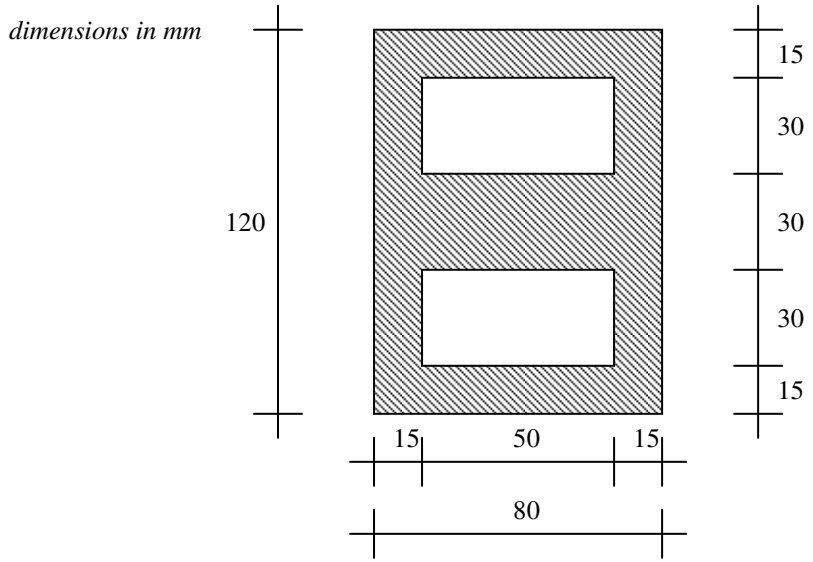
TU Delft

ASSIGNMENT 2

CROSS SECTION WITH HOLES



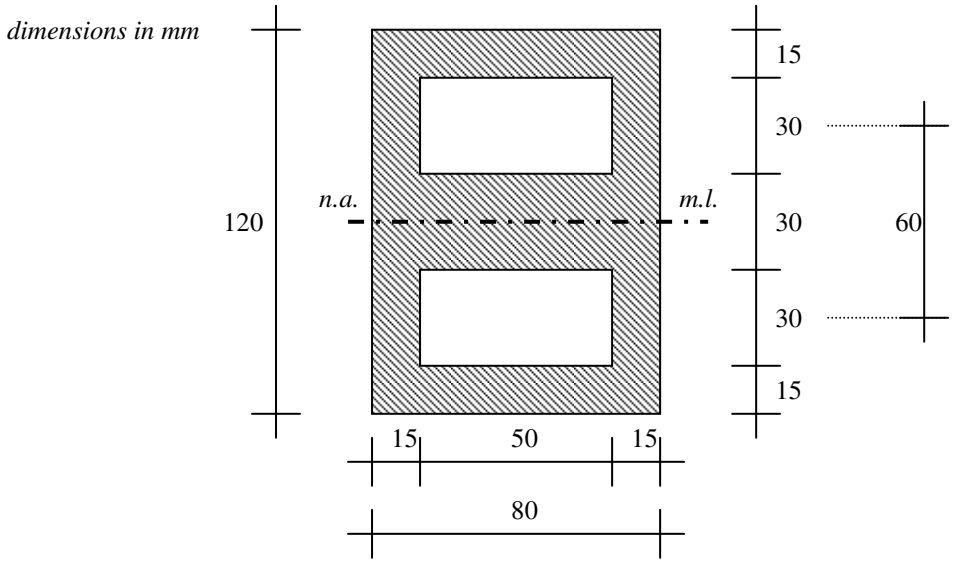
THIS ASSIGNMENT WILL BE DISCUSSED IN THE 7th WEEK

Question:

- Within which boundaries do you expect the shape factor to be in?
- Find the elastic and plastic moment capacity and the shape factor of this cross section

Answer:
$\alpha = 1{,}38$

SOLUTION



Elastic analysis:

$$I_{zz} = \tfrac{1}{12}\times 80\times 120^3 - 2\times\tfrac{1}{12}\times 50\times 30^3 - 2\times 50\times 30\times 30^2$$

$$I_{zz} = 859{,}5\times 10^4 \ mm^4$$

$$W = \frac{I_{zz}}{60} = 143{,}25\times 10^3 \ mm^3$$

Plastic analysis:

$$W_p = \tfrac{1}{4}\times 80\times 120^2 - 50\times 30\times 60 = 198\times 10^3 \ mm^3$$

Shape factor:

$$\alpha = \frac{M_p}{M_e} = \frac{W_p f_y}{W f_y} = \frac{198}{143{,}25} = 1{,}38$$

- Symmetrical cross section
  - Elastic analysis : *neutral axis*
  - Plastic analysis : *median line* (coincides in this example with the neutral axis)

- Massive cross section the shape factor is 1,5. Removing material in the elastic region will reduce the shape factor : $1{,}0 \le \alpha \le 1{,}5$.