SHAFTING, HOLLOW vs. SOLID

SECTION MODULUS = $\frac{I}{c}$

Where I **= Moment of Inertia**

c **= Distance to extreme fiber**

Hollow Shaft **: O.D.= 6.625", I.D. = 5.761" (6" Sch40) 28.57 pounds/ft**

Moment of inertia for hollow shaft = $0.049087 \times \left(OD^4 - ID^4\right)$ **= 40.4904**

Section modulus for hollow shaft = $\frac{0.049087 \times \left(OD^4 - ID^4\right) \times 2}{OD}$ **= 12.2**

4.99" dia. Solid Shaft: 66.65 pounds/ft

Moment of inertia for *4.99" solid shaft* = $0.785398 \times R^4$ **= 30.4349**

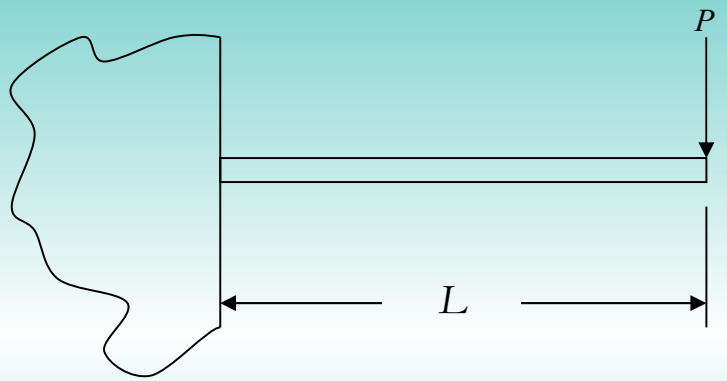
Section modulus for *4.99" solid shaft* = $\frac{0.785398 \times R^4}{R}$ **= 12.2**

(57% material savings for the same section modulus)

SHAFTING, HOLLOW vs. SOLID

DEFLECTION

Deflection on simple cantilevered beam:



Max Deflection = $\frac{Pl^3}{3EI}$

Where *P* = 50 lbs

***L* = 100 inches**

***E* = 30,000,000 psi**

***I* = Moment of Inertia inches^4**

Hollow Shaft Deflection = $\frac{50lbs \times 100^3 in}{3 \times 30{,}000{,}000 \times 40.4904}$ ***= 0.01372”***

4.99” Solid Deflection = $\frac{50lbs \times 100^3 in}{3 \times 30{,}000{,}000 \times 30.4349}$ ***= 0.01825”***

(33% more deflection)