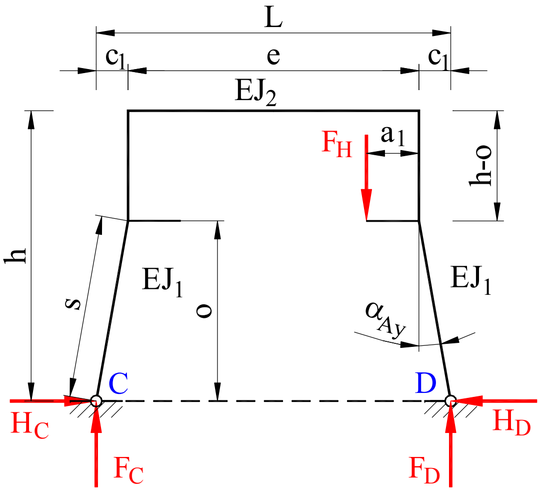
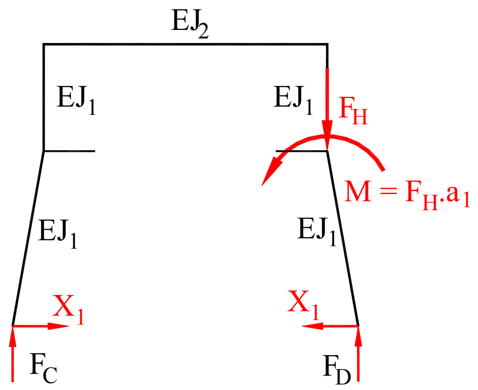




$a_1 := 740 \cdot mm$ $e_0 := 3720 \cdot mm$ $o := 7760 \cdot mm$ $h := 10460 \cdot mm$

$\alpha_{Ay1} := 0 \cdot deg$ $h - o = 2700 \cdot mm$ $c_1 := o \cdot \tan(\alpha_{Ay1})$ $c_1 = 0 \cdot mm$

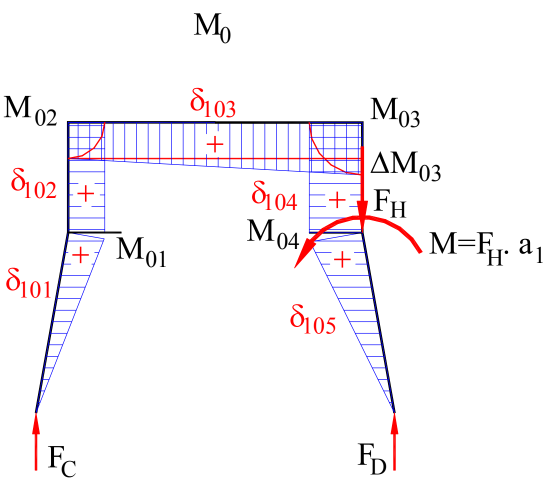
$L_1 := e_0 + 2 \cdot c_1$ $L_1 = 3720 \cdot mm$ $F_H := 322 \cdot kN$ $k_{105} := 0$

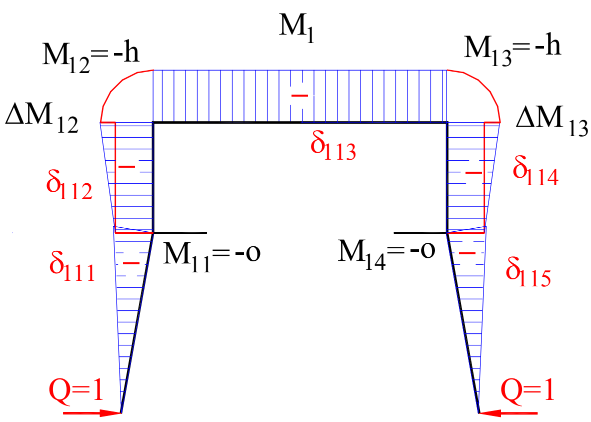
$E := 210000 \cdot MPa$ $J_1 := 51.459 \cdot 10^6 \cdot mm^4$ $J_2 := J_1$ $J_2 = 51.459 \cdot 10^6 \cdot mm^4$

