

The Sponge I-Beam

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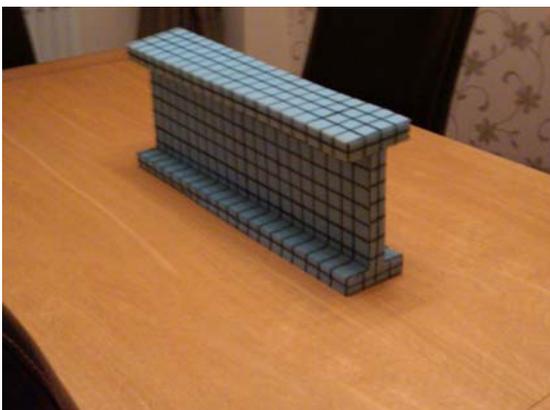
Inspired by the sponge beam with the simple square cross-section which has frequented Structural & Stress Analysis and Steel & Concrete Structures lectures for the past three years, I have therefore decided to create an I-Beam version for purposes of demonstration to the 1st, 2nd and 3rd Years of the future the bending, torsional and lateral-torsional deformation of an I-Beam.

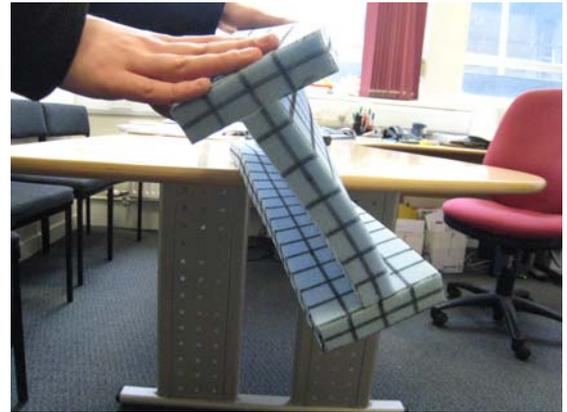
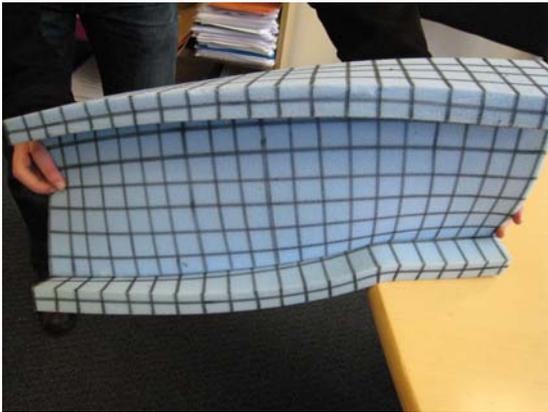
The sponge I-Beam was constructed in a similar fashion to the existing beam, in the way that it will incorporate a grid of lines over its surface in order to make areas of tension and compression on the beam easy to recognise. Due to the small size of the sponge beam, the dimensions will only be roughly those of actual I-Beams in industry, because if the web and flanges of the beam were cut to scale, they would be much too thin and would be susceptible to damage after prolonged subjection to bending and twisting. The sponge I-Beam will also have to be shortened somewhat lengthwise, as it would obviously be impractical to have a scale model of a 5m long I-Beam in lecture theatres. The method of constructing the model itself was to cut out three separate pieces of sponge, two flanges and one web, and then stick them together afterwards to form a completed I-Beam. I used high strength flexible spray glue to achieve this.

The dimensions I have chosen for my sponge I-Beam, in order to give maximum rigidity without losing the general shape of an I-Beam in industry are:

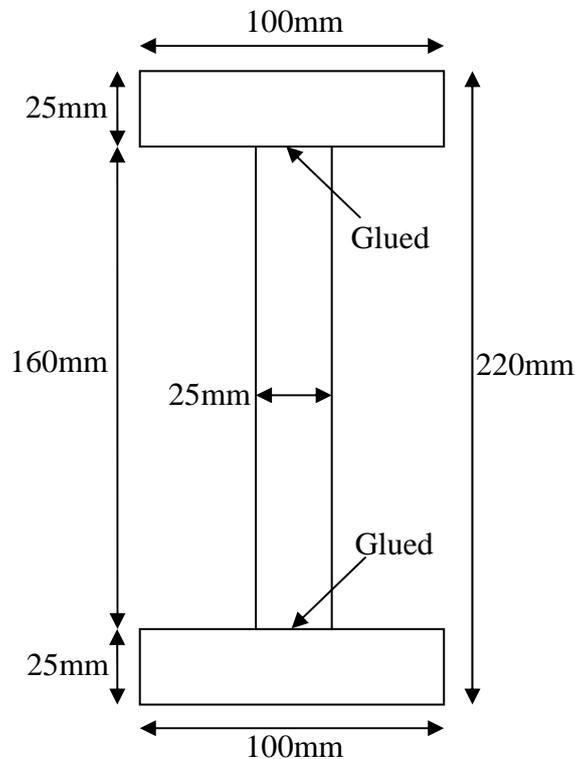
Depth of Section, d	= 220mm
Flange width, b_f	= 100mm
Flange thickness, t_f	= 25mm
Web thickness, t_w	= 25mm
Depth between flanges, d_1	= 160mm
Area of Cross-section, A_g	= 9000mm ²
The length of the I-Beam, L	= 555mm

Below is a selection of photographs showing the sponge I-Beam from a variety of angles, as well as showing the model demonstrating bending and lateral-torsional buckling. These are evidence that the I-beam is a good tool to improve Civil Engineering students' understanding of structural concepts:





I have also included a cross-section of the I-Beam showing the beam dimensions, which was created electronically using the shapes and labelling functions within Microsoft Word.



I hope that many future Years of Civil Engineers will enjoy and benefit from my simple but highly effective demonstrative model of an I-Beam, as I have enjoyed and benefitted from the current square cross-sectional sponge beam.

References

¹ http://www.ejsong.com/mdme/modules/FEA/7766K_FEA_files/UBeam_dims.PNG

² http://www.roymech.co.uk/Useful_Tables/Sections/UB_dim.htm

³ Hulse, R., Cain, J.A., *Structural Mechanics*, (2nd ed.), Palgrave Macmillan (2000)