Beam Design

Review of Lecture 5: Trusses

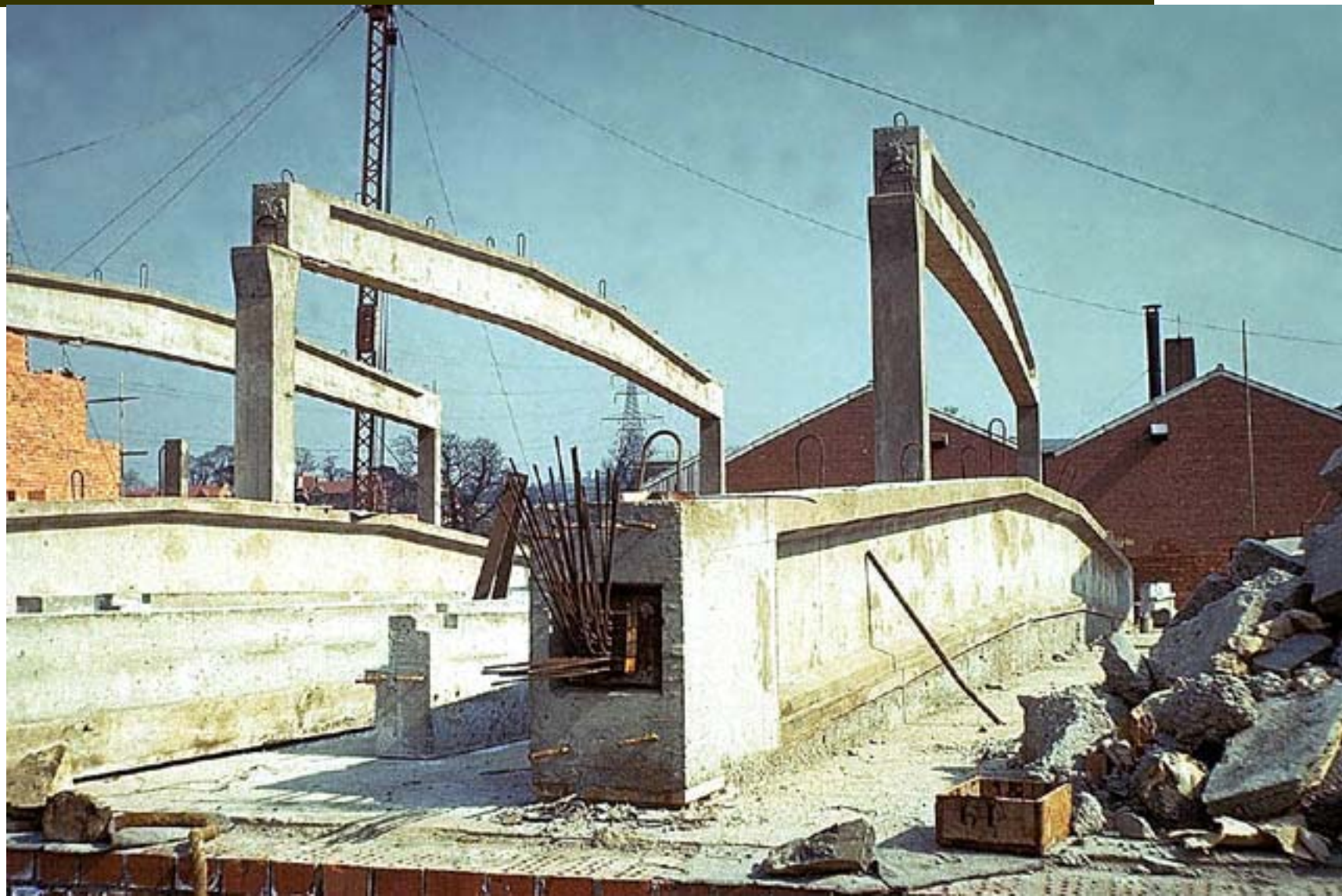
- **Rotational Equilibrium**
  - ***Sum of the moments must equal zero.***
  - **Use to calculate reactions at supports and to find internal forces**

