Beam Factsheet

Introduction

Beams are used widely in the construction industry to build structures such as buildings and bridges. A beam can be made of any material if it is made into a long and thin extended structure. Beams are a good way of spanning gaps in buildings, since they go a long way without becoming too heavy.

Figure 1: A simple log bridge in the mountains in France

Properties

Engineers and builders who use beams everyday need to understand their properties. This helps them to make sure that structures will be safe by using a beam which will be strong enough to support the required load. Beams of various materials and dimensions are tested before being used in a real building. In modern construction, beams are typically made of steel, reinforced concrete, or wood.

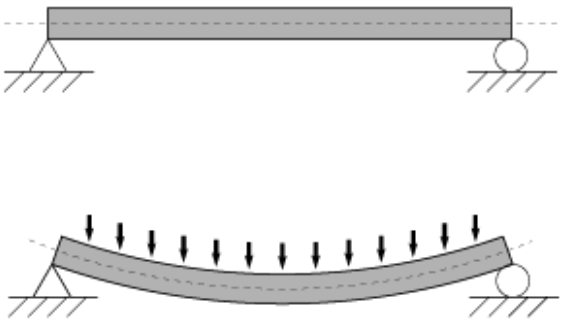

Figure 2: A beam supported at both ends bending under a uniform load.

Shape

Beams can also be made in special shapes, which make them stiffer, and less likely to bend – in steel-frame buildings and bridges, steel I-beams are often used, which have an I-shaped cross section. These beams are light and very resistant to bending for their weight, since this is the most efficient shape for loading in one direction only. Efficiency is a measure of how little deflection a beam will have for the same cross sectional area of beam and the same load.

A universal I-beam is only the most efficient shape in one direction of bending: up and down looking at the profile as an I. If the beam is bent side to side, it functions as an H where it is less efficient. The most efficient shape for both directions in 2D is a box (a square shell) however the most efficient shape for bending in any direction is a cylindrical shell or tube. But, for unidirectional bending, the universal (I or wide flange) beam is king. Other common beam profiles are the C-channel, the hollow structural section beam, the pipe, and the angle.

Bridges

Figure 3: This bridge in Japan has the longest span of any in the world.

Figure 4: Two beams are used cleverly in the construction of this bridge in the Swiss Alps.