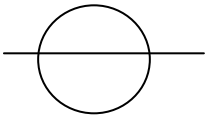
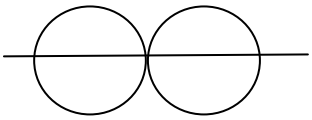
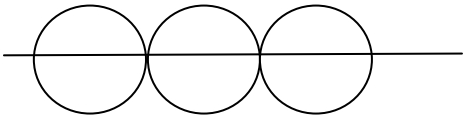
Second Moments of Areas (I) for common built-up spaghetti beams
(Straight line indicates axis of rotation, d = diameter of single spaghetti strand)



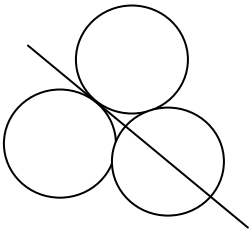
$$I = \frac{\pi d^4}{64}$$



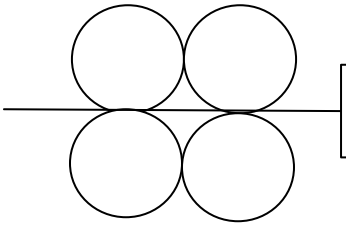
$$I = \frac{\pi d^4}{32}$$



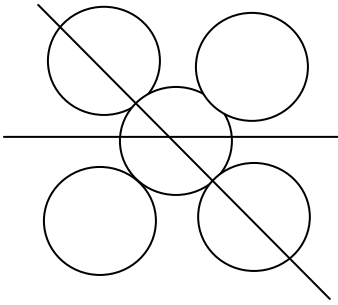
$$I = \frac{3\pi d^4}{64}$$



$$I = \frac{11\pi d^4}{64}$$

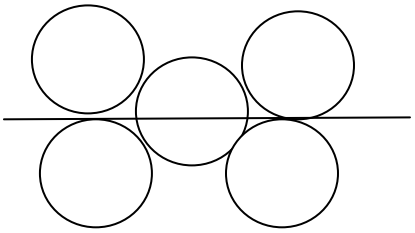


$$I = \frac{10\pi d^4}{32}$$

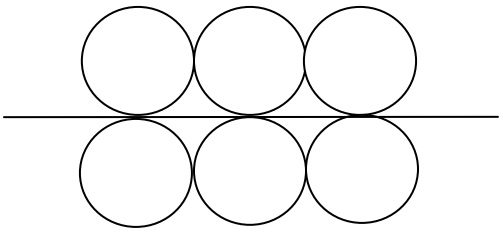


$$I = \frac{37\pi d^4}{64}$$

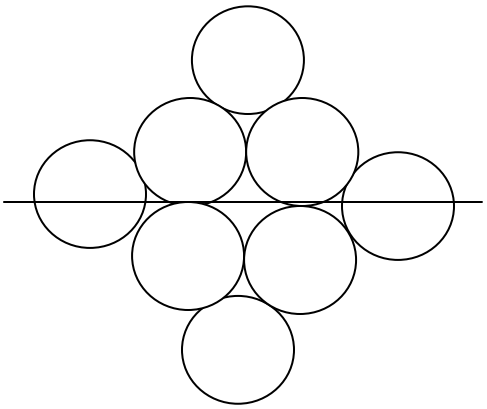
(Both axis shown give same I)



