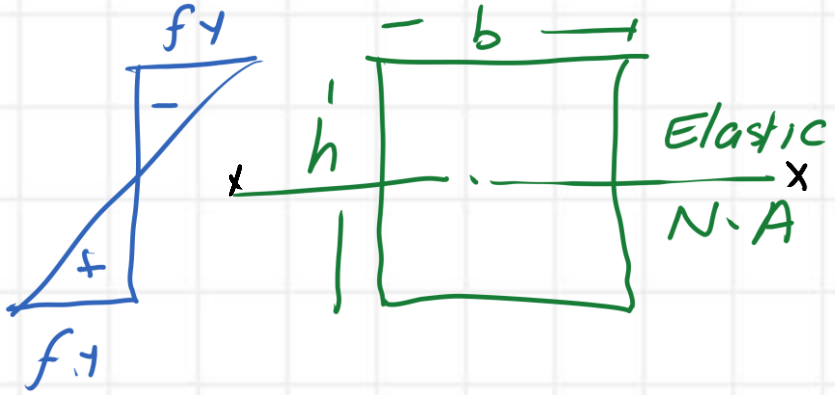
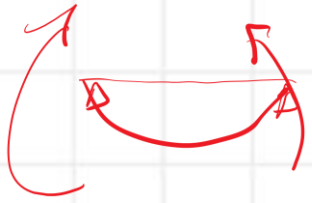




Estimation of elastic section modulus S_x

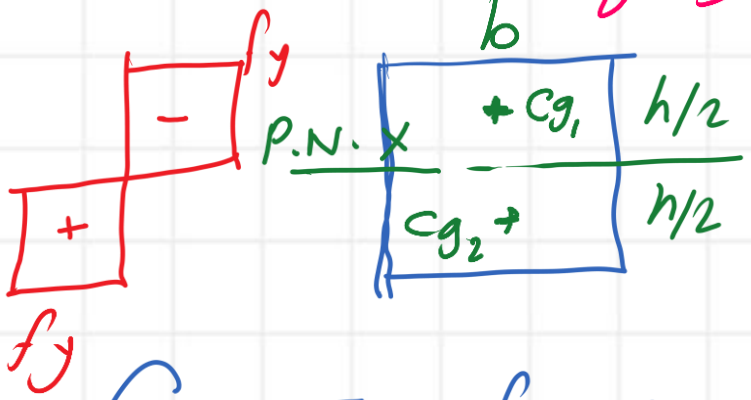
$$f_y = \frac{M_y\, y}{I_x} \qquad y = \frac{h}{2},\ I_x = \frac{bh^3}{12}$$

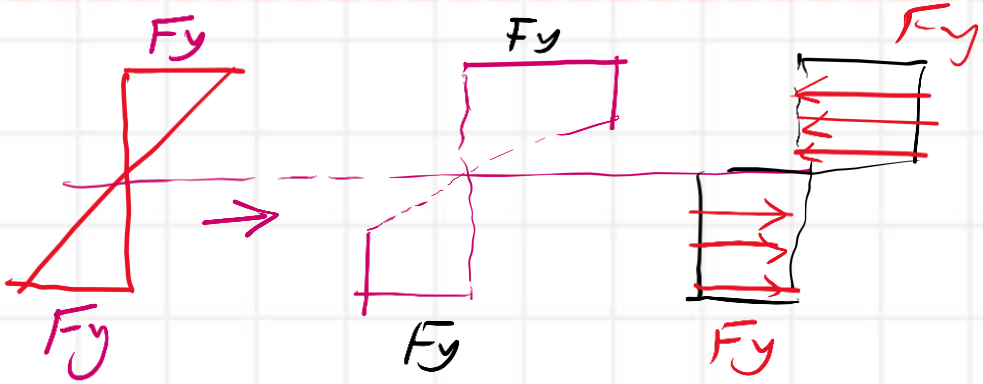
$$f_y = M_y \cdot \frac{h}{2}\left(\frac{1}{\frac{bh^3}{12}}\right) = M_y \cdot \left(\frac{1}{\frac{bh^2}{6}}\right) = \frac{M_y}{S_x}$$

$$S_x = \frac{M_y}{f_y} = \frac{bh^2}{6}$$

For Rectangular section.

