

_____ :

90x90x5 (EN 10210-2:2006)

B.

_____ :

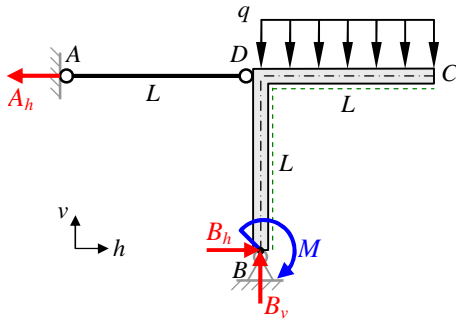
$q = 10 \text{ kN/m}; L = 1 \text{ m}; d = 0,008 \text{ m}; E = 2,1 \cdot 10^{11} \text{ Pa}.$

- _____ :
1. _____)
 2. _____ L.
- (AD) , N. (CD)
- (BD) , N, Q_z ,
- , ...

$$B = \frac{\partial U}{\partial M_\Phi} = \int_{L_1} \frac{N_1}{EA_1} \frac{\partial N_1}{\partial M_\Phi} dx + \int_{L_2} \frac{M_{y2}}{EI_{y2}} \frac{\partial M_{y2}}{\partial M_\Phi} dx + \int_{L_3} \frac{M_{y3}}{EI_{y3}} \frac{\partial M_{y3}}{\partial M_\Phi} dx. \quad (1)$$

$N, \quad 1, \quad 2$

3.



$$M_i = 0: \quad A_h L - qL^2/2 - M = 0; \quad A_h = qL/2 + M/L.$$

$$h_i = 0: \quad B_h - A_h = 0; \quad B_h = qL/2 + M/L.$$

$$v_i = 0: \quad B_v - qL = 0; \quad B_v = qL.$$

$$M_{Ai} = 0: \quad 3/2 \cdot qL^2 + M - B_v L - B_h L = 0$$

$$3/2 \cdot qL^2 + M - qL^2 - qL^2/2 - M = 0 \Rightarrow$$

4.

4.1. (AD), $x \in [0; L]$

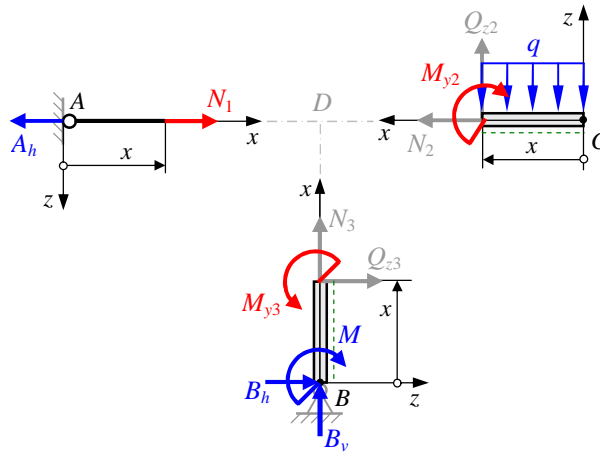
$$x_i = 0: \quad N_1 - A_h = 0; \quad N_1 = qL/2 + M/L; \quad N_1/L = 1/L.$$

4.2. (CD), $x \in [0; L]$

$$M_{y2} = 0: \quad M_{y2} + qx^2/2 = 0; \quad M_{y2} = -qx^2/2; \quad M_{y2}/L = 0.$$

4.3. (BD), $x \in [0; L]$

$$M_{y3} = 0: \quad M_{y3} + x \cdot B_h - M = 0; \quad M_{y3} = -x \cdot qL/2 - x \cdot M/L; \quad M_{y3}/L = 1 - x/L.$$



5.

(1) $\Delta_B = 0.$

$$B = \frac{1}{EA_1} \int_0^L N_1 \frac{\partial N_1}{\partial M_\Phi} dx + \frac{1}{EI_{y2}} \int_0^L M_{y2} \frac{\partial M_{y2}}{\partial M_\Phi} dx + \frac{1}{EI_{y3}} \int_0^L M_{y3} \frac{\partial M_{y3}}{\partial M_\Phi} dx;$$

$$B = \frac{1}{EA_1} \int_0^L \frac{qL}{2} \frac{1}{L} dx + \frac{1}{EI_y} \left[\int_0^L \left(-\frac{qx^2}{2} \right) \cdot 0 \cdot dx + \int_0^L \left(-\frac{qL}{2} x \right) \left(1 - \frac{x}{L} \right) dx \right];$$

$$B = \frac{1}{EA_1} \int_0^L \frac{q}{2} dx + \frac{1}{EI_y} \left[\int_0^L \frac{q}{2} x^2 dx - \int_0^L \frac{qL}{2} x dx \right] = \frac{1}{EA_1} \frac{qL}{2} + \frac{1}{EI_y} \left[\frac{q}{2} \frac{L^3}{3} - \frac{qL}{2} \frac{L^2}{2} \right];$$

$$B = \frac{1}{2} \frac{qL}{EA_1} - \frac{1}{12} \frac{qL^3}{EI_y}.$$

6.

$$A_1 = \frac{d^2}{4} = \frac{.0,008^2}{4} = 0,5027 \cdot 10^{-4} \text{ m}^2;$$

$$I_{y2} = I_{y3} = I_y = 200 \text{ cm}^4 = 200 \cdot 10^{-8} \text{ m}^4 \quad (90 \times 90 \times 5 \quad \text{EN 10210-2:2006});$$

$$B = \frac{1}{2} \frac{qL}{EA_1} - \frac{1}{12} \frac{qL^3}{EI_y} = \frac{10 \cdot 10^3 \cdot 1}{2 \cdot 2,1 \cdot 10^{11} \cdot 0,5027 \cdot 10^{-4}} - \frac{10 \cdot 10^3 \cdot 1^3}{12 \cdot 2,1 \cdot 10^{11} \cdot 200 \cdot 10^{-8}} = 0,0004736 - 0,001984;$$

$$B = -0,0015104 \text{ rad} = -0,0015104 \cdot \frac{180}{\pi} = -0^\circ 5' 11,54''.$$