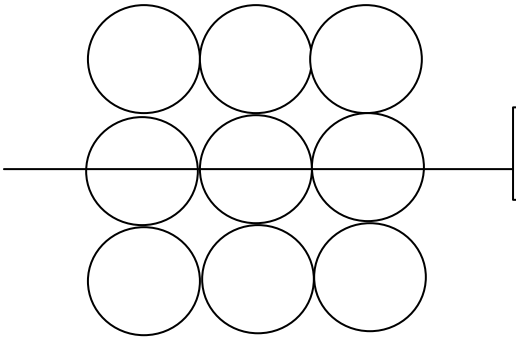
$$I = \frac{21\pi d^4}{64}$$



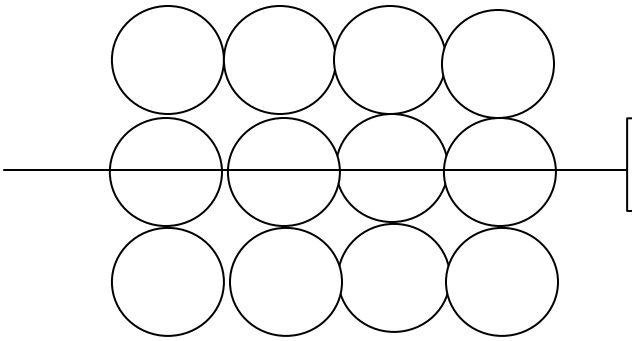
$$I = \frac{15\pi d^4}{32}$$



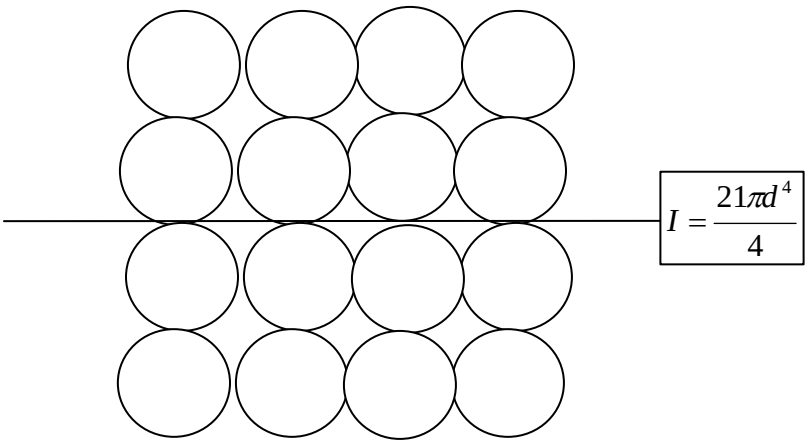
$$I = \frac{83.8\pi d^4}{64}$$



$$I = \frac{105\pi d^4}{64}$$



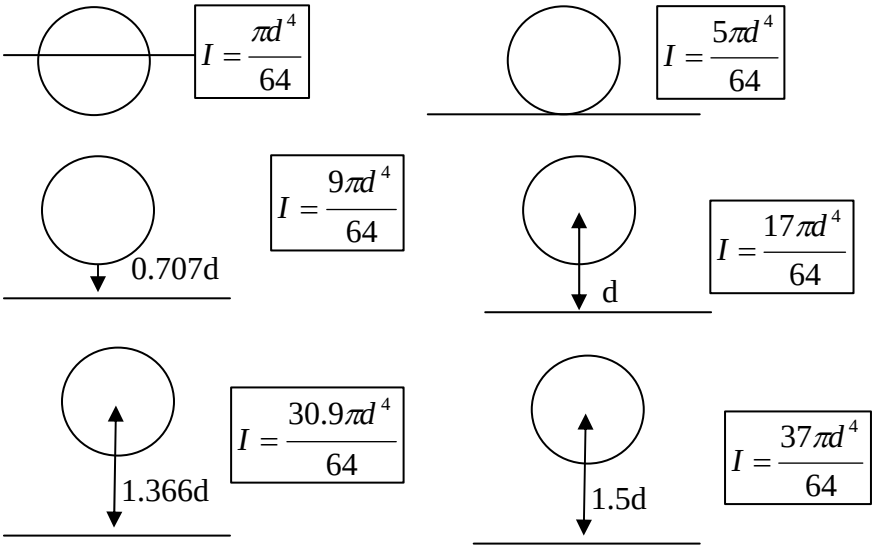
$$I = \frac{35\pi d^4}{16}$$



Caveat: Are the strands perfectly fixed to each other? You'll probably epoxy the strands every couple of inches, so there might be some slippage. This might lower the effective I

Explanation: Calculation of I from Components

You can calculate the I for built-up beams by adding the I's of the individual components, as long as the I's are all relative to the same axis. The built up beams above are all combinations of circles rotating relative to 6 different axes.



Where the straight line in each diagram is the axis of rotation. The first moment of area is for a circle about its centroid. The remaining I's are calculated using the parallel axis rule:

$$I_z = I_c + Al^2$$

Where I_z is the moment of area about a parallel axis, I_c is the moment of area about the centroid (the center for symmetrical areas), A is the area of the circle, and l is the distance between the axis about the centroid and the new axis. Note that l is given in the figures in terms of d, the diameter of the circle.