- **Trusses are an efficient way to carry loads with minimal material**

- **Look for examples of moment equilibrium around you**

Concrete beams

Concrete connections



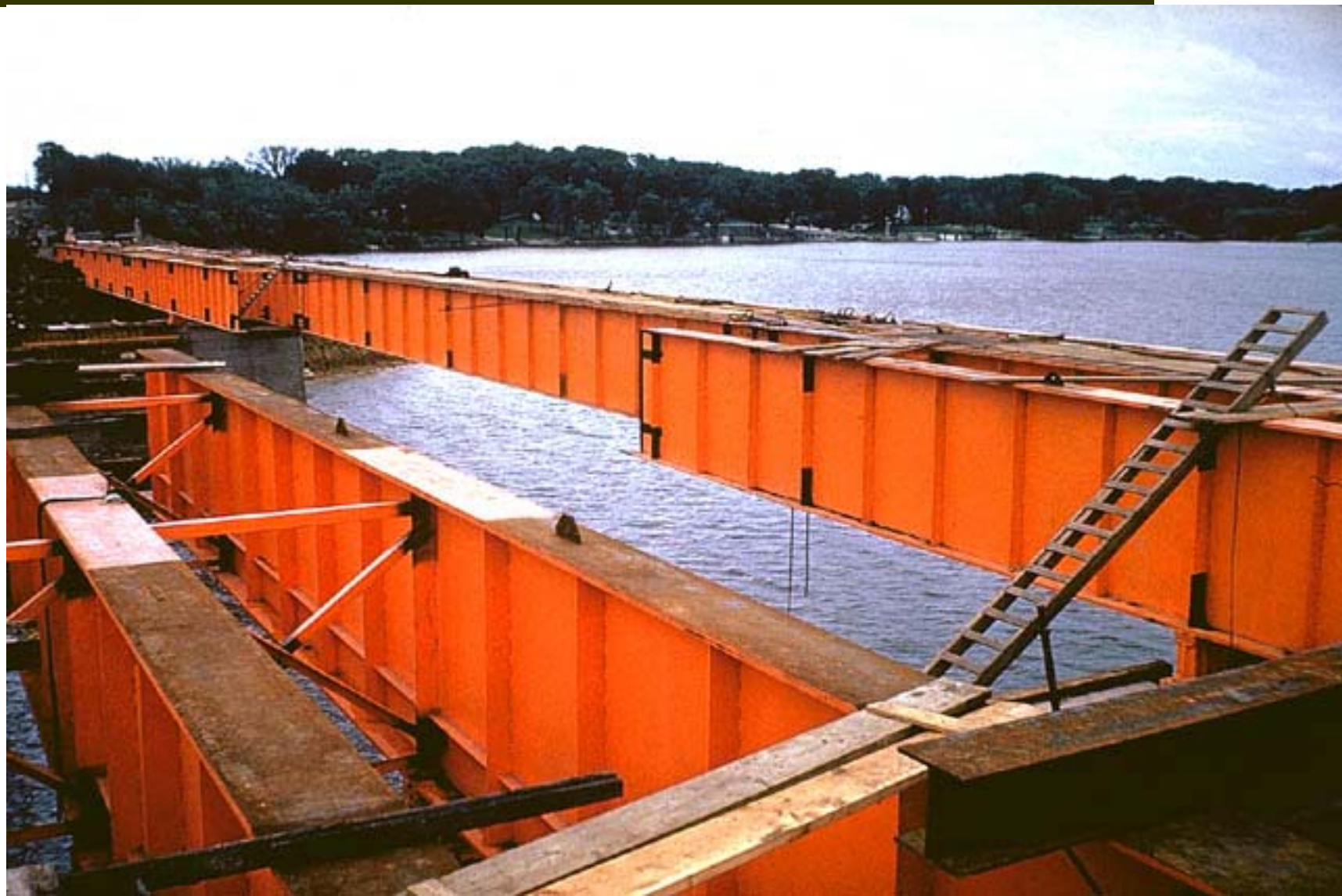
Reinforcing rod connections

Concrete Y-beams

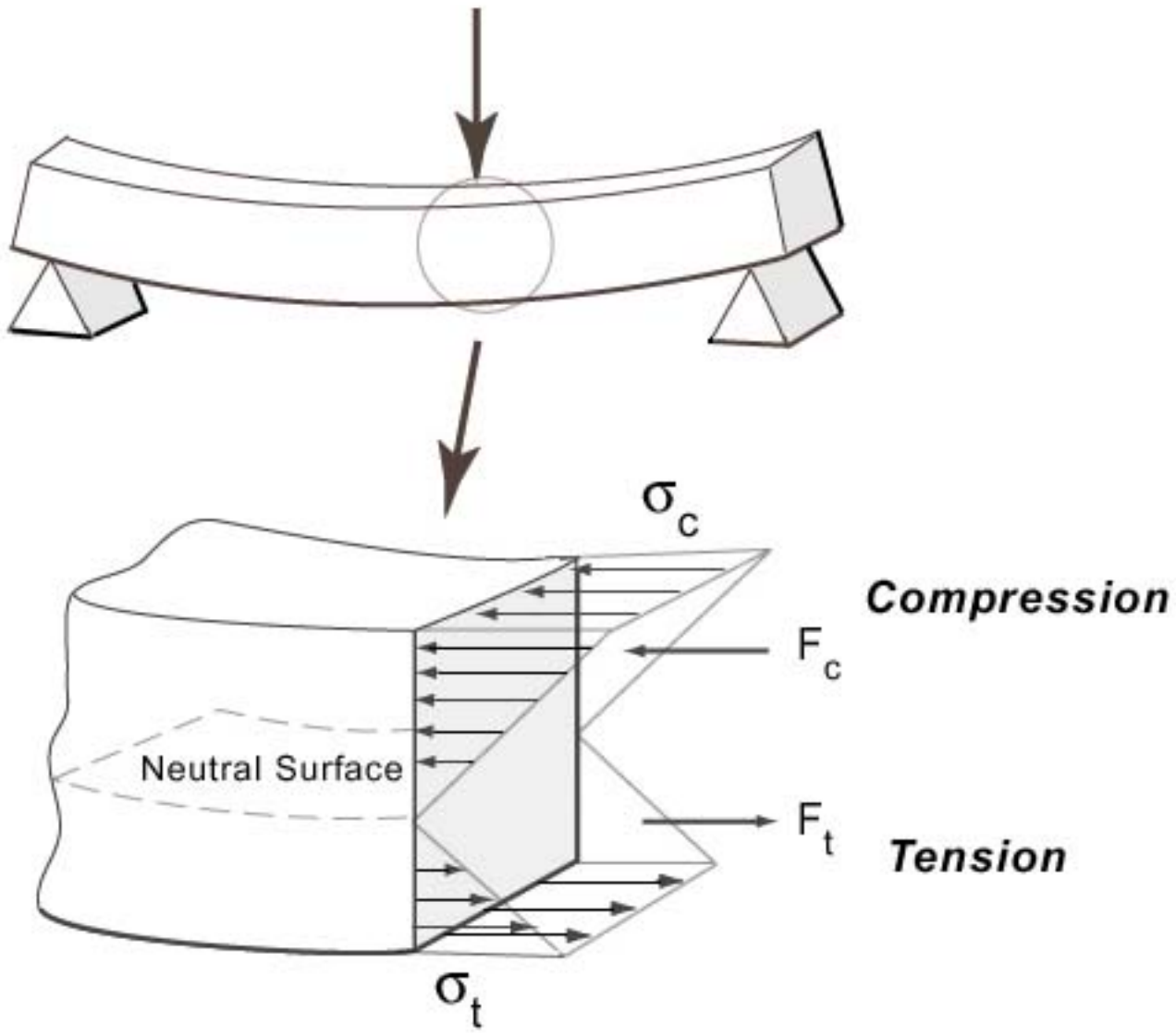
Interior View

Castellated Beams

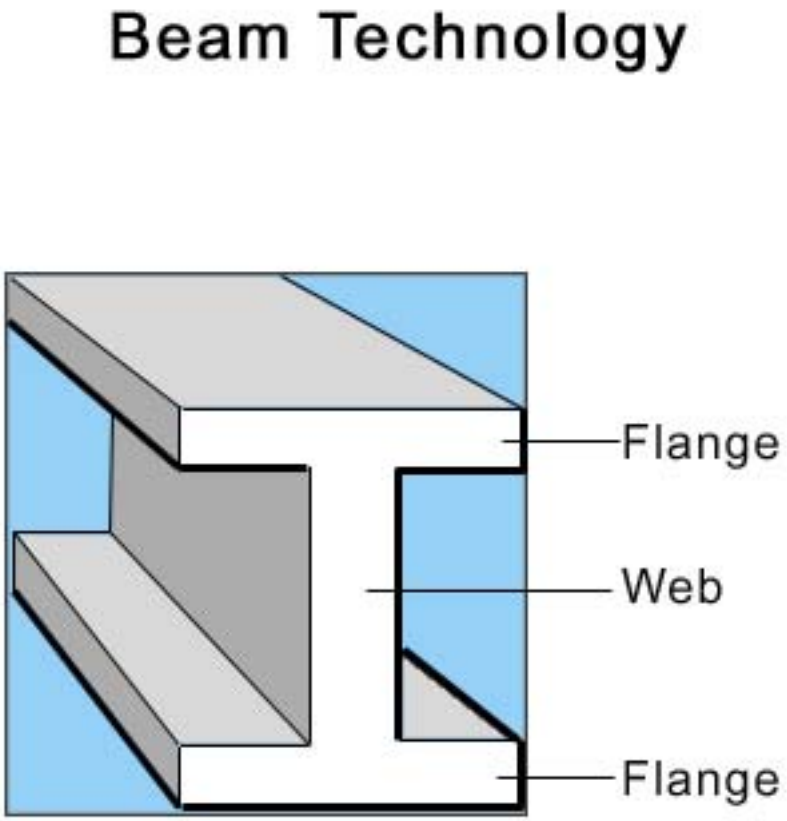
