

$$V_{bp} = V_{bl} - F_2 = -21,3$$

$$V_b = V_{bp} - Q_4 = -29,3$$



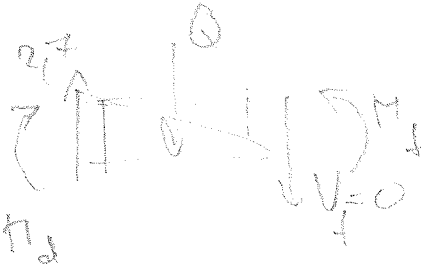

$$M_c = +M = 26$$

$$M_a = +M - Q_1 \cdot 0,6 = 23,12$$

$$M_d = M - Q_1 \cdot 2,6 + A \cdot 2 - Q_2 \cdot 1 = 60,52$$

$$M_e = M - Q_1 \cdot 5,6 + A \cdot 5 - Q_2 \cdot 4 - F_1 \cdot 2 - Q_3 \cdot 1,5 = 50,62$$

$$M_b = 0$$



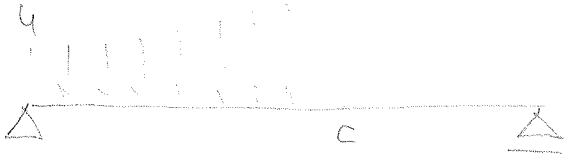

$$2,7 - 4 \cdot x = 0$$

$$x = 0,675$$

$$M_d + G \frac{x}{2} + M_t = 0$$

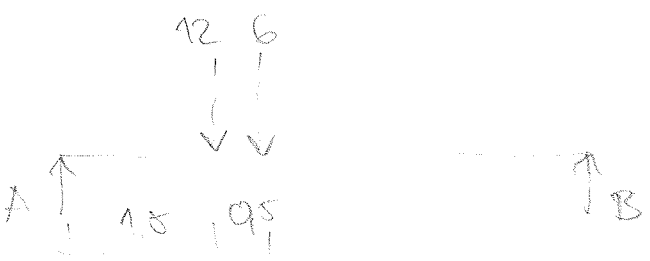
$$M_t = 60,52 + 2,7 \cdot \frac{0,675}{2} =$$

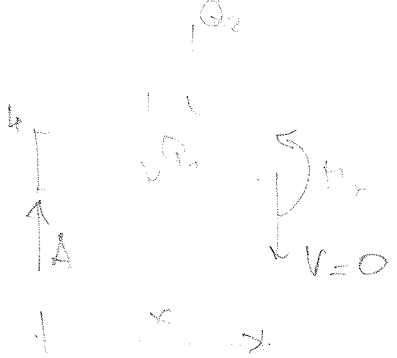
$$= 61,43$$




$$A = \frac{3{,}5 \cdot 12 + 6 \cdot 3}{5} = 12$$

$$B = 6$$




$q_1 = 4$ $\quad Q_1 = 4x$

$q_2 = \frac{4}{3}x$ $\quad Q_2 = \frac{4}{3}x^2/2 = \frac{2}{3}x^2$

$$\Sigma F_{zi} =$$

$$-A + Q_1 + Q_2 = 0$$

$$-12 + 4x + \frac{2}{3}x^2 = 0$$

$$D = b^2 - 4ac = 4 \cdot 4 + 4 \cdot \frac{2}{3} 12 = 16 + 32 = 48$$

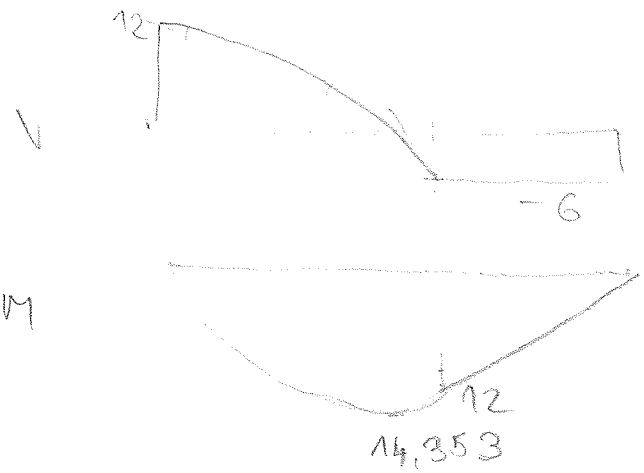
$$x_{1,2} = \frac{-b \pm \sqrt{D}}{2a} = \frac{-4 \pm \sqrt{48}}{2\frac{2}{3}} = \begin{cases} -8{,}1969 \\ 2{,}196 = x_1 = x \end{cases}$$