$$F_D := F_H \cdot \frac{(L_1 - a_1 - c_1)}{L_1}$$ $F_D = 257.9 \cdot kN$

$$F_C := F_H \cdot \frac{(a_1 + c_1)}{L_1}$$ $F_C = 64.1 \cdot kN$

$$s_1 := \sqrt{o^2 + c_1^{\,2}}$$ $o = 7760 \cdot mm$ $s_1 = 7760 \cdot mm$





$X_1 = H_D = H_C$ $X_1 = -\frac{\delta_{10}}{\delta_{11}}$ $M_H := F_H \cdot a_1$ $M_H = 238.3\,m \cdot kN$ $Q := 1$

$M_{01} := F_C \cdot c_1$ $M_{01} = 0\,m \cdot kN$ $M_{11} := -o$ $M_{11} = -7.8\,m$

$M_{02} := F_C \cdot c_1$ $M_{02} = 0\,m \cdot kN$ $M_{12} := -h$ $M_{12} = -10.5\,m$

$\Delta M_{12a} := M_{12} - M_{11}$ $\Delta M_{12a} = -2.7\,m$

$M_{03} := F_H \cdot a_1 + F_D \cdot c_1$ $M_{03} = 238.3\,m \cdot kN$ $\Delta M_{12} := -(h - o)$ $\Delta M_{12} = -2.7\,m$

$\Delta M_{03} := F_H \cdot a_1 + F_D \cdot c_1 - F_C \cdot c_1$ $\Delta M_{03} = 238.3\,m \cdot kN$ $M_{13} := -h$ $M_{13} = -10.5\,m$

$M_{04} := F_H \cdot a_1 + F_D \cdot c_1$ $M_{04} = 238.3\,m \cdot kN$ $M_{14} := -o$ $M_{14} = -7.8\,m$

$\Delta M_{13} := -(h - o)$ $\Delta M_{13} = -2.7\,m$

$\Delta M_{13a} := M_{13} - M_{14}$ $\Delta M_{13a} = -2.7\,m$

δ_{101}

$$\delta_{101} = \int_0^{s_1} M_{01} \cdot M_{11} \cdot \frac{1}{E \cdot J_1}\,dx$$

$\delta_{101} = \frac{1}{3} \cdot M_{01} \cdot M_{11} \cdot \frac{s_1}{E \cdot J_1}$ $\delta_{101} := -\frac{1}{3} \cdot F_C \cdot c_1 \cdot o \cdot \frac{s_1}{E \cdot J_1}$ $\delta_{101} = 0\,m$

δ_{102}

$\delta_{102} = \delta_{102a} + \delta_{102b}$

δ_{102a}

$$\delta_{102a} = \int_0^{h-o} M_{01} \cdot \Delta M_{12} \cdot \frac{1}{E \cdot J_1}\,dx$$

$\delta_{102a} = \frac{1}{2} \cdot M_{01} \cdot \Delta M_{12} \cdot \frac{h - o}{E \cdot J_1}$ $\delta_{102a} := \frac{1}{2} \cdot F_C \cdot c_1 \cdot [-(h - o)] \cdot \frac{h - o}{E \cdot J_1}$ $\delta_{102a} = 0\,m$

δ_{102b}

$$\delta_{102b} = \int_0^{h-o} M_{01} \cdot M_{11} \cdot \frac{1}{E \cdot J_1}\,dx$$

$\delta_{102b} = M_{01} \cdot M_{11} \cdot \frac{h - o}{E \cdot J_1}$ $\delta_{102b} := F_C \cdot c_1 \cdot (-o) \cdot \frac{h - o}{E \cdot J_1}$ $\delta_{102b} = 0\,m$

$\delta_{102} = \delta_{102a} + \delta_{102b}$ $\delta_{102} := -\frac{F_C \cdot c_1 \cdot (h - o) \cdot (h + o)}{2 \cdot E \cdot J_1}$ $\delta_{102} = 0\,m$

