Structural Steel and Timber Design SAB3233

Topic 7
Laterally unrestrained beams

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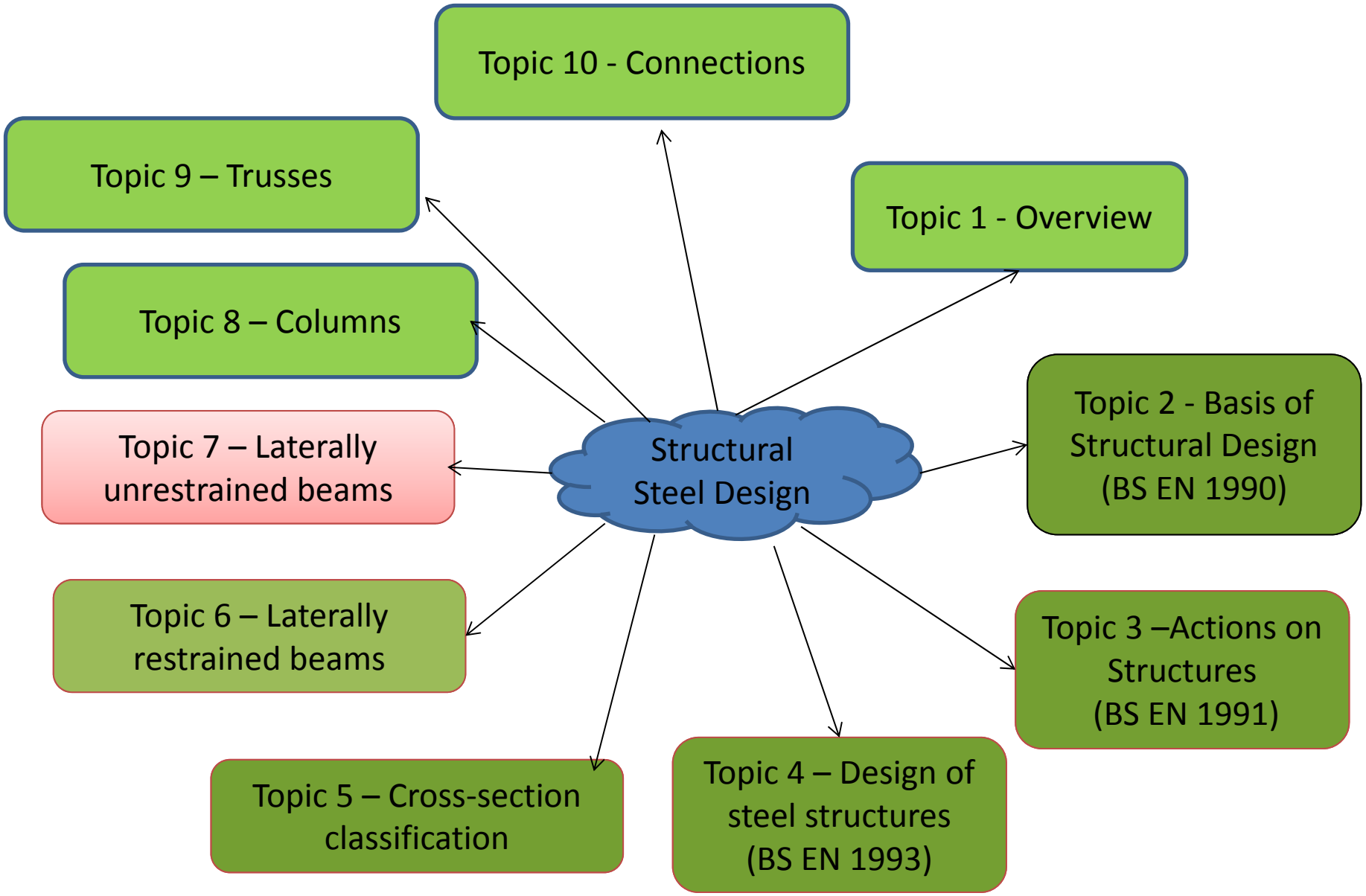
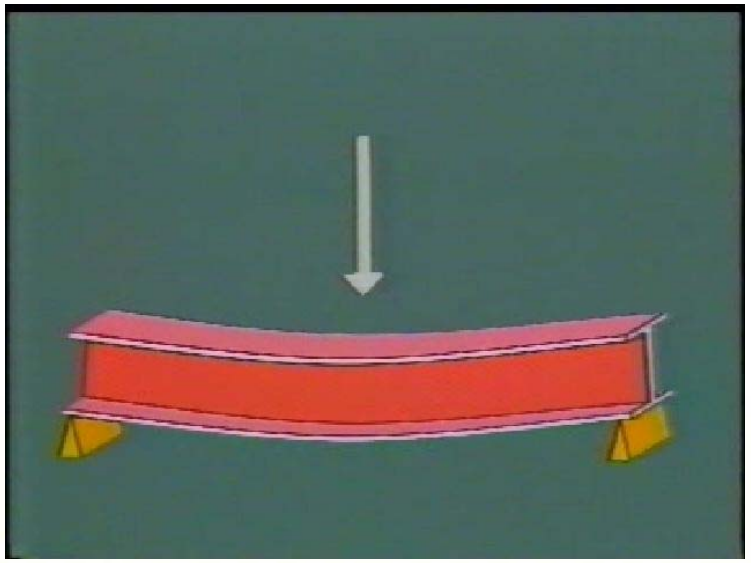
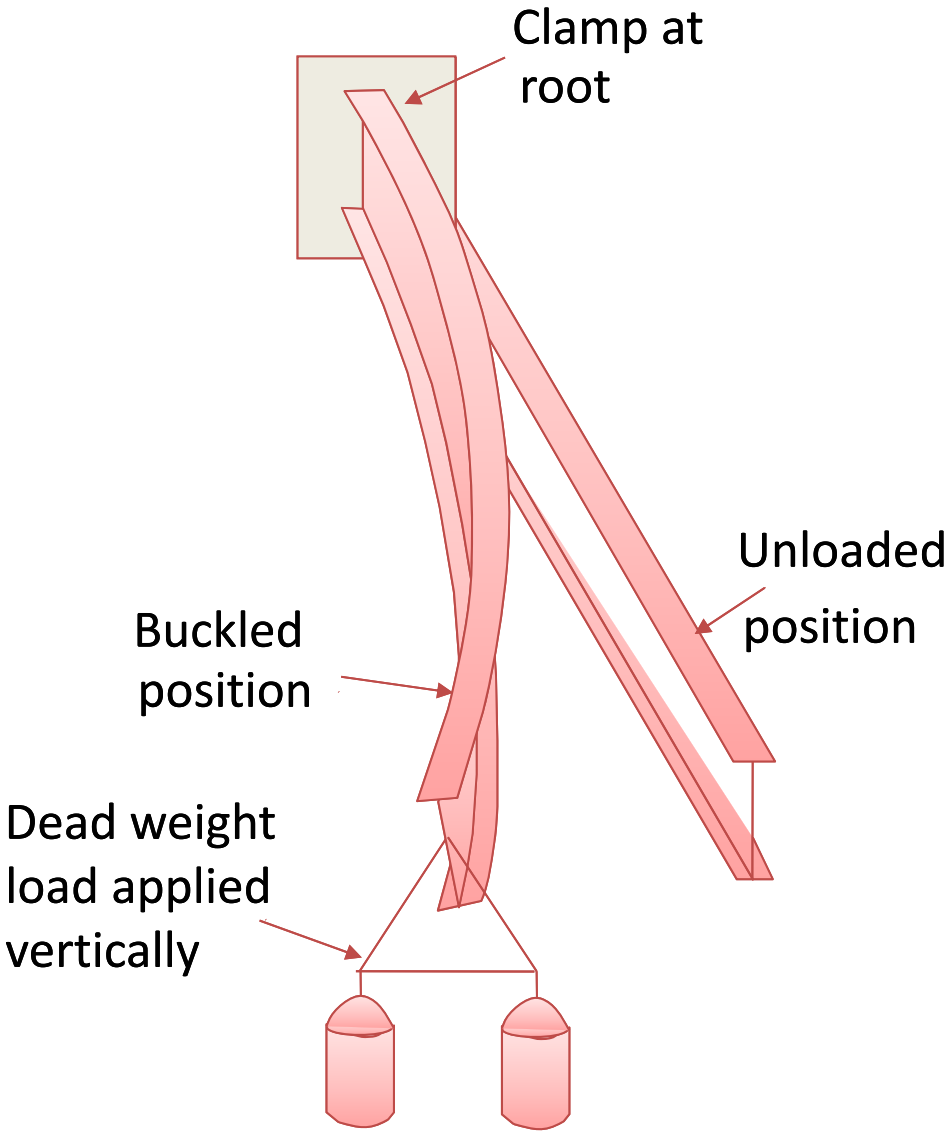

