CIV102 - STRUCTURES and MATERIALS

Topic: Timber!

1) Timber → Engineered Wood Product

Advantages	Disadvantages
Light	Burns
Reasonably Strong	Splinters
Cheap	Rot
Easily Change Shape	Warp
	Higher variability in strength than other materials } Uncertainty

Isotropic → Steel
Anisotropic → Wood

Size effect
→ Allowable stress depends on size of member (larger = stronger)

2) Types of Wood

Hardwood → Oak
Softwood → Pine

Appendix D

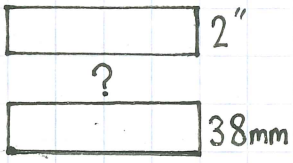
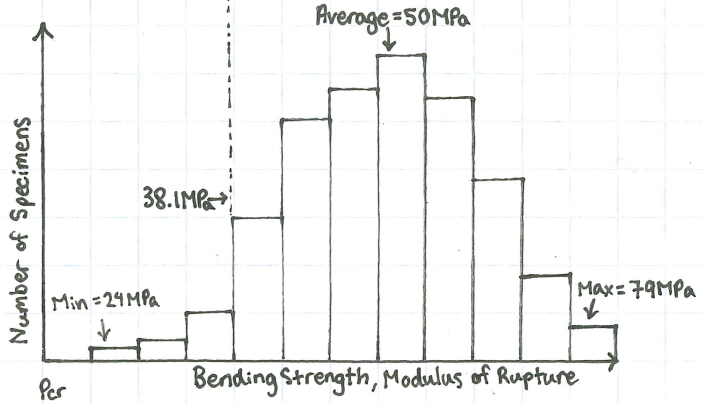
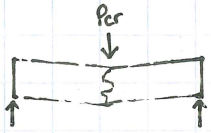


Table - D

5th percentile → Strength That is higher than 5% of all test values

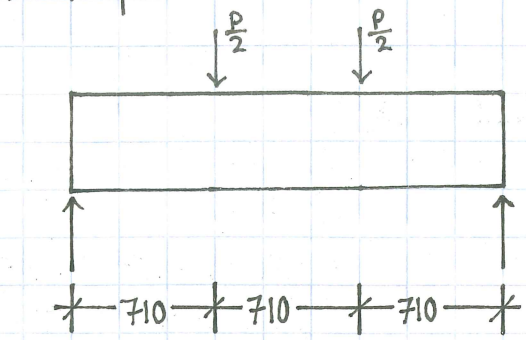


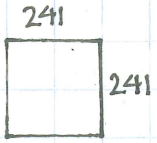


$\frac{My}{I}$ = Modulus of Rupture

Bending Stress
Shear Stress
} Divide by F.O.S. = 1.5 to set allowable stresses

3) Example

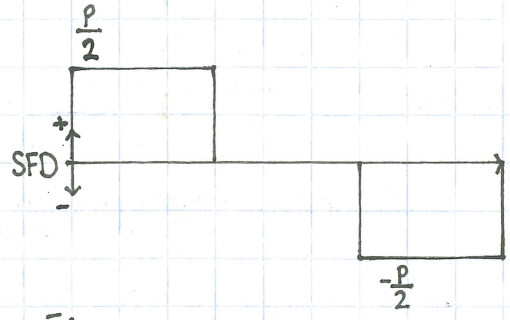


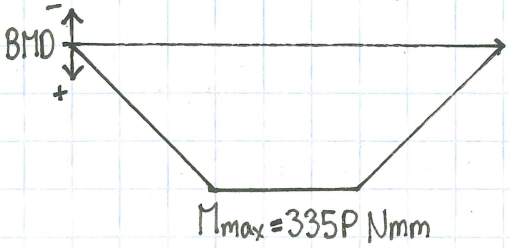


Douglas Fir
- Bending Strength = 24 MPa
- Shear Strength = 1.1 MPa

$$\text{Allowable Bending} = \frac{24}{1.5} = 16\,\text{MPa}$$

$$\text{Allowable } \tau_{xy} = \frac{1.1}{1.5} = 0.73\,\text{MPa}$$





What is max safe value of P?

Check Bending

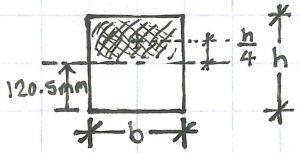
$$I = \frac{bh^3}{12} = 281 \times 10^6\,\text{mm}^4$$

$$\sigma_{\text{Allowable}} = \frac{My}{I}$$

$$16 = \frac{355P \cdot 241}{2 \cdot 281 \times 10^6} \Rightarrow P = 105\,\text{kN}$$

Check Shear

$$\tau_{xy,\text{allow}} = \frac{VQ}{Ib} = 0.73$$



$$Q = Ad$$

$$Q = \frac{bh}{2} \cdot \frac{h}{4} = \frac{bh^2}{8}$$

$$Q = 1750 \times 10^3\,\text{mm}^4$$

$$0.733 = \frac{VQ}{Ib}$$

$$0.733 = \frac{P \cdot 1750 \times 10^3}{2 \cdot 281 \times 10^6 \cdot 241} \Rightarrow P = 56.7\,\text{kN}$$

∴ Member limited in safe load by shear to P = 56.7kN