Factors affecting the selection of materials:

(1) - Mechanical and physical properties , service requirements and processing :

To select a suitable material for specific conditions, all mechanical and physical properties, *e.g.*,

- strength, (for example :)

❖ *(Torsion of Rectangular section) :*

. Rectangular sections

Detailed analysis of the torsion of non-circular sections which includes the warping of cross-sections is beyond the scope of this text. For *rectangular shafts*, however, with longer side d and shorter side b, it can be shown by experiment that the maximum shearing stress occurs at the centre of the longer side and is given by

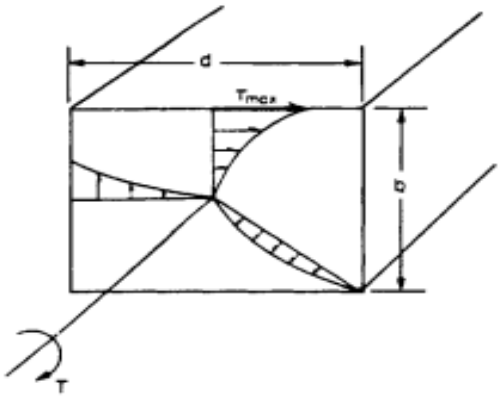
$$\tau_{max} = \frac{T}{k_1 d b^2}$$

where k_1 is a constant depending on the ratio d/b and given in Table below.

Table . Table of k_1 and k_2 values for rectangular sections in torsion' .

d/b	1.0	1.5	1.75	2.0	2.5	3.0	4.0	6.0	8.0	10.0	∞
k_1	0.208	0.231	0.239	0.246	0.258	0.267	0.282	0.299	0.307	0.313	0.333
k_2	0.141	0.196	0.214	0.229	0.249	0.263	0.281	0.299	0.307	0.313	0.333

The essential difference between the shear stress distributions in circular and rectangular members is illustrated in Fig. , where the shear stress distribution along the major and minor axes of a rectangular section together with that along a "radial" line to the corner of the section are indicated. The maximum shear stress is shown at the centre of the longer side, as noted above, and the stress at the corner is zero.



i.e. $$\tau_{max} = \frac{T}{\sum k_1 d b^2}$$

and $$\frac{\theta}{L} = \frac{T}{G \sum k_2 d b^3}$$

and for d/b ratios in excess of 10, $k_1 = k_2 = \frac{1}{3}$, so that

$$\tau_{max} = \frac{3T}{\sum d b^2}$$

$$\frac{\theta}{L} = \frac{3T}{G \sum d b^3}$$

Example :

ملاحظة : جميع الامثلة و حلولها تم تناولها داخل المحاضرة و هي مهمة

Example :

Determine of key materials when :