Remarks: See §5.4.2 example 1, pages 322 till 335

Answers:

a. The normal centre NC is located 200 mm left from the wide flange.

d. $\sigma_{\text{narrow flange}} = +61{,}8 \text{ N/mm}^2$

$\sigma_{\text{wide flange}} = -37{,}2 \text{ N/mm}^2$

e. $\tau_{\text{max;narrow flange}} = 3{,}0 \text{ N/mm}^2$

$\tau_{\text{max;wide flange}} = 5{,}25 \text{ N/mm}^2$

$\tau_{\text{max;}web} = 12{,}0 \text{ N/mm}^2$

Explanation:

c. $M_z$ varies linearly from -211,68 kNm to -13,23 kNm

$V_z = +66{,}15 \text{ kN}$, constant

$N = -66{,}15 \text{ kN}$, constant

d. $M_z = -145{,}3 \text{ kN}$ in this cross-section.

$$\sigma_{\text{narrow flange}} = \frac{(-66{,}15\times10^3 \text{ N})}{(15{,}75\times10^3 \text{ mm})} + \frac{(-145{,}53\times10^6 \text{ Nmm})(-400 \text{ mm})}{882\times10^6 \text{ mm}^6}$$

$$\sigma_{\text{wide flange}} = \frac{(-66{,}15\times10^3 \text{ N})}{(15{,}75\times10^3 \text{ mm})} + \frac{(-145{,}53\times10^6 \text{ Nmm})(200 \text{ mm})}{882\times10^6 \text{ mm}^6}$$

e. The shear stress distribution in the flanges varies linearly. It is maximum at the junction with the web:

$$\tau_{\text{max;narrow flange}} = \frac{(66{,}15\times10^3 \text{ N})(420\times10^3 \text{ mm}^3)}{(10{,}5 \text{ mm})(882\times10^6 \text{ mm}^4)} = 3 \text{ N/mm}^2$$

$$\tau_{\text{max;}wide\text{ flange}} = \frac{(66{,}15\times10^3 \text{ N})(735\times10^3 \text{ mm}^3)}{(10{,}5 \text{ mm})(882\times10^6 \text{ mm}^4)} = 5{,}25 \text{ N/mm}^2$$

Stress distribution in the web is parabolic with the maximum at the height of the NC:

$$\tau_{\text{max;web}} = \frac{(66{,}15\times10^3 \text{ N})(1680\times10^3 \text{ mm}^3)}{(10{,}5 \text{ mm})(882\times10^6 \text{ mm}^4)} = 12{,}0 \text{ N/mm}^2$$