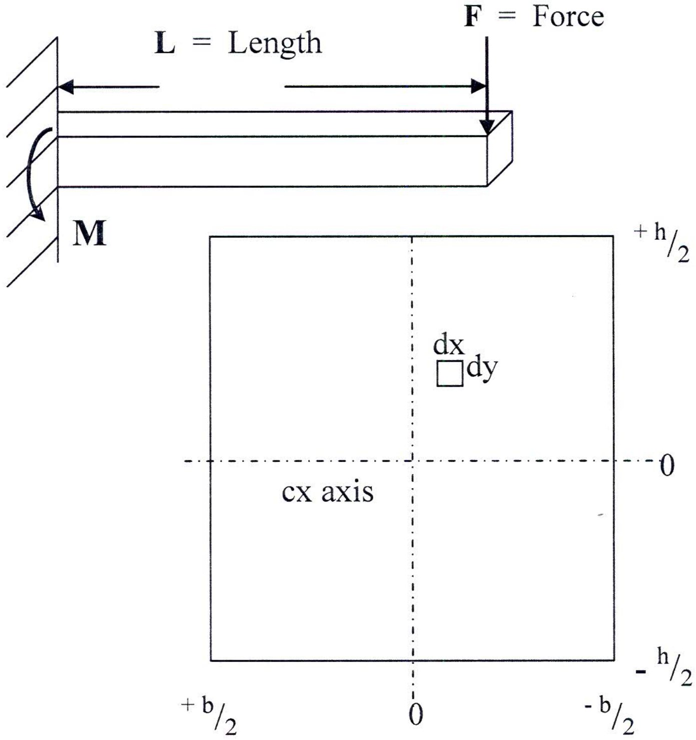
Modulus of Rupture of a Rectangular Wooden Beam

(**MOR** is an index of the rupture strength of a material in bending)



M = Moment = **F x L**

Cross-sectional area of a wooden beam with respect to the x-axis about the centroid (i.e. cx axis)

I = Moment of Inertia is a term used to describe the capacity of a cross-section to resist bending. It is always considered with respect to a reference axis and is a mathematical property of a section concerned with surface area and how that area is distributed about the reference axis. The reference axis is usually a centroidal axis. The Area Moment of Inertia of a beams cross-sectional area measures the beams ability to resist bending. The larger the Moment of Inertia the less the beam will bend.

$$I_{cx} = \int y^2\, dA = \int_{-b/2}^{+b/2} \int_{-h/2}^{+h/2} y^2\, dy\, dx$$

$$I_{cx} = \int_{-b/2}^{+b/2} \left[y^3/3 \right]_{-h/2}^{+h/2} dx = \int_{-b/2}^{+b/2} \left[h^3/24 - (-h^3/24) \right] dx$$

$$I_{cx} = h^3/12 \int_{-b/2}^{+b/2} dx = h^3/12 \, [\, x \,]_{-b/2}^{+b/2} = b\, h^3/12$$

$$\textbf{MOR} = M / (I_{cx} / d)$$

MOR = Modulus of Rupture

d = distance from neutral axis to extreme fiber

I_{cx} / d is referred to as the sectional modulus

$$\textbf{MOR} = F \times L / ((bh^3/12) / h/2) = \mathbf{F \times L / (bh^2/6)}$$