FLESSIONE UNIFORME → il momento flettente è costante.

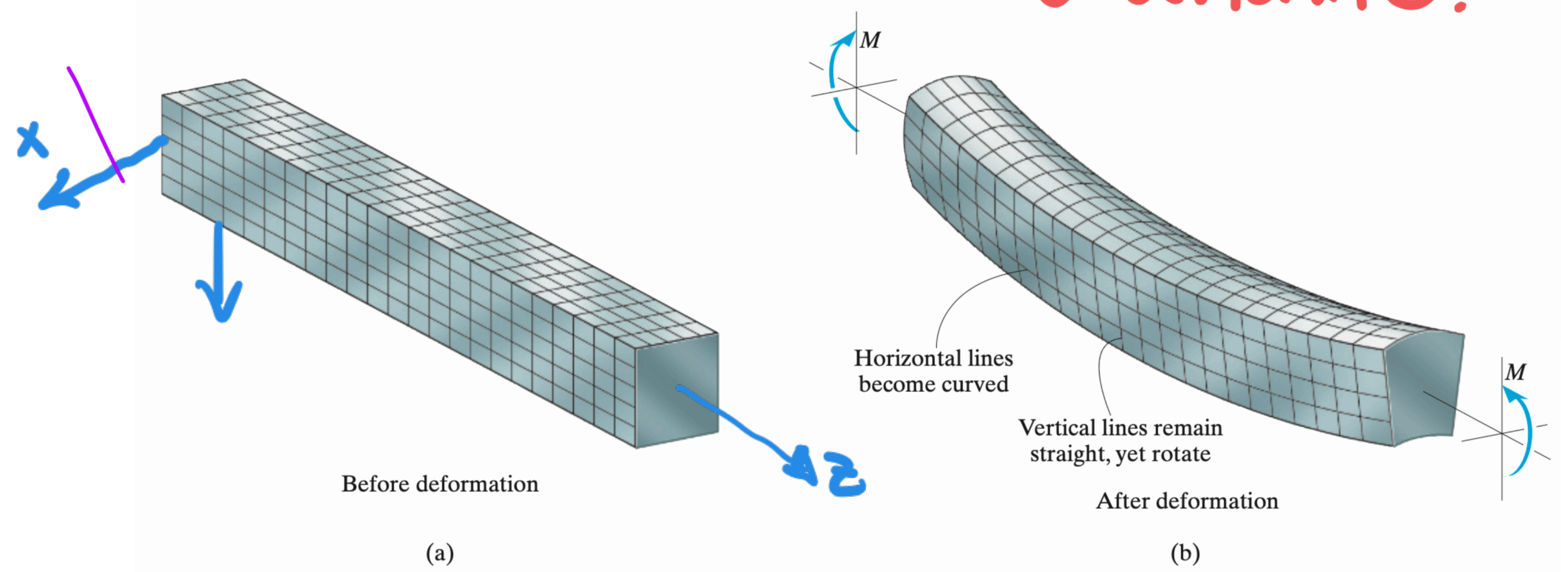
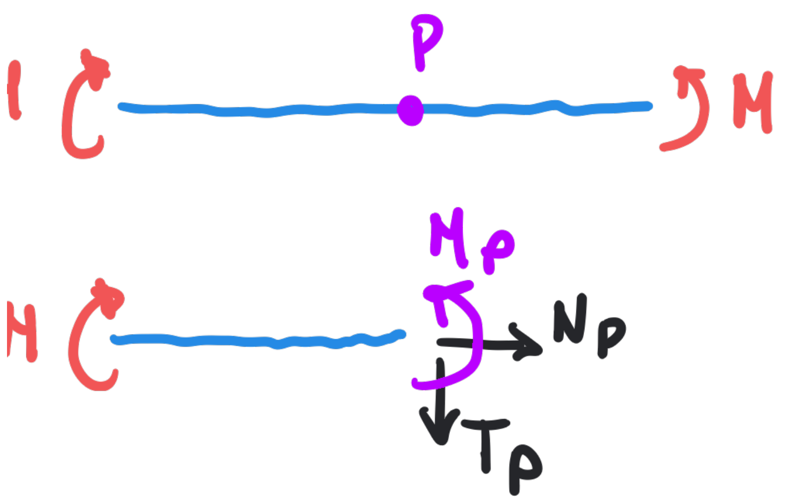
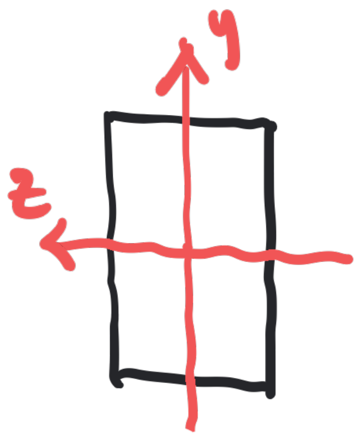