δ_{103}

$\delta_{103} = \delta_{103a} + \delta_{103b}$

δ_{103a}

$$\delta_{103a} = \int_0^{e_0} \Delta M_{03} \cdot M_{12} \cdot \frac{1}{E \cdot J_2}\,dx$$

$\delta_{103a} = \frac{1}{2} \cdot \Delta M_{03} \cdot M_{12} \cdot \frac{e_0}{E \cdot J_2}$ $\delta_{103a} := \left[F_H \cdot a_1 + c_1 \cdot \left(F_D - F_C\right)\right] \cdot (-h) \cdot \frac{e_0}{2 \cdot E \cdot J_2}$ $\delta_{103a} = -0.429\,m$

δ_{103b}

$$\delta_{103b} = \int_0^{e_0} M_{02} \cdot M_{12} \cdot \frac{1}{E \cdot J_2}\, dx$$

$\delta_{103b} = M_{02} \cdot M_{12} \cdot \frac{e_0}{E \cdot J_2}$ $\quad$ $\delta_{103b} := F_C \cdot c_1 \cdot (-h) \cdot \frac{e_0}{E \cdot J_2}$ $\quad$ $\delta_{103b} = 0\,m$

$\delta_{103} := (\delta_{103a} + \delta_{103b})$ $\quad$ $\boxed{\delta_{103} = -0.429\,m}$

δ_{104}

$\delta_{104} = \delta_{104a} + \delta_{104b}$

δ_{104a}

$$\delta_{104a} = \int_0^{h-o} M_{03} \cdot \Delta M_{13} \cdot \frac{1}{E \cdot J_1}\, dx$$

$\delta_{104a} = \frac{1}{2} \cdot M_{03} \cdot \Delta M_{13} \cdot \frac{h-o}{E \cdot J_1}$ $\quad$ $\delta_{104a} := \frac{1}{2} \cdot (F_H \cdot a_1 + F_D \cdot c_1) \cdot [-(h-o)] \cdot \frac{h-o}{E \cdot J_1}$ $\quad$ $\delta_{104a} = -80.372 \cdot mm$

δ_{104b}

$$\delta_{104b} = \int_0^{h-o} M_{04} \cdot M_{14} \cdot \frac{1}{E \cdot J_1}\, dx$$

$\delta_{104b} = M_{04} \cdot M_{14} \cdot \frac{h-o}{E \cdot J_1}$ $\quad$ $\delta_{104b} := (F_H \cdot a_1 + F_D \cdot c_1) \cdot (-o) \cdot \frac{h-o}{E \cdot J_1}$ $\quad$ $\delta_{104b} = -461.99 \cdot mm$

$\delta_{104} = \delta_{104a} + \delta_{104b}$ $\quad$ $\delta_{104} := -\frac{(h-o) \cdot (h+o)}{2 \cdot E \cdot J_1} \cdot (F_H \cdot a_1 + F_D \cdot c_1)$ $\quad$ $\boxed{\delta_{104} = -0.542\,m}$

δ_{105}

$$\delta_{105} = \int_0^{s_1} M_{04} \cdot M_{14} \cdot \frac{1}{E \cdot J_1}\, dx$$

$\delta_{105} = \frac{1}{3} \cdot M_{04} \cdot M_{14} \cdot \frac{s_1}{E \cdot J_1}$ $\quad$ $\delta_{105} := \frac{1}{3} \cdot (F_H \cdot a_1 + F_D \cdot c_1) \cdot (-o) \cdot \frac{s_1}{E \cdot J_1} \cdot k_{105}$ $\quad$ $\boxed{\delta_{105} = 0}$

$\delta_{10} := \delta_{101} + \delta_{102} + \delta_{103} + \delta_{104} + \delta_{105}$ $\quad$ $\boxed{\delta_{10} = -0.971\,m}$

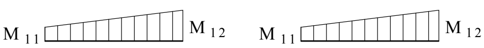
$\delta_{11} = \delta_{111} + \delta_{112} + \delta_{113} + \delta_{114} + \delta_{115}$