Timber Cantilever Beams



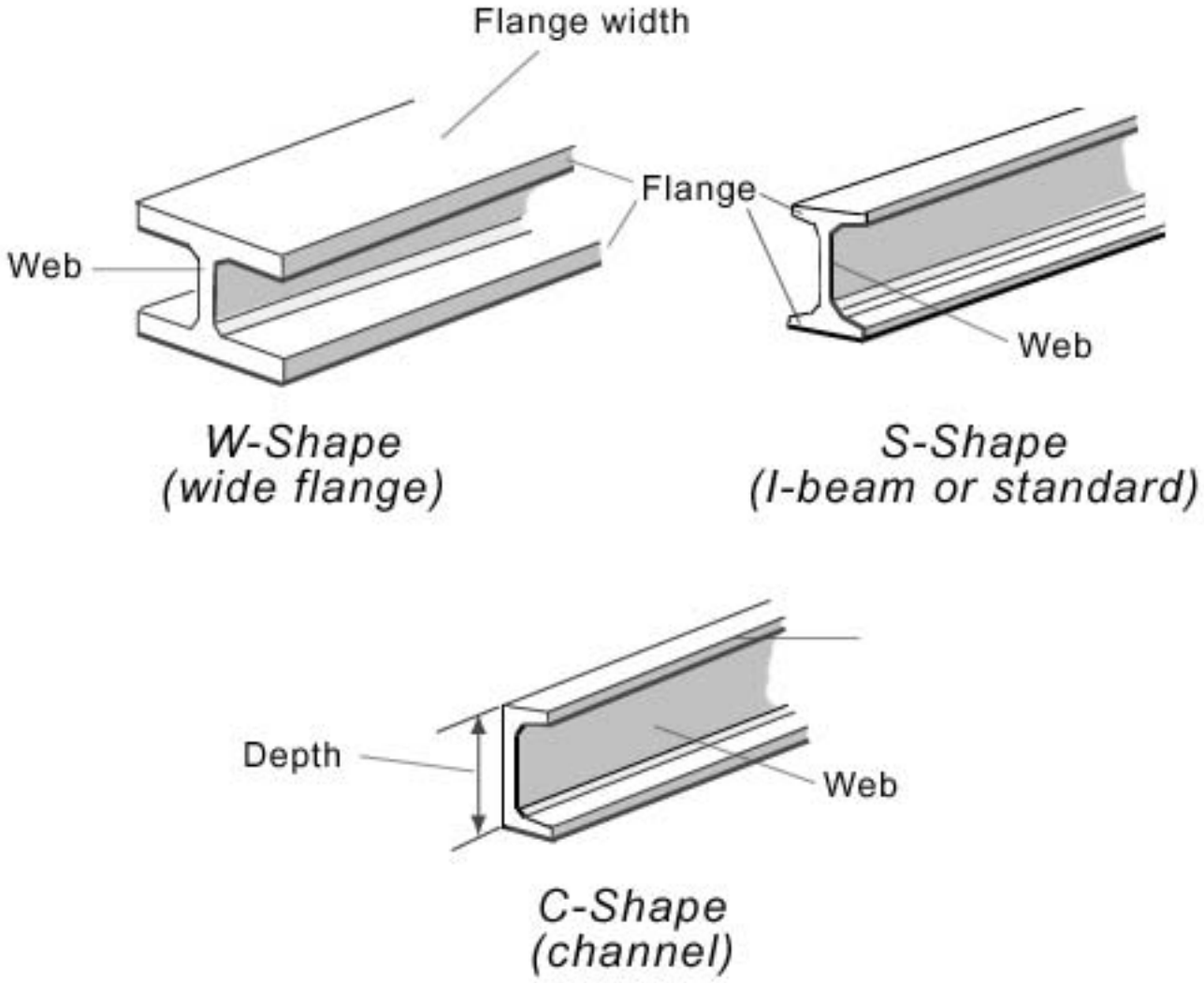
Bending Stresses in a Beam



Beam Terminology



Steel Section Terminology



W-Shape
(wide flange)

