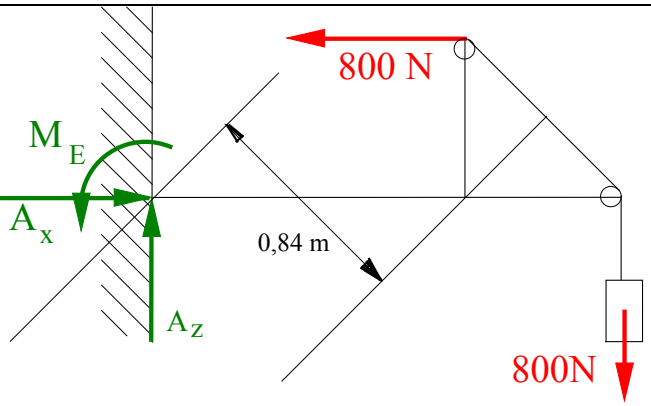


Auflagerreaktionen:

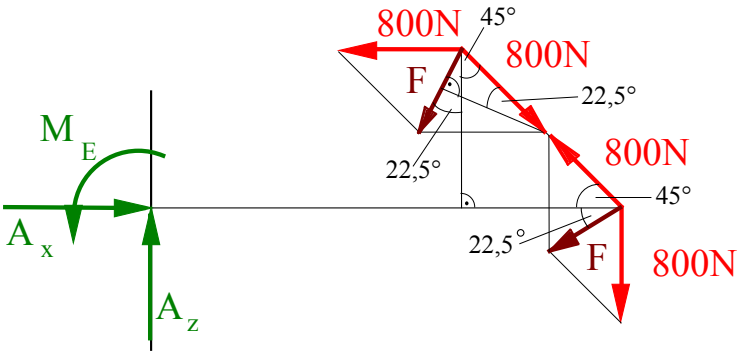
$A_x = 800\,N; \qquad A_z = 800\,N$

$M_E = (800 \cdot 1{,}8 - 800 \cdot 0{,}6)\,Nm$

$M_E = 960\,Nm$

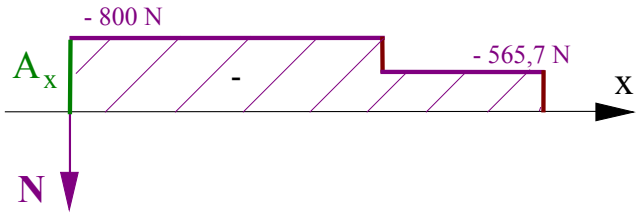
$\frac{F}{2} = 800\,N \cdot \sin 22{,}5°$

$\rightarrow \qquad F = 612{,}29\,N$



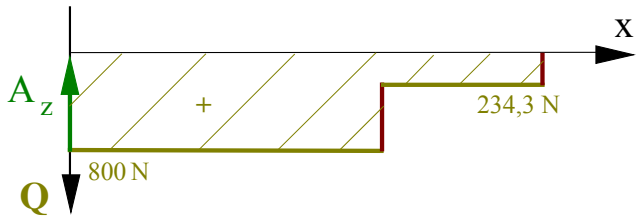
Normalkraft:

$N(x) = -A_x + F\sin 22{,}5° \{x - 1{,}2m\}^0$



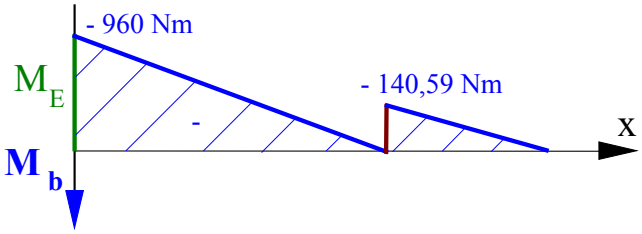
Querkraft:

$Q(x) = A_z - F\cos 22{,}5° \{x - 1{,}2m\}^0$



Biegemoment:

$M_b(x) = -M_E + A_z x -$
$\quad -F\cos 22{,}5° \{x - 1{,}2m\}^1 -$
$\quad -F\sin 22{,}5° \cdot 0{,}6m \{x - 1{,}2m\}^0$



zu Aufgabe 1, Aufgabenblatt 4:

x[m]	N[N]	Q[N]	M_b[Nm]
$0^{(+0)}$	-800	800	-960
$1{,}2^{(-0)}$	-800	800	0
$1{,}2^{(+0)}$	-565,7	234,3	-140,59
$1{,}8^{(-0)}$	-565,7	234,3	0

