

Second Moment of Area

Civil Engineering

Why depth beats bulk in a section.

Bending stiffness depends on how far material sits from the neutral axis, not on how much there is.

Rectangle $I = bd^3/12$ · Circle $I = \pi d^4/64$ · Parallel axis $I = I_0 + Ah^2$

b 200, d 400 mm

$bd^3 \div 12$.

$I \approx 1.07 \times 10^9 \text{ mm}^4$

Same beam laid flat

Four times weaker.

$I \approx 2.67 \times 10^8 \text{ mm}^4$

Double the depth

$I \propto d^3$.

I rises 8 times

THE COMMON MISTAKE

✗ **Adding I values about their own axes**

✓ **Shift each part to the common axis**

Second moments only add about a shared axis. Apply the parallel axis theorem, $I_0 + Ah^2$, to every part before summing a built-up section.

Educational reference. I is geometry alone. Stress and deflection checks built on it are code work.