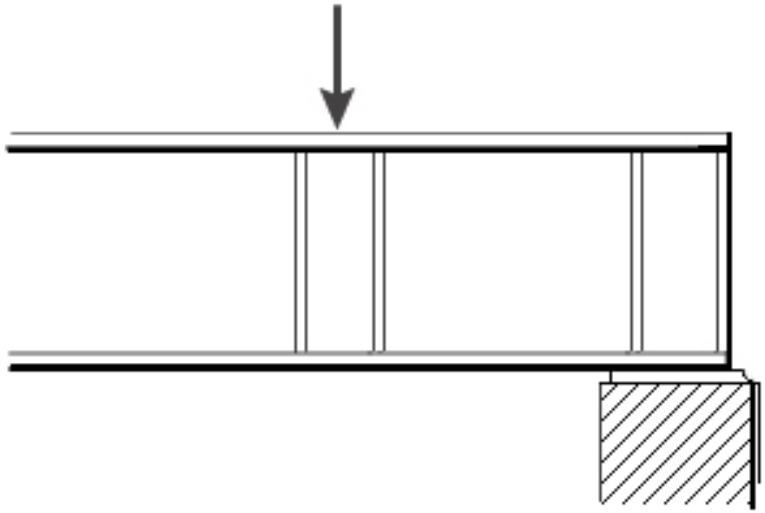
S-Shape
(I-beam or standard)

C-Shape
(channel)

