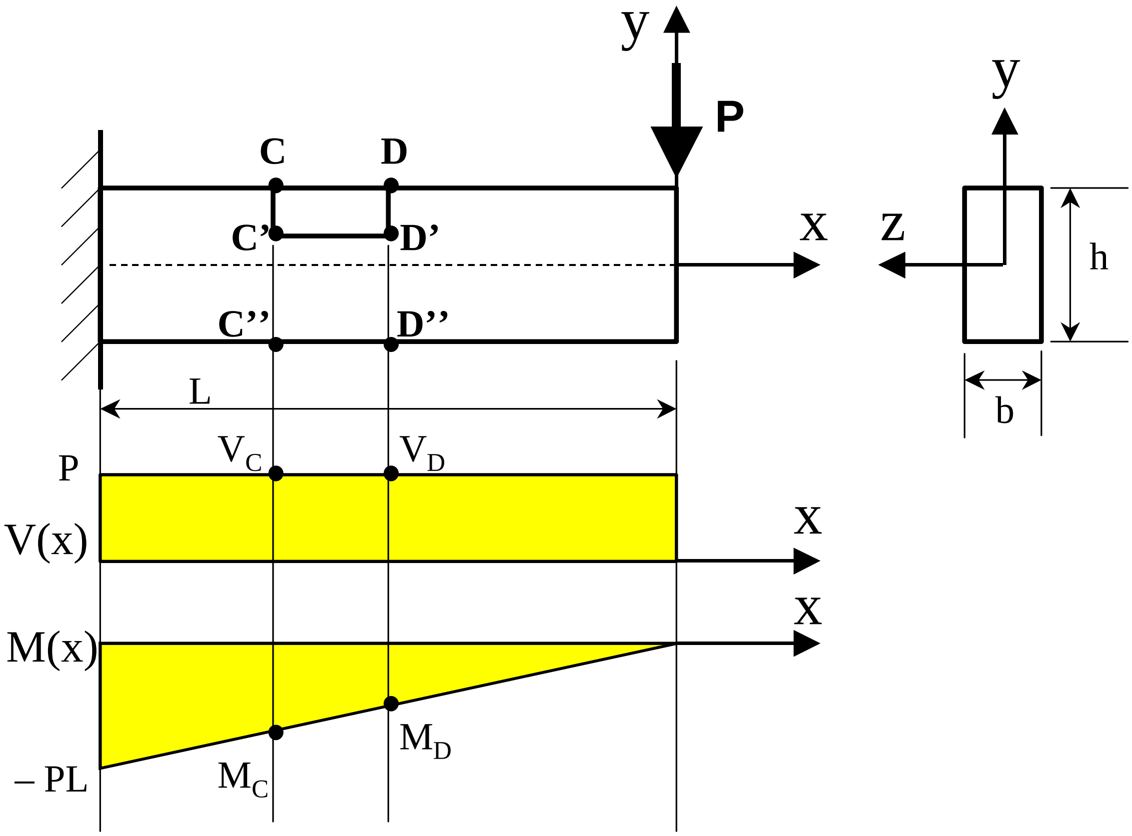
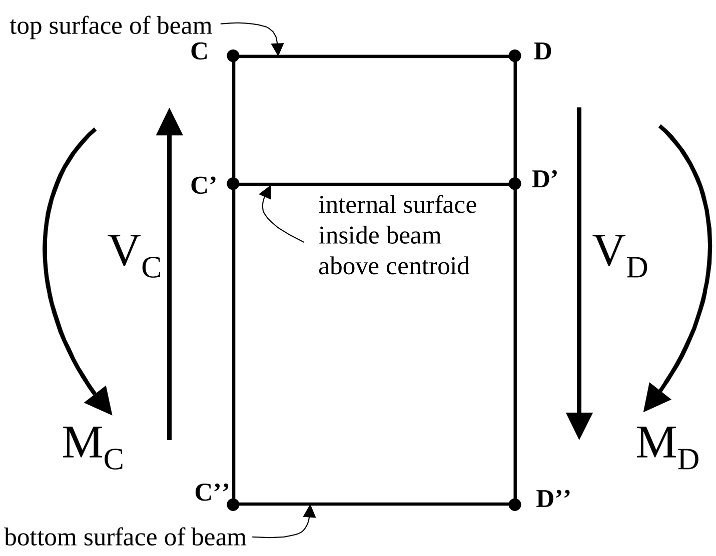
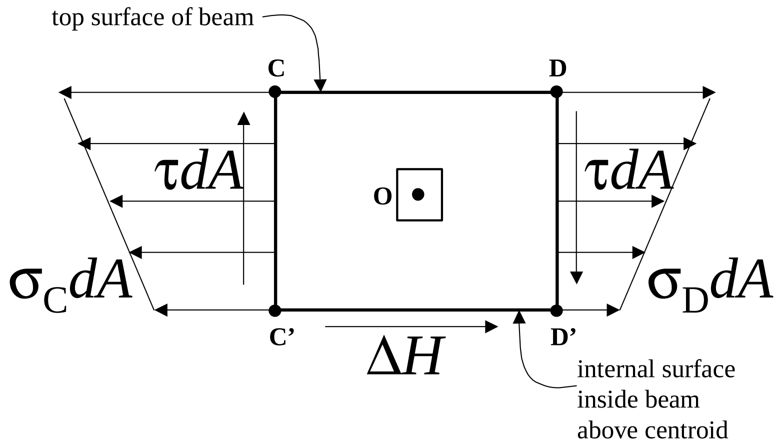
# Recap of Shear Stresses in Beams