$Q_1 = 8{,}7846$

$Q_2 = 3{,}2153$

$$M_x = Q_1 \frac{x}{2} + Q_2 \frac{2}{3}x = 14{,}353$$

$M_C = 2B = 12$




$$q = 4 + \frac{4}{3}x$$

$$V = -\frac{8}{3}x^2 - 4x + 12$$

$$V = 0 \quad x = \begin{cases} -8{,}196 \\ 2{,}196 \end{cases}$$

$$M = -\frac{8}{9}x^3 + 2x^2 + 12x$$

$$M_x = 14{,}353$$

$$q = 4 + \frac{4}{3}x$$

$$V = \int -q\,dx + C = -\frac{2}{3}x^2 - 4x + C$$

$$V_{(x=0)} = 12 \quad \Rightarrow \quad C = 12$$

$$V = -\frac{2}{3}x^2 - 4x + 12 = 0$$

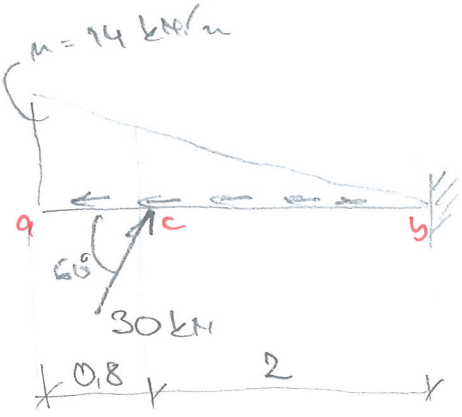
$$V = 0 \quad \Rightarrow \quad x < \frac{2,196}{-8,196}$$

$$M = \int V\,dx + C = -\frac{2}{9}x^3 - 2x^2 + 12x + C$$

$$M_{(x=0)} = 0 \quad \Rightarrow \quad C = 0$$

$$M = -\frac{2}{9}x^3 - 2x^2 + 12x$$

$$M_{(x=2,196)} = 14,354$$




$F_x = 30 \cdot \cos 60 = 15$ kN

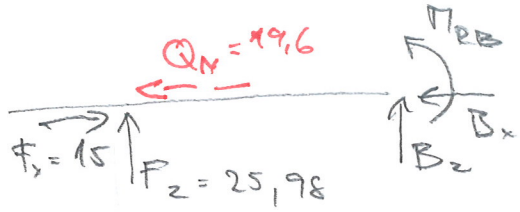
$F_z = 30 \cdot \sin 60 = 25{,}98$ kN

$Q_N = \frac{14 \cdot 2{,}8}{2} = 19{,}6$

$\Sigma F_{xi} = 0$

$F_x - Q_N - B_x = 0$

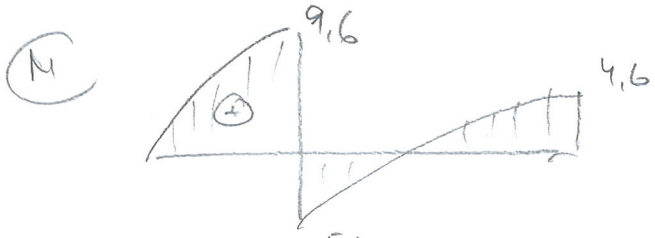
$B_x = F_x - Q_N = 15 - 19{,}6 = -4{,}6$