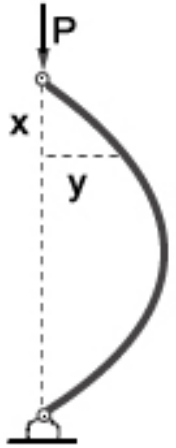
Steel Buckling

Must be stiffened with plates in regions of high shear

Web buckling

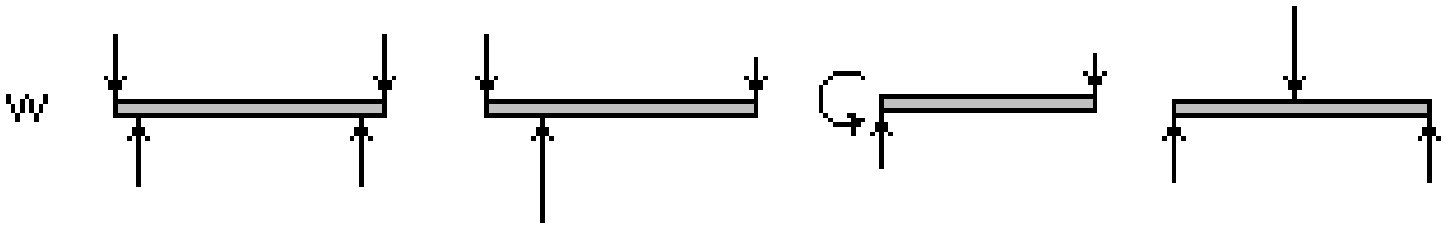


Bearing plate and web stiffening



Buckling strut

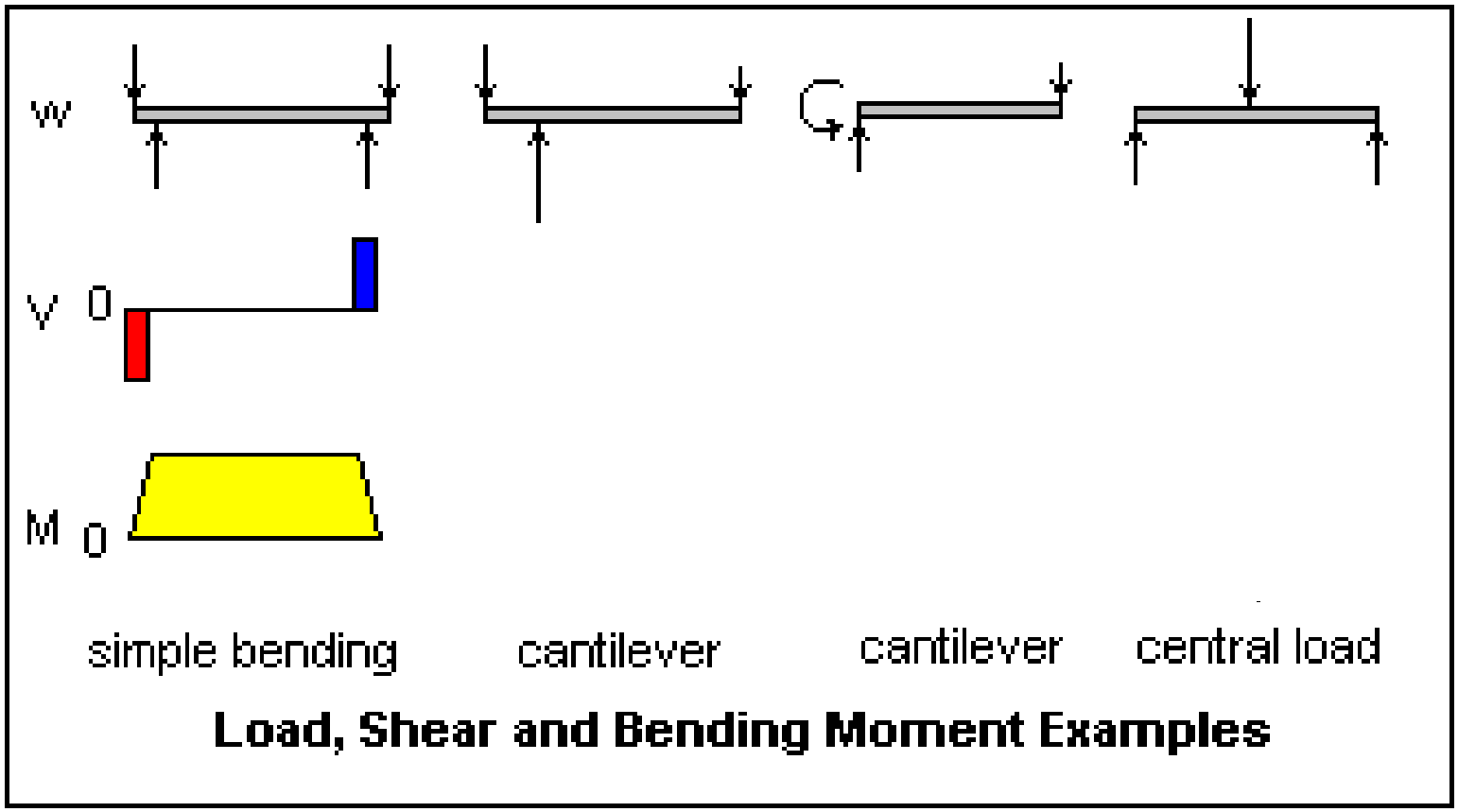