Biegelinie:

$$EI_y\, z''(x) = -M_b(x) = M_E - A_z\, x + F\cdot\cos 22{,}5^\circ \{x-1{,}2m\}^1 + F\cdot\sin 22{,}5^\circ \cdot 0{,}6m\{x-1{,}2m\}^0$$

$$EI_y\, z'(x) = M_E\, x - \frac{1}{2}A_z\, x^2 + \frac{1}{2}F\cdot\cos 22{,}5^\circ \{x-1{,}2m\}^2 + F\cdot\sin 22{,}5^\circ \cdot 0{,}6m\{x-1{,}2m\}^1 + C_1$$

$$EI_y\, z'(x=0) = C_1 = 0$$

$$EI_y\, z(x) = \frac{1}{2}M_E\, x^2 - \frac{1}{6}A_z\, x^3 + \frac{1}{6}F\cdot\cos 22{,}5^\circ \{x-1{,}2m\}^3 + \frac{1}{2}F\cdot\sin 22{,}5^\circ \cdot 0{,}6m\{x-1{,}2m\}^2 + C_2$$

$$E\,I_y\, z(x=0) = C_2 = 0$$

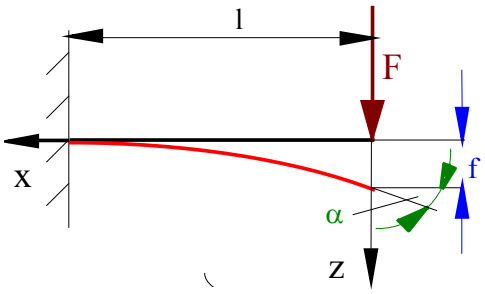
$$EI_y\, z(x) = 480Nm\, x^2 - 133{,}33N x^3 + 94{,}28N\{x-1{,}2m\}^3 + 70{,}29Nm\{x-1{,}2m\}^2$$

$$EI_y\, z(1{,}2m) = 460{,}80Nm^3 \rightarrow z(1{,}2m) = \frac{460{,}80Nm^3}{EI_y}$$

$$EI_y\, z(1{,}8m) = \left(480\cdot 1{,}8^2 - 133{,}33\cdot 1{,}8^3 + 94{,}28\cdot 0{,}6^3 + 70{,}29\cdot 0{,}6^2\right)Nm^3 = 823{,}27Nm^3$$

$$z(1{,}8m) = \frac{823{,}27Nm^3}{EI_y}$$

Lösung durch Überlagerung von Lastfällen:



aus Vorlesung:

$$f = \frac{F\cdot l^3}{3\,E\,I_y} \qquad (1)$$

$$|\tan\alpha| = \frac{F\cdot l^2}{2\,E\,I_y} \qquad (2)$$

$$EI_y\, z(x) = \frac{F}{6}x^3 - \frac{F}{2}l^2 x + \frac{F}{3}l^3 \qquad (3)$$

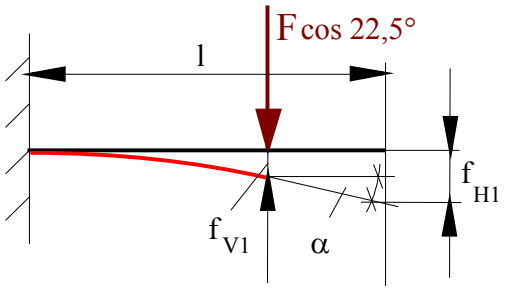
Lastfall 1:

$$f_{V1} = \frac{F\cdot\cos 22{,}5^\circ\cdot 1{,}2^3\cdot m^3}{3\,E\,I_y} = \frac{325{,}83}{E\,I_y}Nm^3$$

