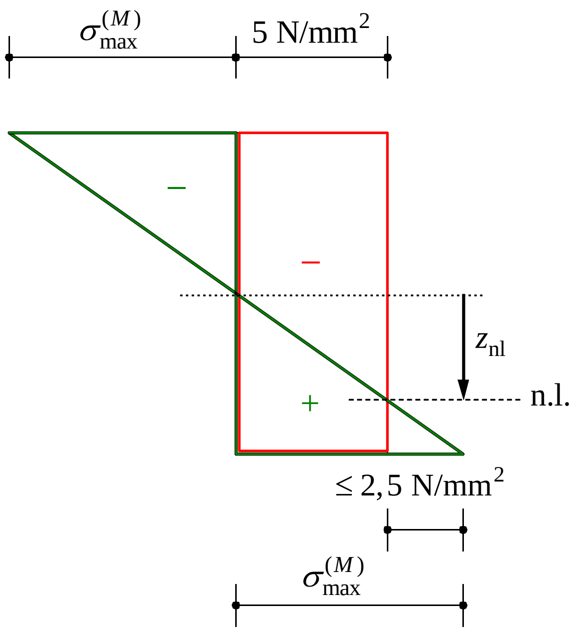
Remarks: See §4.4, pages 168 till 170

Answer:

a. $M_{\max} = 450 \text{ kNm}$

Explanation:



$$A = 360 \times 10^3 \text{ mm}^2 \text{ and } I = 24 \times 10^9 \text{ mm}^4$$

a. $\sigma^{(N)} = \dfrac{-1800 \times 10^3 \text{ N}}{360 \times 10^3 \text{ mm}^2} = -5 \text{ N/mm}^2$

$$\sigma_{\max}^{(M)} - (5 \text{ N/mm}^2) \leq 2,5 \text{ N/mm}^2$$

$$\sigma_{\max}^{(M)} = \frac{M \times (400 \text{ mm})}{24 \times 10^9 \text{ mm}^4} \leq +7,5 \text{ N/mm}^2 \Rightarrow M \leq 450 \text{ kNm}$$

b. linearly varies from $-12,5 \text{ N/mm}^2$ to $+2,5 \text{ N/mm}^2$

$$z_{\text{na}} = \tfrac{2}{3} \times (400 \text{ mm}) = 266,7 \text{ mm}$$

Remarks:

The opposite situation where stress at the top and compression at the bottom can also occur; in that case $z_{\text{na}} = -266,7 \text{ mm}$