Remarks: See §5.2.1, pages 282 till 285

Hint:

Sketch the moment and shear force diagrams. Sketch also the distribution normal and shear stress in a cross-section.

Answer:

a. $q = 11,2$ kN/m

b. $q = 10,0$ kN/m

c. The limiting value of the shear stress is indicative.

Explanation:

The normal stress is maximum in the edge of the middle cross-section, where $M = M_{max} = \frac{1}{8} q \ell^2$.

The shear stress is maximum in the central two joints and at the place of the supports where $V = V_{max} = \frac{1}{2} q \ell$

Cross-sectional properties (units in mm):

$$I_{zz} = \tfrac{1}{12} \times 120 \times (5 \times 40)^3 = 80 \times 10^6 \text{ mm}^4$$

$$\left| S_z^{(a)} \right| = 2 \times 40 \times 120 \times 60 = 576 \times 10^3 \text{ mm}^3$$

$$\left| \sigma_{max} \right| = \frac{\tfrac{1}{8} q (2000 \text{ mm})^2 (100 \text{ mm})}{80 \times 10^6 \text{ mm}^4} \leq 7 \text{ N/mm}^2 \implies q \leq 11,2 \text{ N/mm}$$

$$\left| \tau_{max} \right| = \frac{\tfrac{1}{2} q (2000 \text{ mm})(576 \times 10^3 \text{ mm}^3)}{(120 \text{ mm})(80 \times 10^6 \text{ mm}^4)} \leq 0,6 \text{ N/mm}^2 \implies q \leq 10 \text{ N/mm}$$