Fig. 6–19



$M_p = M$ (costante)

$N_p = T_p = 0$

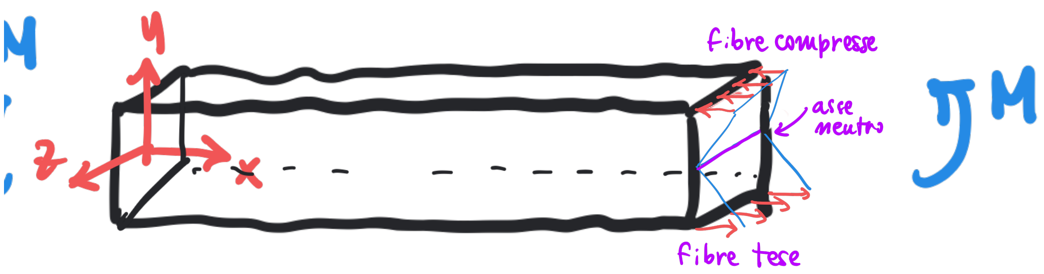


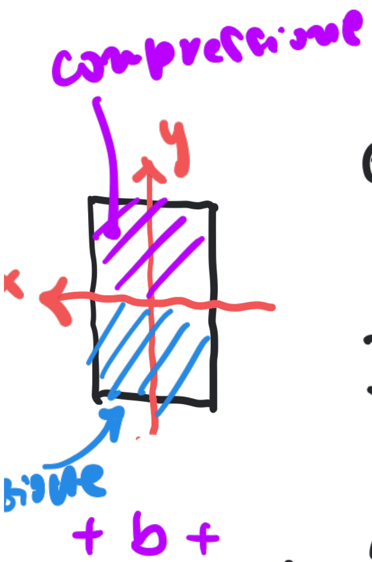
$$\sigma = -\frac{M}{I} y$$

$$I = \int_A y^2 \, dA$$

Momento d'inerzia rispetto all'asse z

tato tensionale in una trave inflessa





$$\sigma = -\frac{M}{I}\, y$$

$$I = \int_A y^2\, dA$$

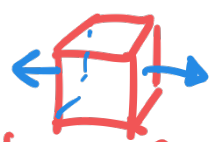
momento d'inerzia rispetto all'asse x.

Sezione rettangolare

$$I = \frac{1}{12} b h^3$$

$\sigma = 0$ per $y = 0$ (asse neutro)