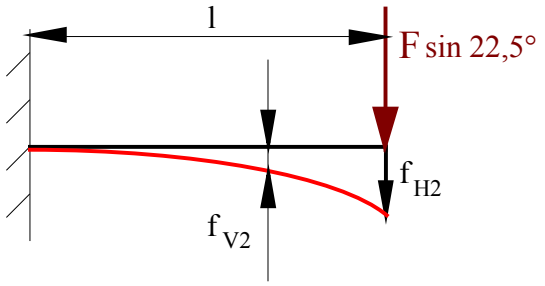
$$f_{H1} = f_{V1} + 0{,}6\,m\cdot\tan\alpha$$

$$f_{H1} = f_{V1} + 0{,}6\,m\frac{F\cdot\cos 22{,}5^\circ\cdot 1{,}2^2\cdot m^2}{2\,E\,I_y}$$

$$f_{H1} = \frac{325{,}83 + 244{,}37}{E\,I_y}Nm^3 = \frac{570{,}21}{E\,I_y}Nm^3$$



zu Aufgabe 1, Aufgabenblatt 4:



Lastfall 2:

Mit (1) und $l = 1{,}8\,m$

$F \mathrel{\hat{=}} F \cdot \sin 22{,}5° = 234{,}31\,N$

$$f_{H2} = \frac{F \cdot \sin 22{,}5° \cdot 1{,}8^3 \cdot m^3}{3\,E\,I_y} = \frac{455{,}51}{E\,I_y}\,Nm^3$$

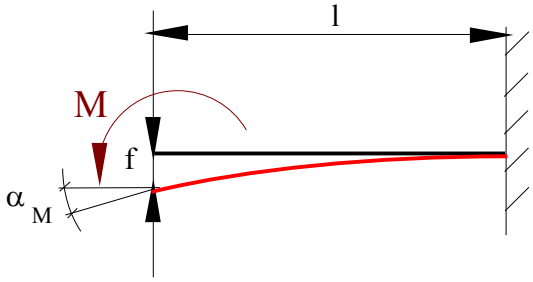
mit (3) und $x = 0{,}6\,m$

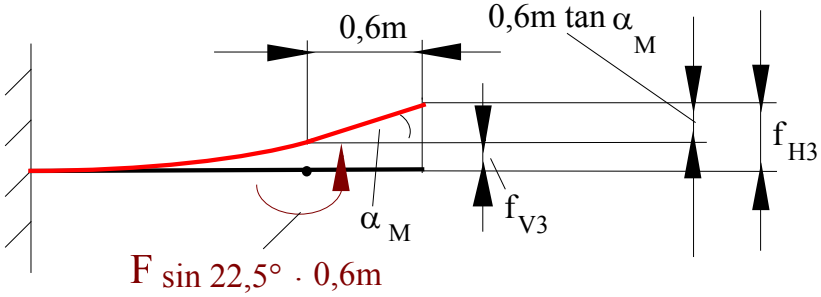
$$EI_y\,z(x) = \frac{F \cdot \sin 22{,}5^\circ}{6} 0{,}6^3\,m^3 - \frac{F \cdot \sin 22{,}5^\circ}{2} 1{,}8^2 \cdot 0{,}6 m^3 + \frac{F \cdot \sin 22{,}5^\circ}{3} 1{,}8^3\,m^3 = 236{,}19\,Nm^3$$

$$f_{V2} = z(x = 0{,}6m) = \frac{236{,}19}{EI_y}\,Nm^3$$

Lastfall 3:

aus Dubbel: $f = \frac{M \cdot l^2}{2\,E\,I_y}$; $\tan\alpha_M = \frac{M \cdot l}{E\,I_y}$





$$f_{V3} = \frac{F \cdot \sin 22{,}5° \cdot 0{,}6\,m}{2\,E\,I_y} 1{,}2^2\,m^2$$

$$f_{V3} = \frac{101{,}22}{E\,I_y}\,Nm^3$$

$$f_{H3} = f_{V3} + \\ + 0{,}6\,m \frac{F \cdot \sin 22{,}5° \cdot 0{,}6\,m}{E\,I_y} 1{,}2\,m$$

$$f_{H3} = \frac{101{,}22 + 101{,}22}{E\,I_y}\,Nm^3 = \frac{202{,}45}{E\,I_y}\,Nm^3$$

Überlagerung:

$$f_V = f_{V1} + f_{V2} - f_{V3} = (325{,}83 + 236{,}19 - 101{,}22)\frac{Nm^3}{EI_y} = \frac{460{,}80}{EI_Y}\,Nm^3$$

$$f_H = f_{H1} + f_{H2} - f_{H3} = (570{,}21 + 455{,}51 - 202{,}45)\frac{Nm^3}{EI_y} = \frac{823{,}27}{EI_y}\,Nm^3$$