Plastic section Modulus Z_x & Shape Factor





C_p

$y_{c.t}$

T_p

$M_p = C_p \cdot y_{c.t} = T_p \cdot y_{c.t}$

$C_p = T_p = f_y \cdot \frac{A}{2}$

$y_{c.t} = 2\left(\frac{h}{4}\right) = \frac{h}{2}$

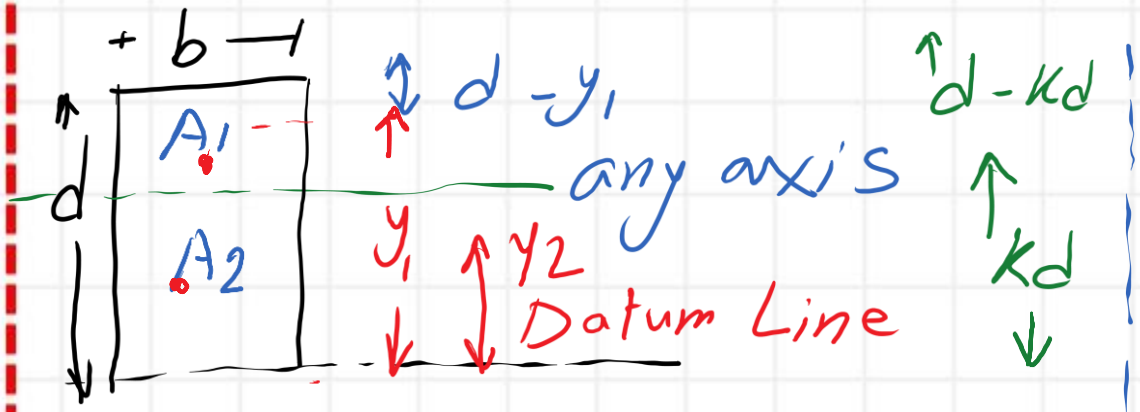
$M_p = C \cdot y_{c.t} = f_y \left(\frac{A}{2}\right)\left(\frac{h}{2}\right)$

For a Form of

$M_p = f_y \cdot Z_x$ → $Z_x = \left(\frac{A}{2}\right) 2\bar{y}$ → For half Area

$Z_x = Ah/4 = \frac{bh^2}{4}$

Shape factor $= \frac{Z_x}{S_x} = \frac{bh^2}{4}\left(\frac{6}{bh^2}\right) = 1.5$ For a rectangular section