- Lo stato tensionale è uniassiale

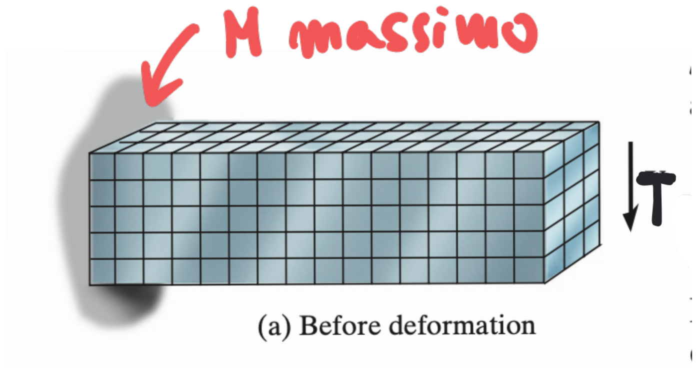


- I punti più sollecitati sono quelli più lontani dall'asse neutro

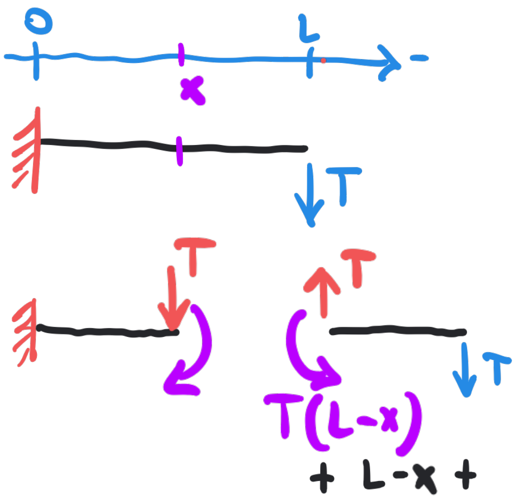
Rif: Casini-Vasta eq. 18.10
Hibbeler, eq. 10.7.

Attenzione: Hibbeler orienta l'asse y verso l'alto, e dunque nella sua formula compare un segno −.

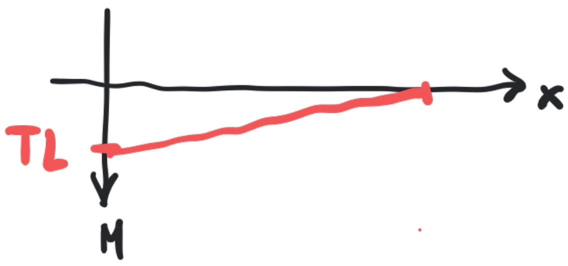
Flessione e taglio



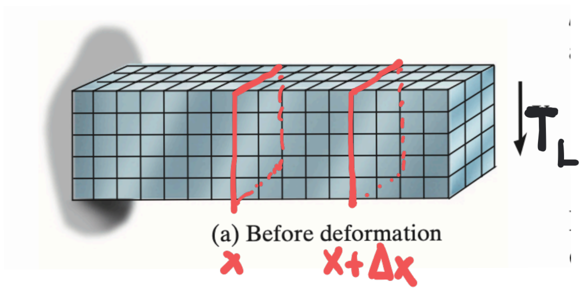
Schema strutturale



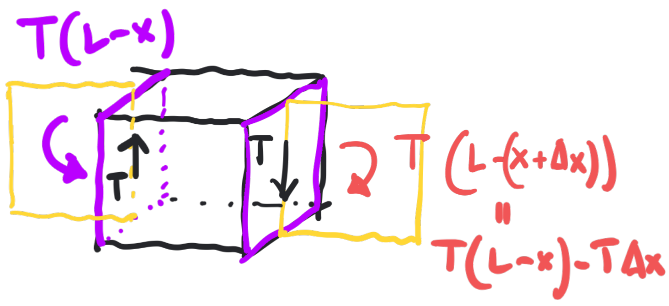
NB: una sollecitazione di taglio è sempre accompagnata da un momento flettente.