$\Sigma F_{zi} = 0$

$F_z + B_z = 0$

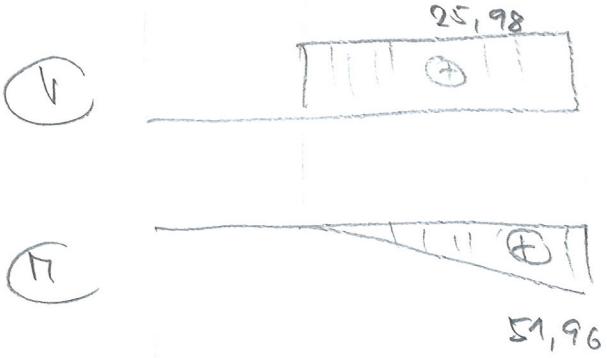
$B_z = -F_z = -25{,}98$




$\Sigma M_{bi} = 0$

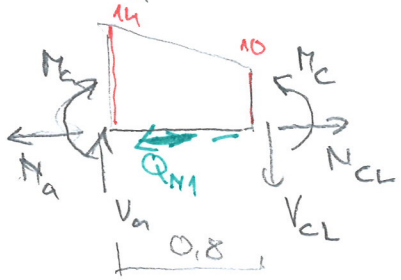
$F_z \cdot 2 - M_{Rb} = 0$

$M_{Rb} = 25{,}98 \cdot 2 = 51{,}96$ kNm




VOLNÝ KONEC BEZ ZATÍŽENÍ

$N_a = V_a = M_a = 0$



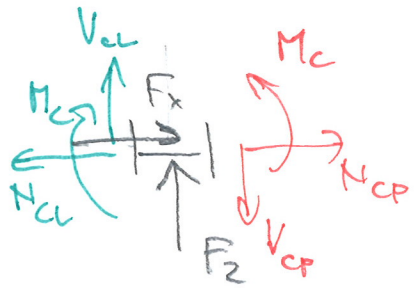

$Q_{N1} = \frac{(14+10) \cdot 0{,}8}{2} = 9{,}6$ kN

$+N_a + Q_{N1} - N_{CL} = 0$

$N_{CL} = N_a + Q_{N1} = 0 + 9{,}6 = 19{,}6$ kN

$V_a - V_{CL} = 0$

$V_{CL} = V_a = 0$




$N_{CL} - F_x - N_{CP} = 0$

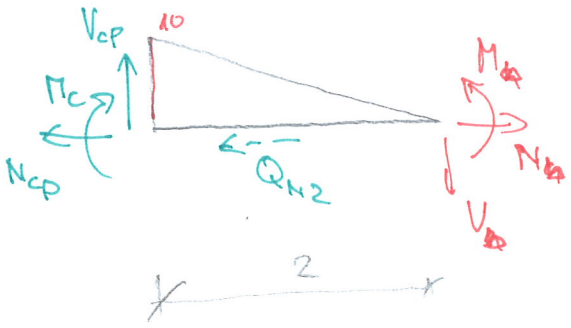
$N_{CP} = N_{CL} - F_x = +9{,}6 - 15 = -5{,}4$ kN

$V_{CL} + F_z - V_{CP} = 0$

$V_{CP} = V_{CL} + F_z = 0 + 25{,}98 = 25{,}98$ kN

$M_a + V_a \cdot 0{,}8 - M_c = 0$

$M_c = M_a + V_a \cdot 0{,}8 = 0$




$$Q_{N2} = \frac{10 \cdot 2}{2} = 10\ kN$$

$$N_{CP} + Q_{N2} - N_A = 0$$

$$N_A = N_{CP} + Q_{N2} = -5{,}4 + 10 = 4{,}6$$

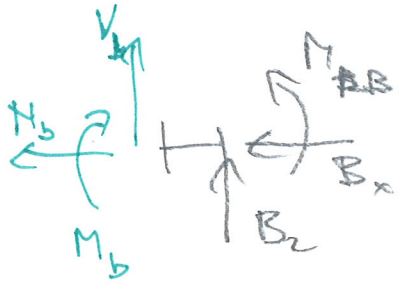
$$V_{CP} - V_A = 0$$

$$V_A = V_{CP} = 25{,}98$$

$$M_C + V_{CP} \cdot 2 - M_A = 0$$

$$M_A = M_C + V_{CP} \cdot 2 = 0 + 25{,}98 \cdot 2 = 51{,}96$$

CONTROLLA




$$N_b + B_x = 4{,}6 - 4{,}6 = 0 \quad \checkmark$$

$$V_b + B_z = 25{,}98 - 25{,}98 = 0 \quad \checkmark$$

$$M_b - M_{AB} = 51{,}96 - 51{,}96 = 0 \quad \checkmark$$