INTERNATIONAL UNIVERSITY OF AFRICA

CIVIL ENGINEERING DEPARTMENT

ANALYSIS AND DESIGN OF STEEL WORKS

GRADE 4

7TH SEMESTER

Lecture No 2

BEAMS

PART 1

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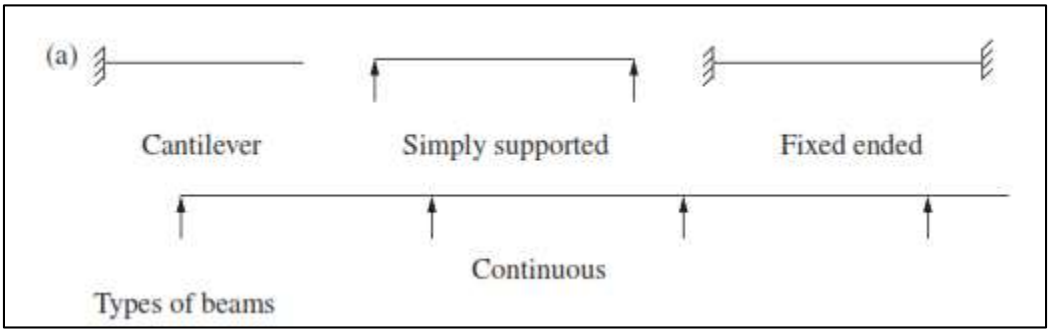
1 Types and uses

Beams span between supports to carry lateral loads which are resisted by bending and shear. However, deflections and local stresses are also important. Beams may be cantilevered, simply supported, fixed ended or continuous, as shown in Figure 1(a).



The main uses of beams are to support floors and columns, carry roof sheeting as purlins and side cladding as sheeting rails.

Any section may serve as a beam, and common beam sections are shown in a

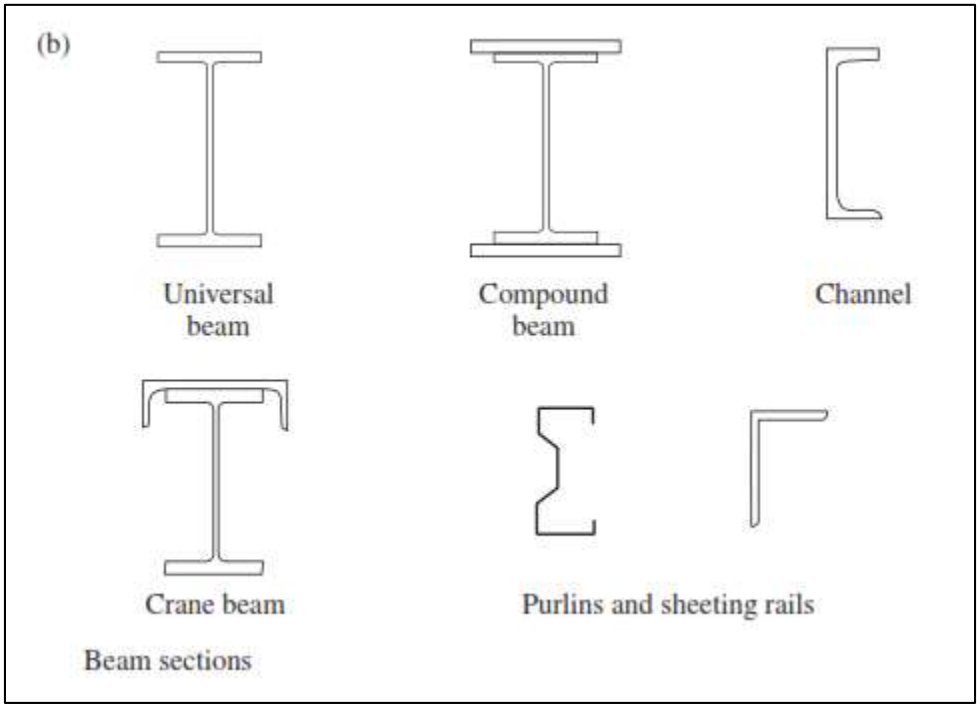


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Figure b

(1) The universal beam where the material is concentrated in the flanges is the most efficient section to resist uniaxial bending.

(2) The universal column may be used where the depth is limited, but it is less efficient.

(3) The compound beam consisting of a universal beam and flange plates is used where the depth is limited and the universal beam itself is not strong enough to carry the load.

(4) The crane beam consists of a universal beam and channel. It is because the beam needs to resist bending in both horizontal and vertical directions.Beams may be of uniform or non-uniform section. Figure 2

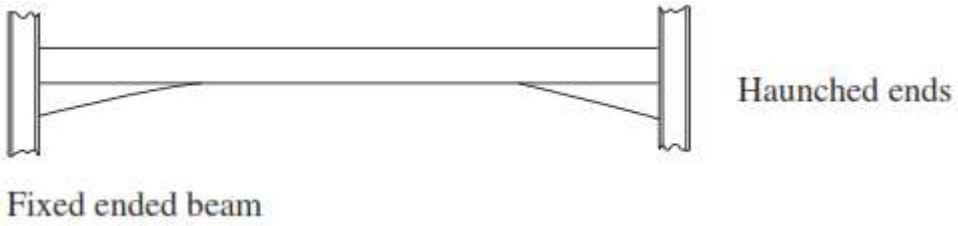


Figure 2 non uniform section

2 Beam loads

Types of beam loads are:

(1) concentrated loads from secondary beams and columns;
(2) distributed loads from self-weight and floor slabs.

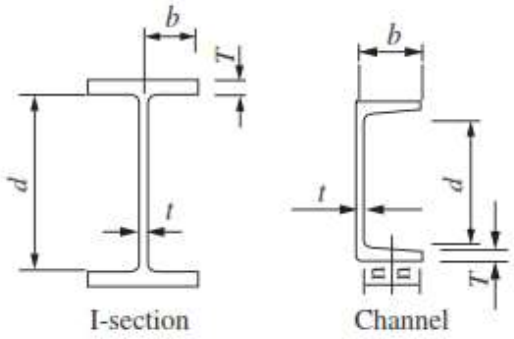
The loads are further classified into:

(1) dead loads from self weight, slabs, finishes, etc.
(2) imposed loads from people, fittings, snow on roofs, etc.
(3) wind loads, mainly on purlins and sheeting rails.

3 Classification of beam cross-sections

The projecting flange of an I-beam will buckle prematurely if it is too thin. Webs will also buckle under compressive stress from bending and from shear.

To prevent local buckling from occurring, limiting ***outstand/thickness ratios*** for flanges and ***depth/thickness*** ratios for webs are given in BS 5950-1: 2000 in Section 3.5.
Beam cross-sections are classified as follows in accordance with their behavior in bending:



Compression element		Ratio	Limiting value		
			Class 1 plastic	Class 2 compact	Class 3 semi-compact
Outstand element of compression flange	Rolled section	b/T	9ε	10ε	15ε
Web with neutral axis at mid-depth		d/t	80ε	100ε	120ε

The parameter, $\varepsilon = (275/p_y)^{0.5}$

Limiting proportions for rolled sections from table 11 Bs 5950 part 1

4 Bending stresses and moment capacity

Plastic properties are used for plastic and compact sections and elastic properties for semi-compact sections to determine moment capacities. For slender sections, only effective elastic properties are used.