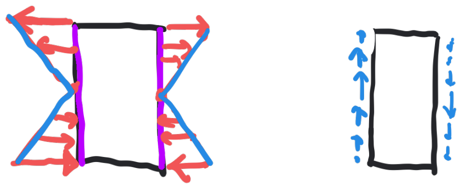
Flessione e taglio

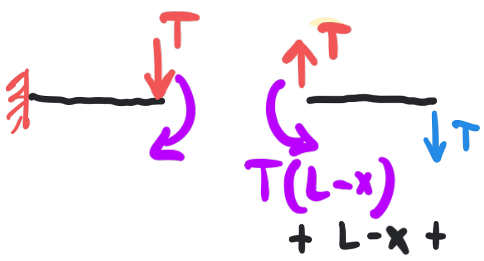


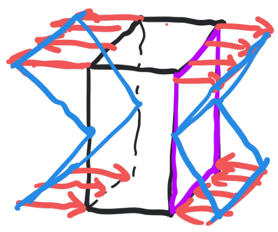
(a) Before deformation

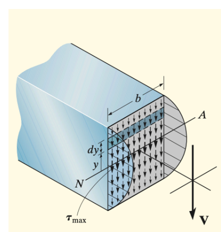


Schema strutturale

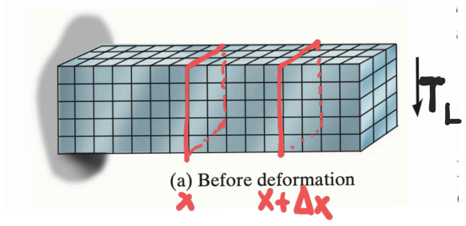




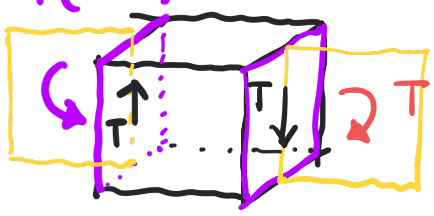



Shear-stress distribution

Flessione e taglio

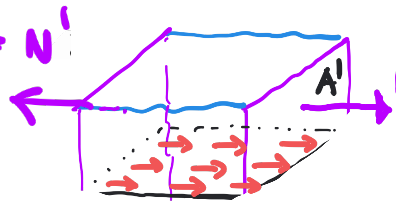


$T(L-x)$



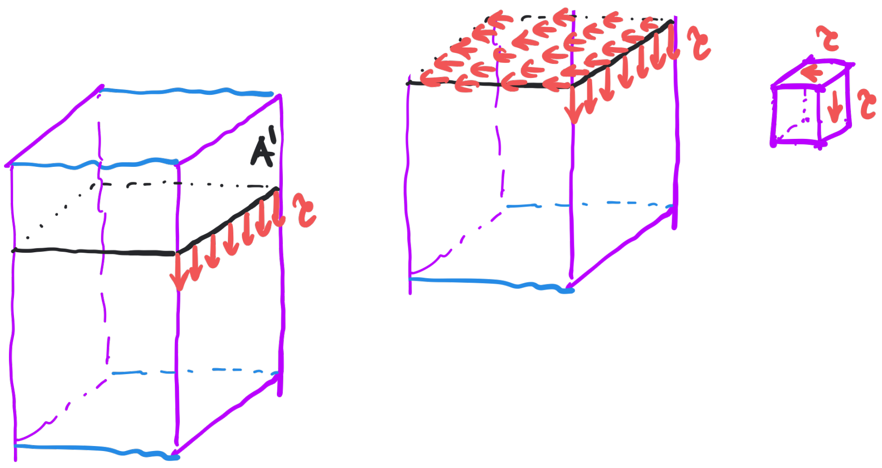
$T(L-(x+\Delta x))$
$\parallel$
$T(L-x)-T\Delta x$

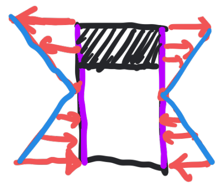
$$\int_{A'} \frac{T(L-x)}{I}\, y\, dA = \int_{A'} \sigma\, dA = N'$$