Topic 10 - Connections
Topic 9 – Trusses
Topic 1 - Overview
Topic 8 – Columns
Topic 2 - Basis of Structural Design (BS EN 1990)
Topic 7 – Laterally unrestrained beams
Structural Steel Design
Topic 6 – Laterally restrained beams
Topic 3 –Actions on Structures (BS EN 1991)
Topic 5 – Cross-section classification
Topic 4 – Design of steel structures (BS EN 1993)

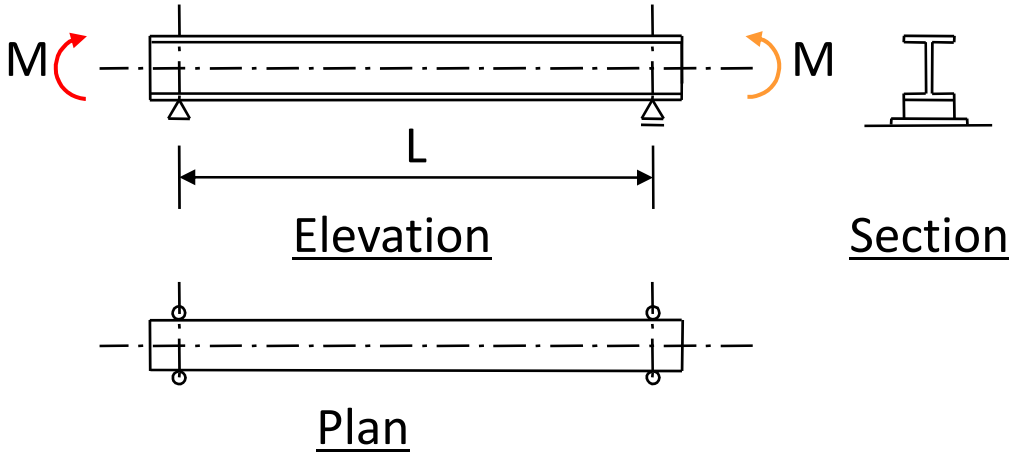
Beam is a member predominantly subject to bending. A beam is a structural member which is subject to transverse loads, and accordingly must be designed to withstand shear and moment. Generally, it will be bent about its major axis

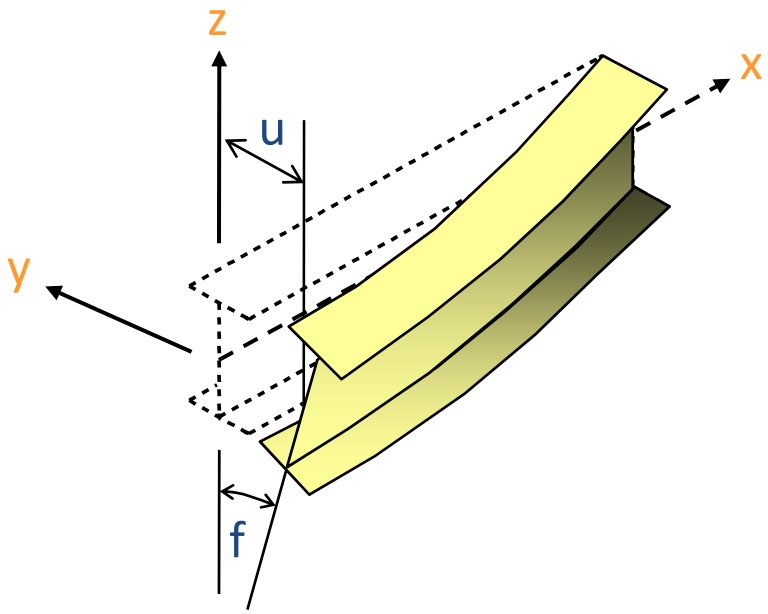




- Slender structural elements loaded in a stiff plane tend to fail by buckling in a more flexible plane.
- In the case of a beam bent about its major axis, failure may occur by a form of buckling which involves both lateral deflection and twisting.

