Circular Tube Supported Floor System

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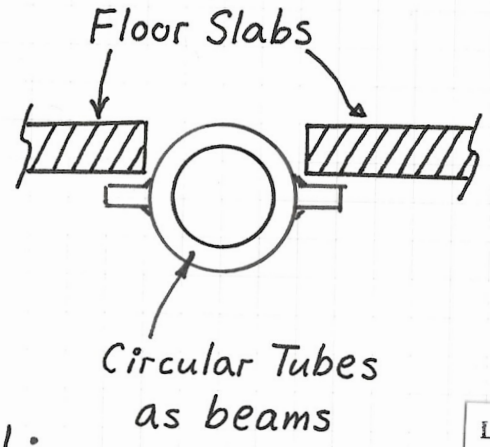
⇒ circular tube itself is most effective for resisting torsion.

⇒ As seen from the picture in the lower right, for the same amount of material; the J-value is much, much larger than, say, an open I-section.

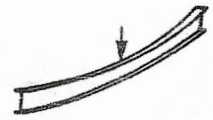
⇒ Circular sections can prevent open sections' main mode of failure, which is lateral torsional buckling.

⇒ An advantage of using circular beams is that we don't need additional lateral bracings. This leads to further cost-savings.



Main Failure Mode of Beams

Lateral torsional buckling	Failure occurs by a combination of lateral deflection and twist, the load at which this occurs being dependent upon the proportions of the beam, the way the loading is applied and the support conditions provided



St. Venant Torsion (2)

Closed Shape:

$$J \approx \frac{4\bar{A}^2 t}{\bar{U}}$$

$\bar{U}$ = median circumference
$\bar{A}$ = area enclosed by $\bar{U}$

Circular Hollow Shape:

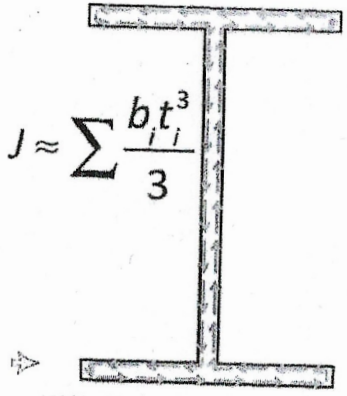
$t = 0.25''$, $A = 3.84\ \text{in}^2$

$D = A/(\pi t) = 4.90''$

$$J = \frac{4(\pi \bar{D}^2/4)^2 t}{\pi \bar{D}} = 22.95\ \text{in}^4$$

Open Shape:

$$J \approx \sum \frac{b_i t_i^3}{3}$$



W8x13 (t_f=0.23", t_w=0.26"):

$A = 3.84\ \text{in}^2$

$J = 0.0871\ \text{in}^4$

Factor of 264...closed sections rule in torsion!