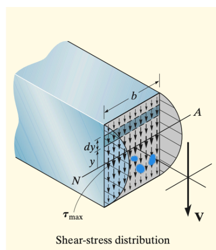


$$N' = \int_{A'} \sigma\, dA = \int_{A'} \frac{T(L-x)-T\Delta x}{I}\, y\, dA$$

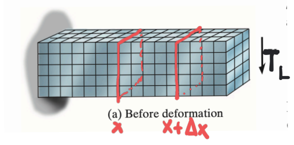
reciproci

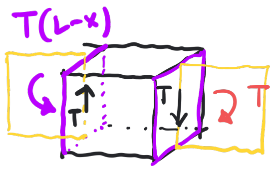




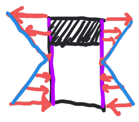


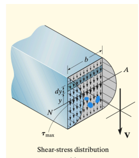
FORMULA DI JOURAWSKY



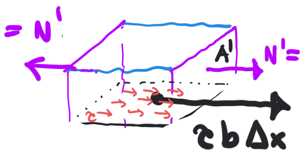


$T(L-(x+\Delta x)) = T(L-x) - T\Delta x$





$$\int_{A'} \frac{T(L-x)}{I} y\, dA = \int_{A'} \sigma\, dA = N'$$



$$N' = \int_{A'} \sigma\, dA = \int_{A'} \frac{T(L-x) - T\Delta x}{I} y\, dA$$

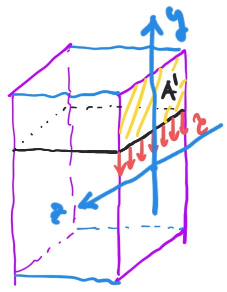
$\rightarrow \sum F_x = 0$

$$\tau b \Delta x - \cancel{\frac{T}{I}(L-x)\int_{A'} y\, dA} + \cancel{\frac{T}{I}(L-x)\int_{A'} y\, dA} - \frac{T}{I}\Delta x \int_{A'} y\, dA = 0$$

$$\tau = \frac{T}{bI} A' \bar{y}'$$

spessore della corda

area della regione sopra la corda

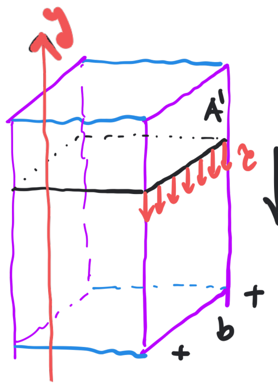


$\int_{A'} y\, dA = \bar{y}'$ baricentro di A'

FORMULA DI JOURANSY

$$\tau = \frac{T}{bI} A'\bar{y}'$$

area delle regione sopra la corda



T $\int_{A'} y\,dA = \bar{y}'$ baricentro di A'

NOTAZ. ITALIANA

CASINI-VASTA (21.11)

$$\tau = -\frac{T_y}{s}\frac{S^*}{I_x}$$

$$S^* = A'y'$$

NOTAZIONE AMERICANA

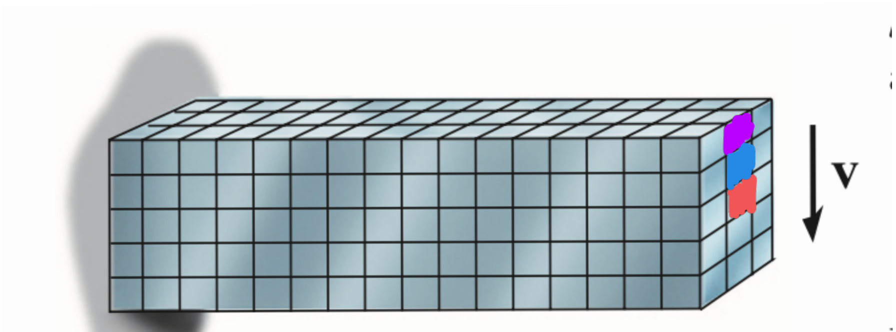
HIBBELER (11.3)