Shear Diagrams



simple bending cantilever cantilever central load

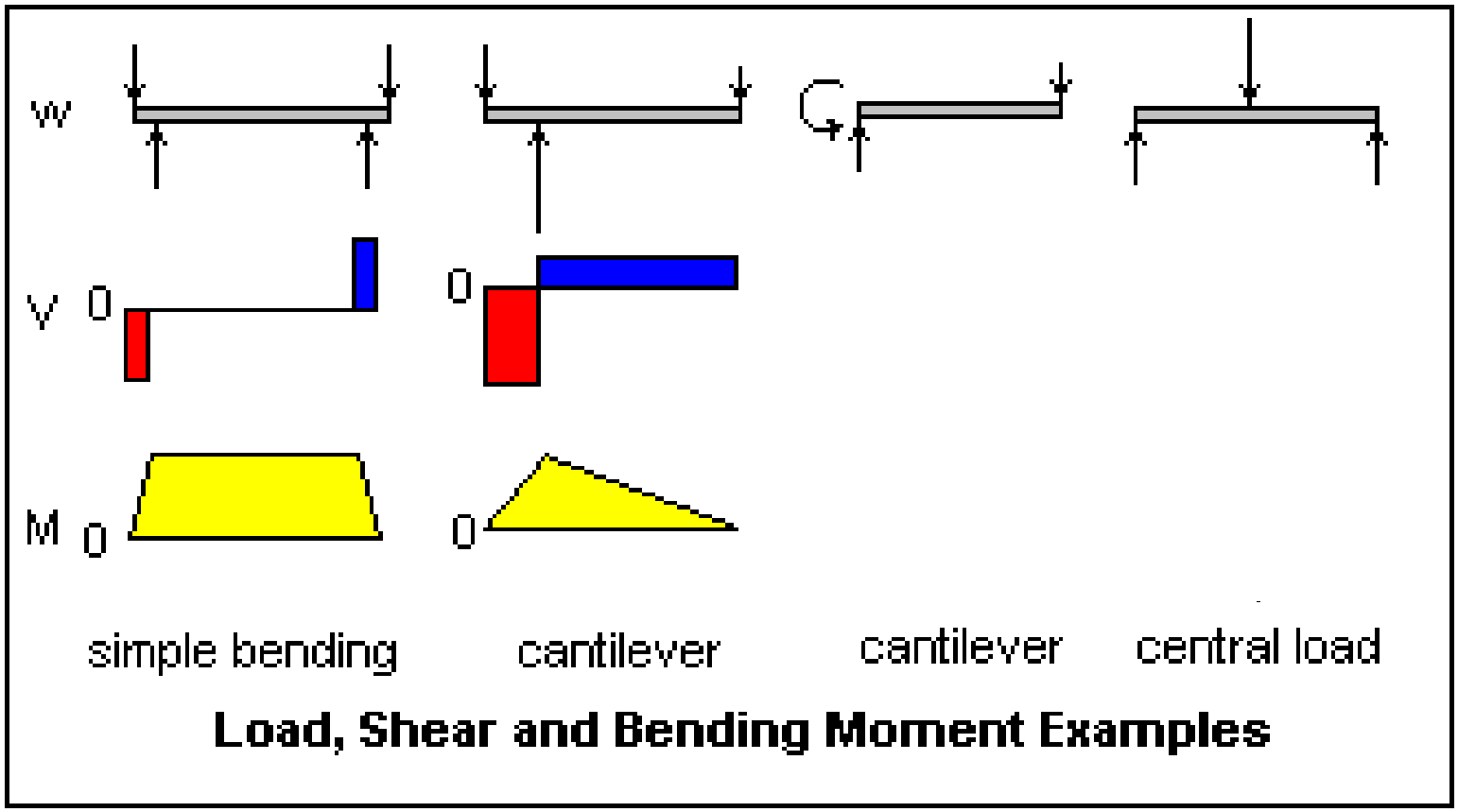
Load, Shear and Bending Moment Examples

Shear Diagrams



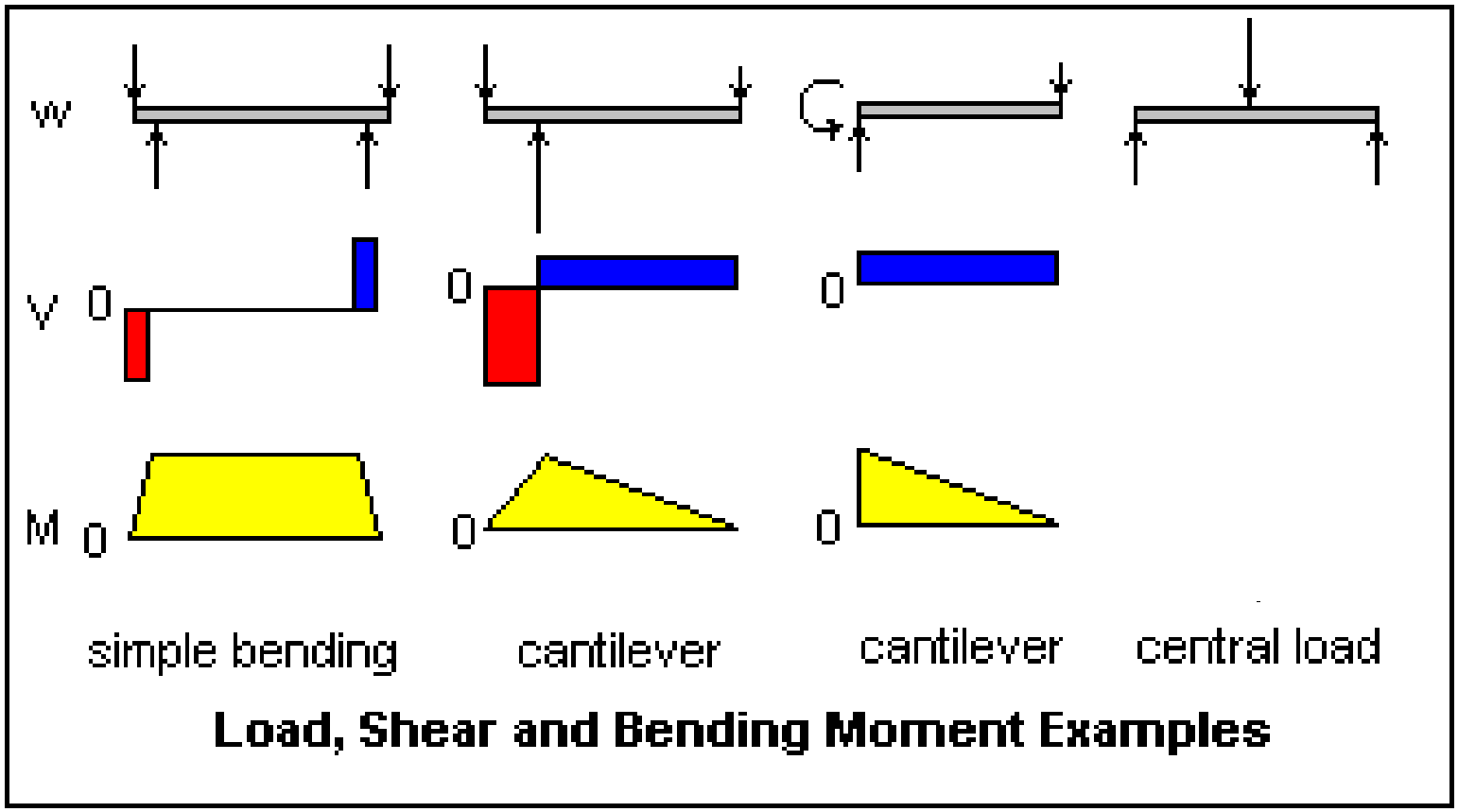
Load, Shear and Bending Moment Examples

