# Elastic Twisting of Solid Noncircular Sections

The assumptions stated above for circular cross sections no longer apply for noncircular sections. Mainly, transverse cross sections <u>warp</u> during twisting of shafts with solid noncircular sections.

The <u>theory</u> of elasticity can be used to derive the formulas for $\gamma$ and $\Phi$. This is beyond the scope of this course.
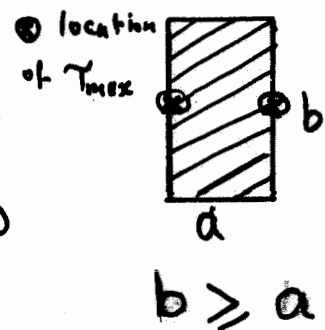
↓ for different noncircular shapes such as:

rectangle  ; triangle 

ellipse  ; thick-walled closed 

$\vdots$

etc.
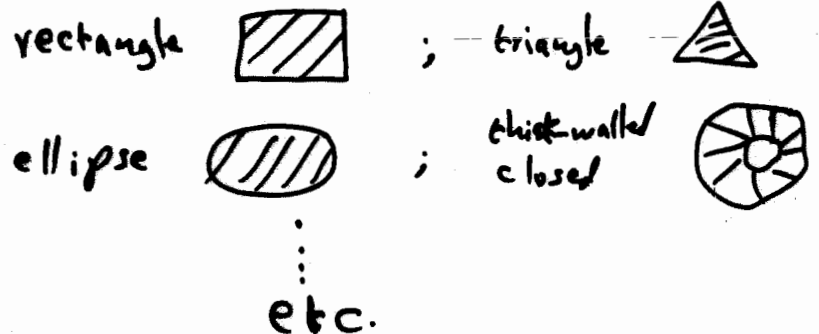
The formulas for rectangular cross sections will be stated below without prove. For other shapes, one can see other references.

$$\tau_{max} = \frac{T}{\alpha \, b a^2}$$

← $\tau_{max}$ only !

at <u>middle</u> of <u>long leg</u>

⊗ location of $\tau_{max}$



$b \geqslant a$

$$\frac{d\Phi}{dz} = \frac{T}{\beta b a^3 G}$$

$$\Phi = \frac{T L}{\beta b a^3 G}$$

$\alpha$ and $\beta$ are obtained from the table given, by knowing $\frac{b}{a}$ ratio.

⊗ <u>Very important</u> : $b \geqslant a \implies \frac{b}{a} \geqslant 1$