① Take any axis with distance kd From the datum

② $A_1 = (d - kd)\,b = d\,(b)(1-k)$

$$y_1 = \left(kd + \frac{d}{2} - \frac{kd}{2}\right)$$

$$= \frac{1}{2}(kd + d) = \frac{d}{2}(k+1)$$

$$A_1 y_1 = \frac{bd^2}{2}(1-k)(1+k) = \frac{bd^2}{2}(1-k^2)$$

③ $A_2 = (b)(kd)$

$$y_2 = \frac{kd}{2}$$

$$A_2 \cdot y_2 = \frac{b k^2 d^2}{2}$$

$$\Sigma A\bar{y} = \frac{bd^2}{2}(1-k^2) + \frac{b}{2}k^2d^2$$

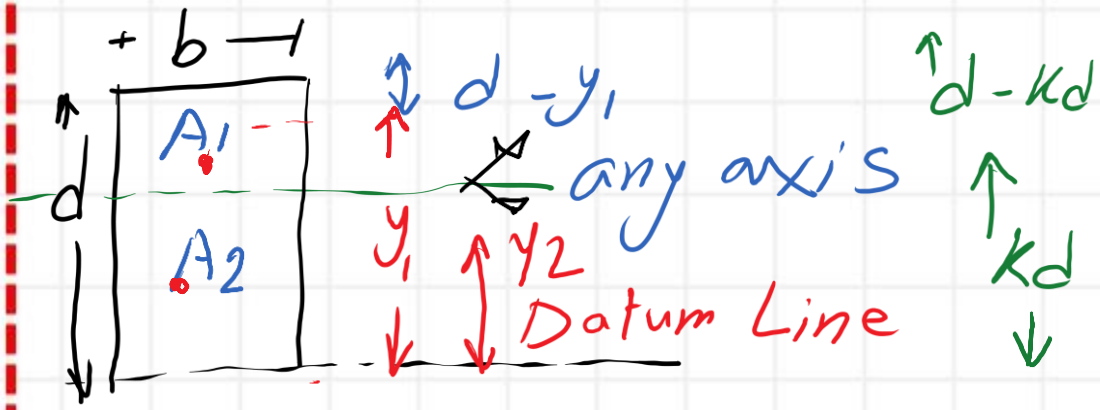
$$\Sigma A\bar{y} = \frac{bd^2}{2}$$

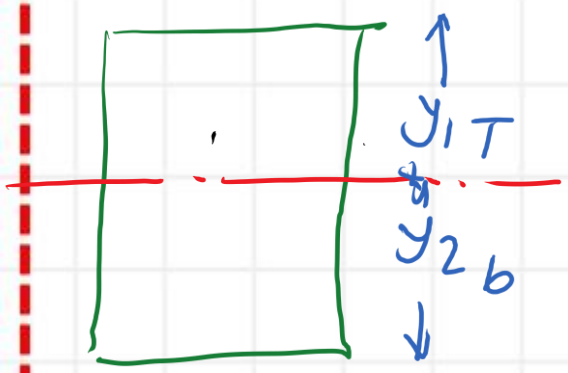
$$\Sigma A = bd$$

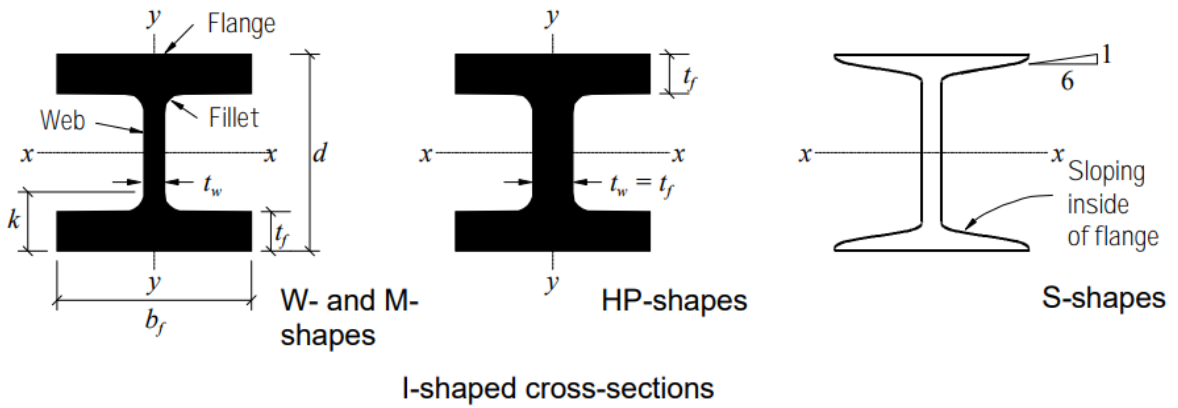
$$\bar{y} = \frac{bd^2}{2}\left(\frac{1}{bd}\right) = \frac{d}{2}$$