Notice: $|M_C| > |M_D|$






$\Sigma F_x \neq 0$ unless you add $\Delta H$

($\Delta H$ is a horizontal shear force that acts along the cut where you want to find $q$ or $\tau$)

$$q = \frac{\Delta H}{\Delta x} = \frac{VQ}{I} = q \text{ = shear force per unit length}$$

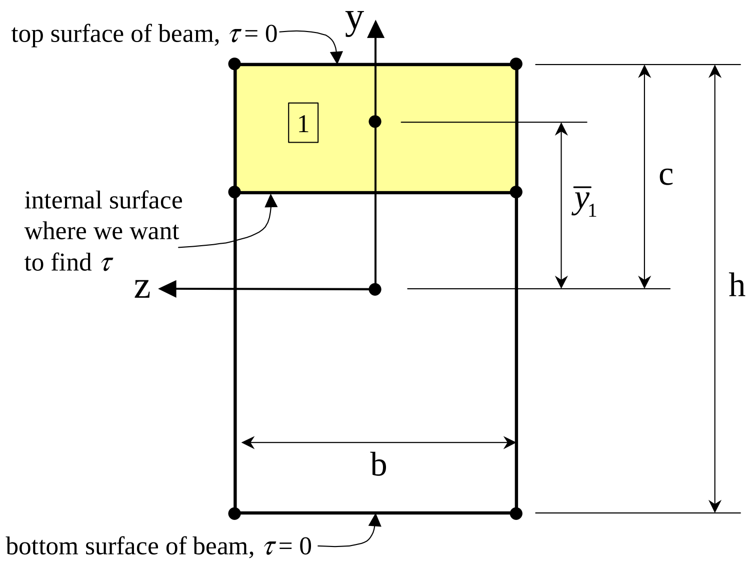
$$\tau = \frac{\Delta H}{\Delta A} = \frac{\Delta H}{t\Delta x} = \frac{q}{t} = \frac{VQ}{It} = \tau \text{ = shear stress}$$

$Q = A\bar{y}$, for the piece that falls off if shear is too large

$t$ = thickness of the cut(s) you make so a piece can fall off

$I$ is for the entire cross section

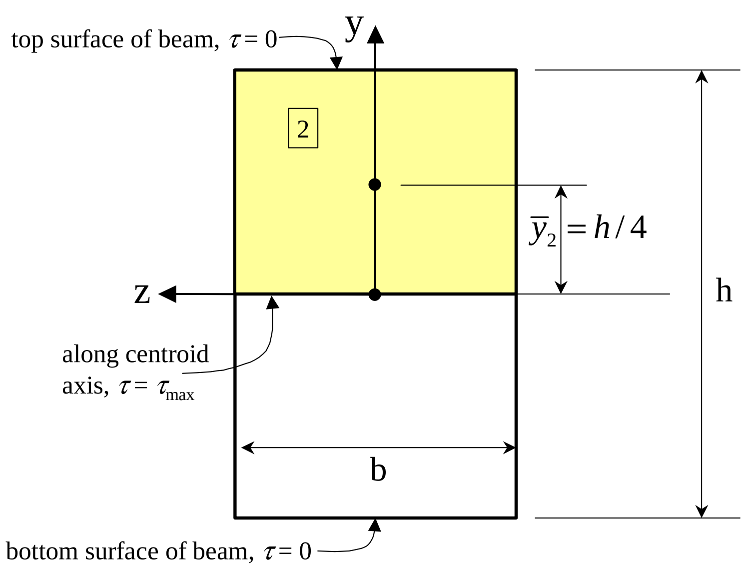
- This is the same $I$ you would use for the bending problem
- For rectangular cross sections, $I = bh^3/12$




$$\tau = \frac{VQ}{It} = \frac{VQ_1}{Ib}$$

$$Q_1 = A_1\bar{y}_1$$

$$I = \frac{1}{12}bh^3$$




$$\tau_{max} = \frac{VQ_{max}}{It} = \frac{VQ_2}{Ib}$$

$$Q_2 = A_2\bar{y}_2$$

$$I = \frac{1}{12}bh^3$$

<u>Nail problems</u> (given: $F_{all}$ for a nail, $s$ = nail spacing)

$$F_{all} \times (\text{number of nails}) = qs = VQs/It$$

<u>Bolt problems</u> (given: $\tau_{all}$ for the bolt material, $s$ = bolt spacing, $r$ = bolt radius)

$$\tau_{all} = \frac{F_{all}}{\pi r^2} \quad , \quad F_{all} \times (\text{number of bolts}) = qs = VQs/It$$