Lateral-torsional buckling

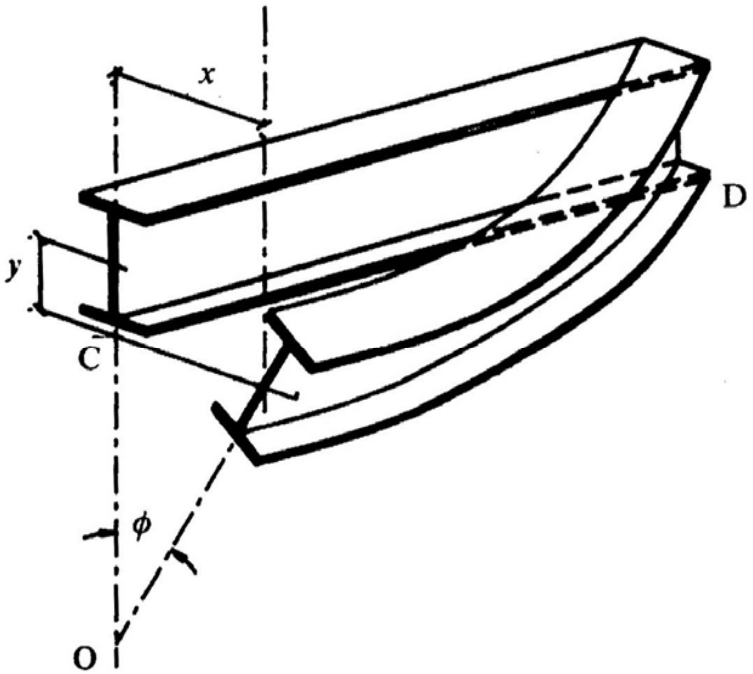




- Perfectly elastic, initially straight, loaded by equal and opposite end moments about its major axis.

- Unrestrained along its length.
- End Supports
  - Twisting and lateral deflection prevented.
  - Free to rotate both in the plane of the web and on plan.

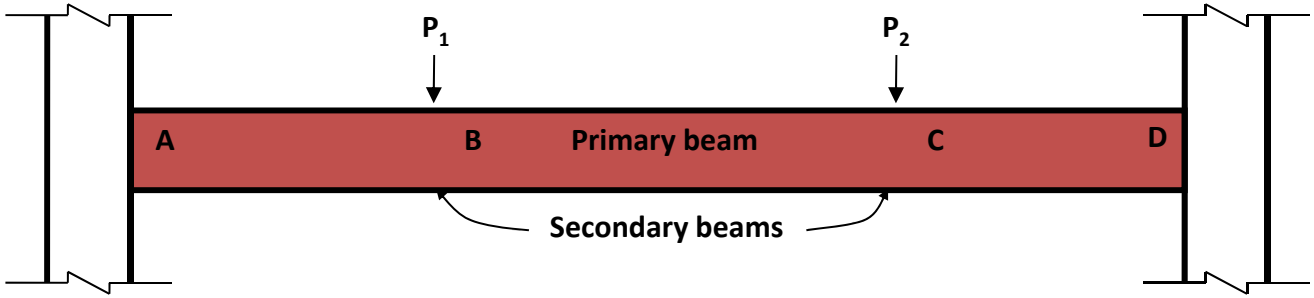
Unrestrained beam



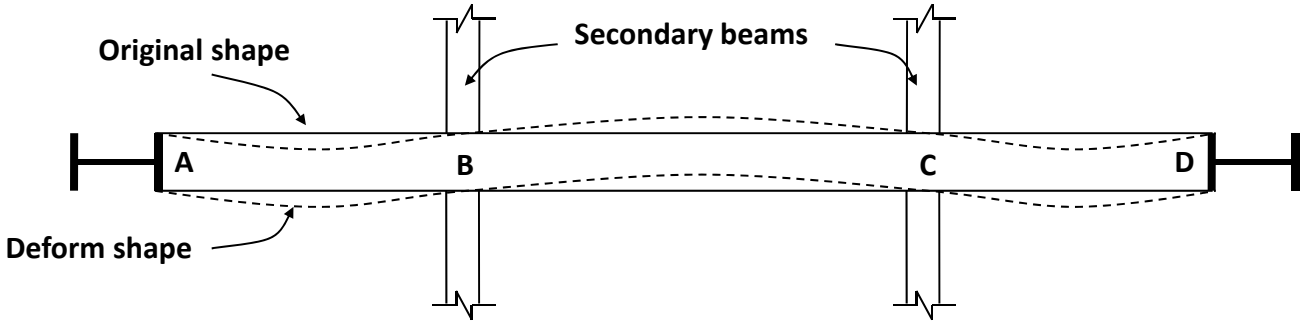
The compression flange is not restrained from deflect laterally and rotate about the plan of the section, which is called lateral torsional buckling

Three components of displacement i.e. vertical, horizontal and torsional displacement

- Lateral restraint may be of along the span or at some points along the span.



Front view of the primary beam



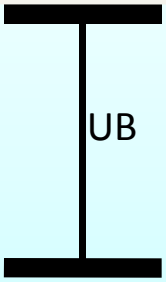
Plan view

Points A, B, C and D are restrained from deform laterally by the secondary beams and the connection at column

Unrestrained Beam

Examples :

Steel slide



Timber floor