Sx: Elastic section modulus

S_x : Elastic Section modulus



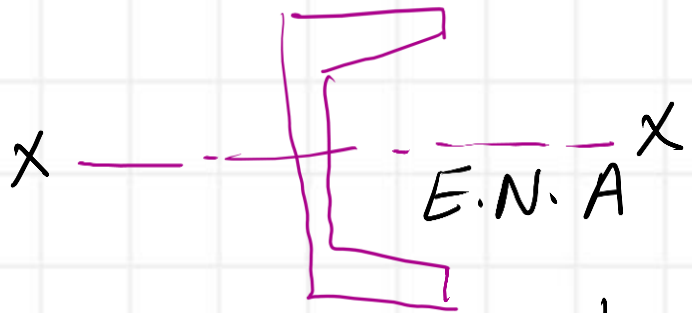




I-shaped cross-sections

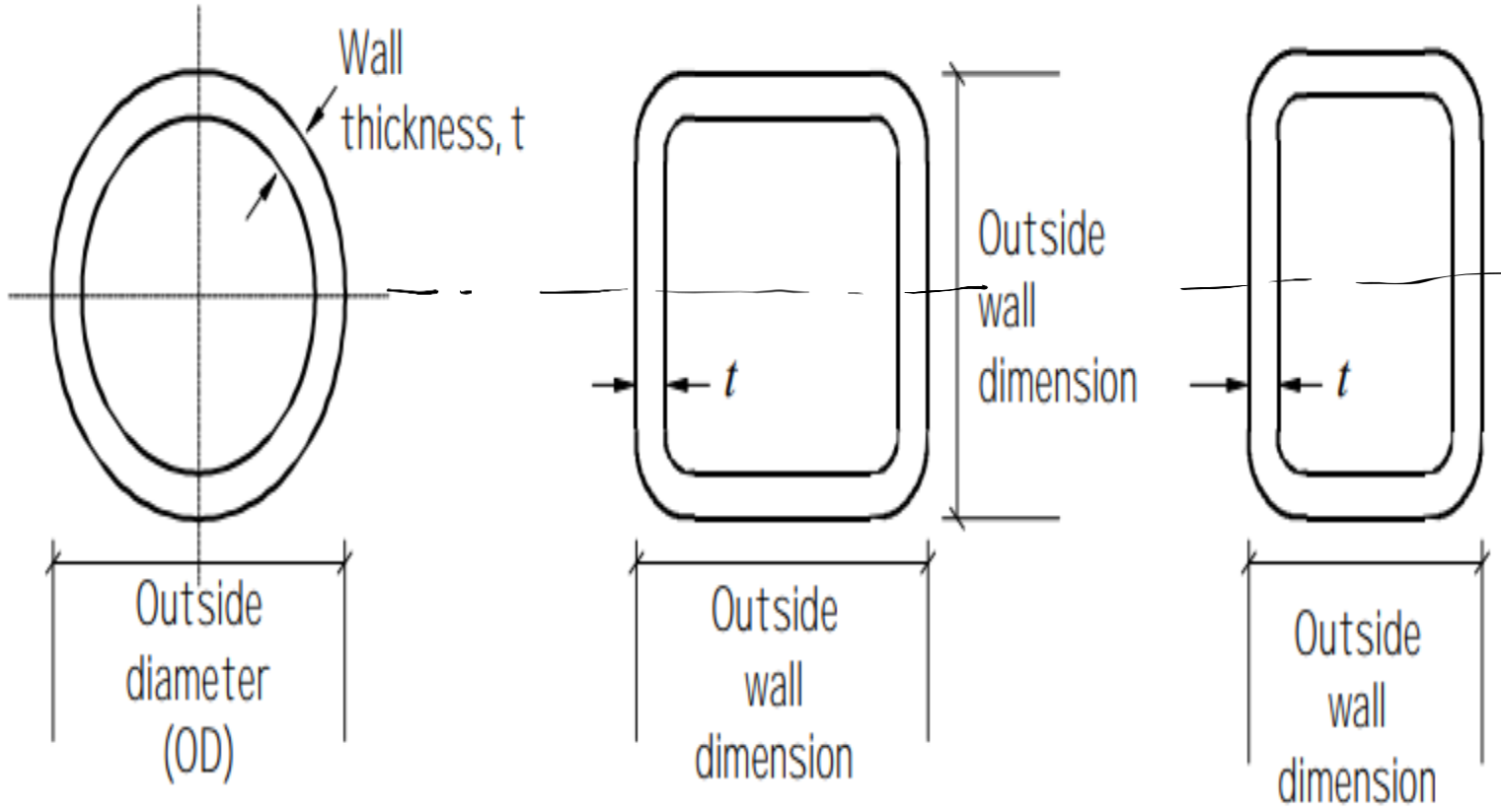
$$I_x = \frac{bd^3}{12} \quad , \quad y_{1T} = y_{2b} = \frac{d}{2}$$

$$S_x = \frac{I_x}{y_{max}} = \frac{bd^3}{12}\left(\frac{1}{d/2}\right) = \frac{bd^2}{6}$$



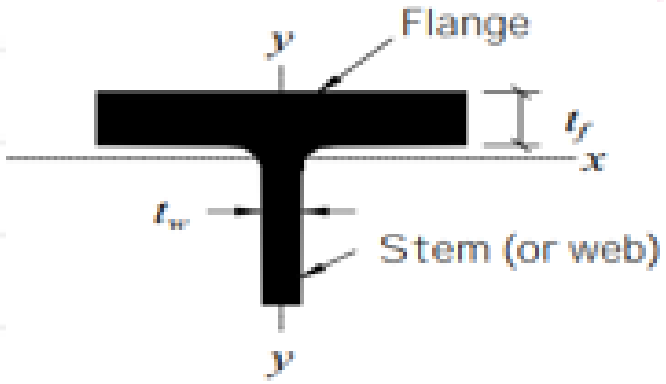
C shape

Tubular products



Circular tube or pipe

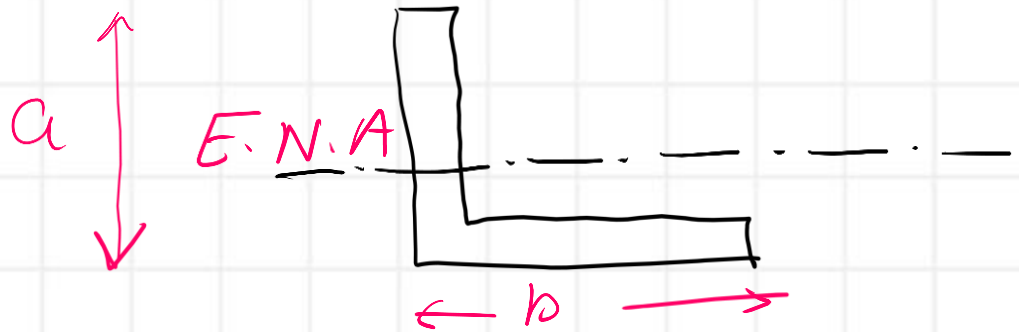
Square and rectangular structural tubing



Tees (WT-shapes)

L singly symmetric about y-axis

E.N.A will not divide the shape at the middle



unequal angle

b > a