δ_{111}

$$\delta_{111} = \int_0^{s_1} M_{11} \cdot M_{11} \cdot \frac{1}{E \cdot J_1}\, dx$$

$\delta_{111} = \frac{1}{3} \cdot M_{11} \cdot M_{11} \cdot \frac{s_1}{E \cdot J_1}$ $\quad$ $\delta_{111} := \frac{1}{3} \cdot (-o) \cdot (-o) \cdot \frac{s_1}{E \cdot J_1}$ $\quad$ $\boxed{\delta_{111} = 0.014 \cdot \frac{m}{kN}}$

δ_{112}



$$\delta_{112} = \int_0^{h-o} \left[M_{11} \cdot \left[(2 \cdot M11 + M_{12}) + M_{12} \cdot (M_{11} + 2 \cdot M_{12}) \right] \cdot \frac{1}{E \cdot J_1} \right] dx$$

$$\delta_{112} = \frac{1}{6} \cdot \left[M_{11} \cdot \left[\left(2 \cdot M_{11} + M_{12}\right) + M_{12} \cdot \left(M_{11} + 2 \cdot M_{12}\right)\right] \cdot \frac{h - o}{E \cdot J_1} \right]$$

$$\delta_{112} = \frac{1}{6} \cdot [(-o) \cdot (-2 \cdot o - h) - h \cdot (-o - 2 \cdot h)] \cdot \frac{h - o}{E \cdot J_1}$$

$$\delta_{112} := \frac{1}{3} \cdot \left(o^2 + h \cdot o + h^2\right) \cdot \frac{h - o}{E \cdot J_1}$$

$\delta_{112} = 0.021 \cdot \frac{m}{kN}$

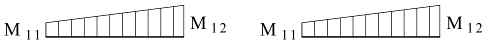
δ_{113}

$$\delta_{113} = \int_0^{e_0} M_{12} \cdot M_{12} \cdot \frac{1}{E \cdot J_2} \, dx$$

$$\delta_{113} = M_{12} \cdot M_{12} \cdot \frac{e_0}{E \cdot J_2} \qquad \delta_{113} := (-h) \cdot (-h) \cdot \frac{e_0}{E \cdot J_2}$$

$\delta_{113} = 0.038 \cdot \frac{m}{kN}$

δ_{114}



Symmetrie

$\delta_{114} := \delta_{112}$

$\delta_{114} = 0.021 \cdot \frac{m}{kN}$

δ_{115}

Symmetrie

$\delta_{115} := \delta_{111}$

$\delta_{115} = 0.014 \cdot \frac{m}{kN}$

$$\delta_{11} := \delta_{111} + \delta_{112} + \delta_{113} + \delta_{114} + \delta_{115}$$

$\delta_{11} = 0.108 \cdot \frac{m}{kN}$

$$H_C = H_D = X_1 \qquad X_1 := -\frac{\delta_{10}}{\delta_{11}}$$

$H_C := X_1$ $\qquad H_C = 8.972 \cdot kN$

$H_D := X_1$ $\qquad H_D = 8.972 \cdot kN$

Kleinlogel/Haselbach, Rahmenformeln, 17. Auflage, 1993 Ernst&Sohn, Berlin. Seite 144, Fall 29/29

$$k := \frac{J_2}{J_1} \cdot \frac{h}{L_1} \qquad N_H := 2 \cdot k + 3 \qquad \alpha_K := \frac{o}{h} \qquad m_k := 2 \cdot h \cdot (2 \cdot k + 3)$$

$$M_C := \frac{F_H \cdot a_1}{2} \cdot \left[\frac{\left(3 \cdot \alpha_K^2 - 1\right) \cdot k}{N_H} - 1 \right]$$

$$H_{C1} := \frac{-M_C}{h}$$

$H_{C1} = 8.972 \cdot kN$

Stahl im Hochbau, 13. Auflage, Seite 1148

$$H_{C2} := 3 \cdot F_H \cdot a_1 \cdot \frac{k \cdot \left(h^2 - o^2\right) + h^2}{h^2 \cdot m_k}$$

$H_{C2} = 8.972 \cdot kN$

ENDE