$$\tau = \frac{VQ}{It} \qquad Q = \bar{y}'A'$$

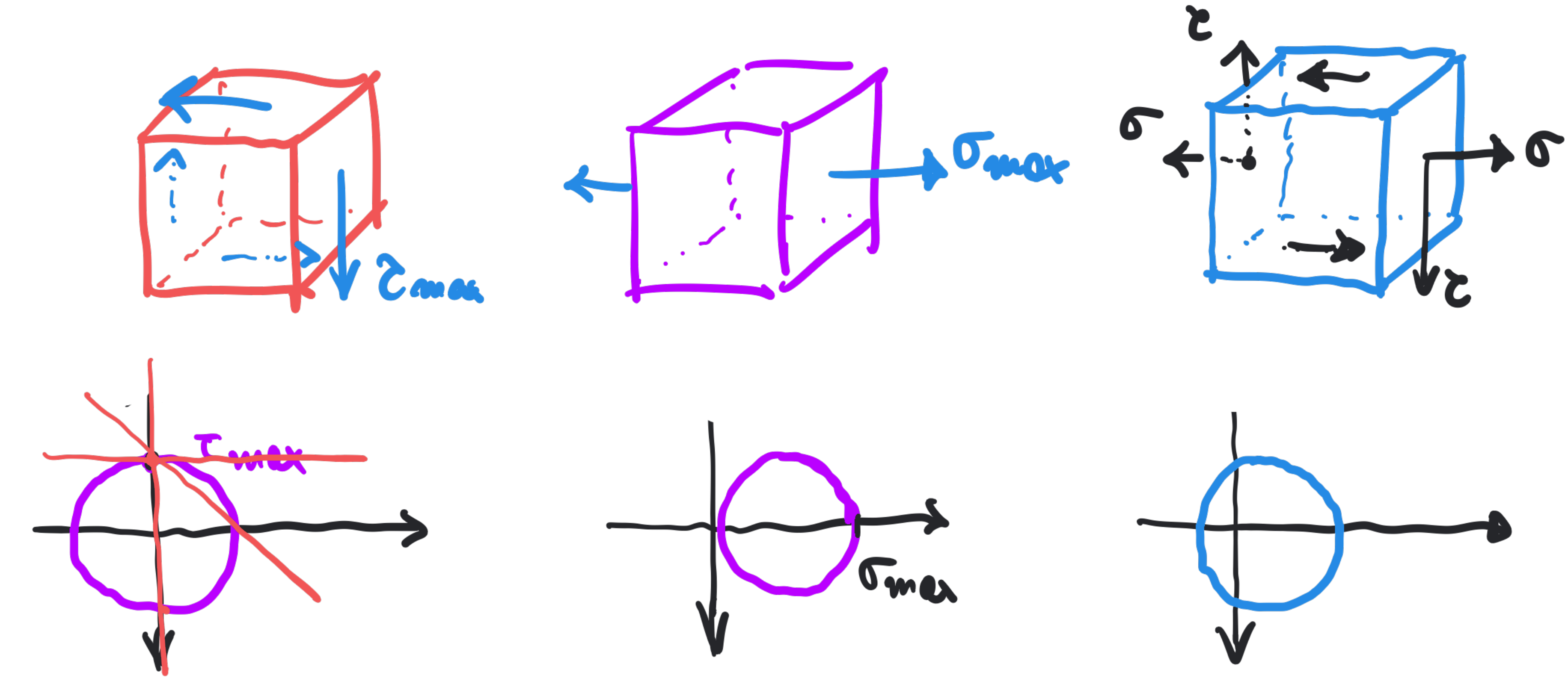
spessore corda

LA DISCREPANZA di segno è dovuta al fatto che H. orienta l'asse y verso l'alto

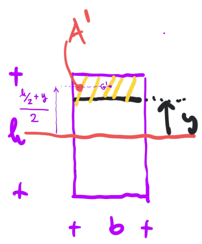
Stato tensionale



(a) Before deformation



TENSIONI TANGENZIALI NELLA SEZIONE RETTANGOLARE



$$\tau = \frac{T}{bI} A' \bar{y}'$$

area della regione sopra la corda

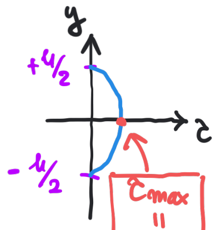
$$\int_{A'} y \, dA = \bar{y}' \quad \text{baricentro di } A'$$

$$A' = \left(\frac{h}{2} - y\right) b$$

$$\bar{y}' = \frac{1}{2}\left(\frac{h}{2} + y\right)$$

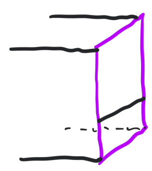
$$I = \frac{1}{12} b h^3$$

$$\tau = \frac{1}{2} \frac{T}{b \frac{1}{12} b h^3} \left(\frac{h}{2} + y\right)\left(\frac{h}{2} - y\right) b = \frac{6T}{bh^3}\left(\frac{h^2}{4} - y^2\right)$$



$$\boxed{\tau_{max} = \frac{3}{2} \frac{T_y}{bh}} = \frac{3}{2}\frac{T}{A}$$

$$\frac{T}{A} < \frac{3}{2}\frac{T}{A}$$



In una sezione rettangolare le tensioni tangenziali medie hanno andamento parabolico, e attingono il loro valore massimo in corrispondenza della corda media

Stimare τ_{max} con la formula $\tau_{max} = T/A$ produce una sottostima di τ_{max} del 30%.