Shear Diagrams



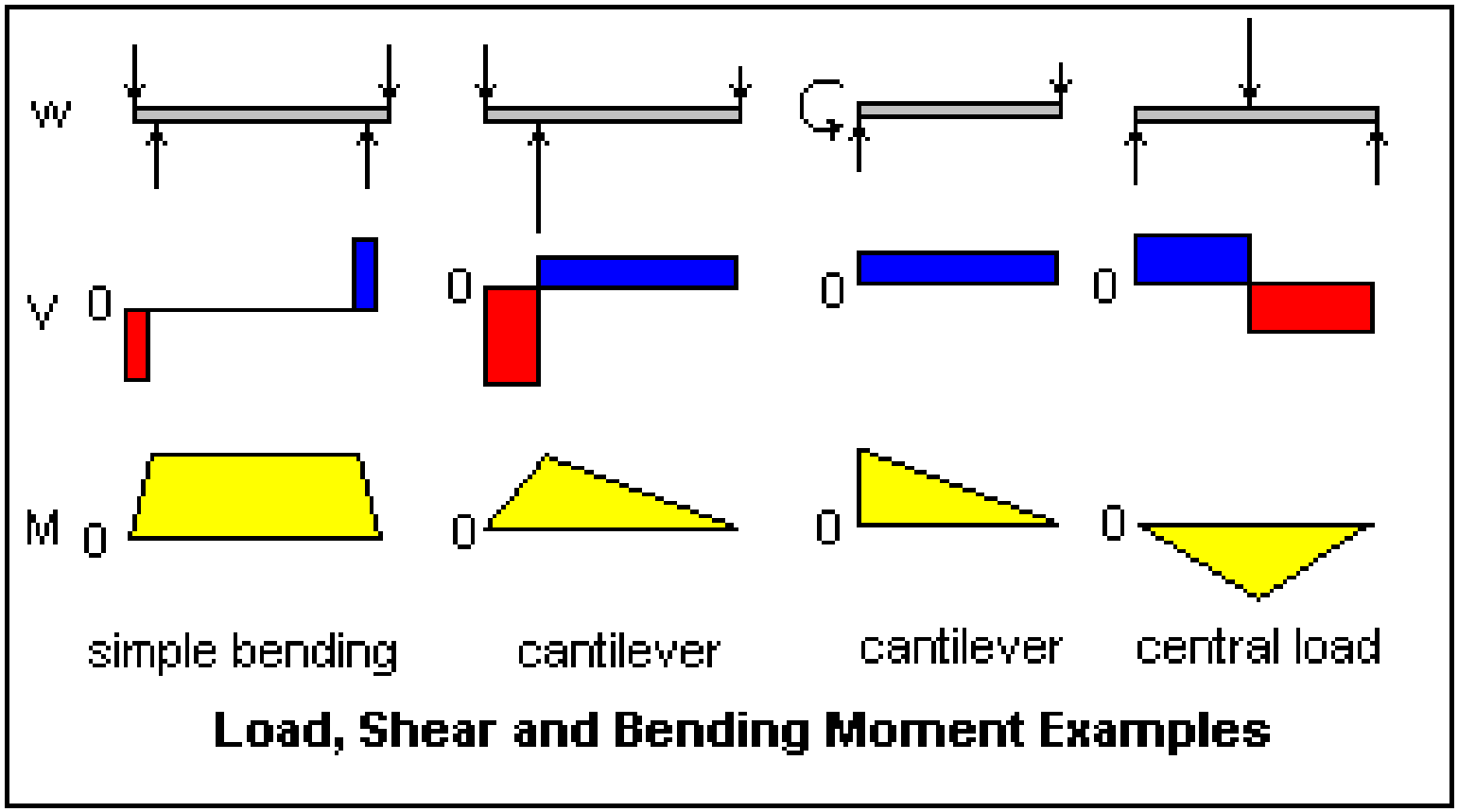
Load, Shear and Bending Moment Examples

Shear Diagrams



Load, Shear and Bending Moment Examples

Shear Diagrams



Load, Shear and Bending Moment Examples

How to draw a shear diagram

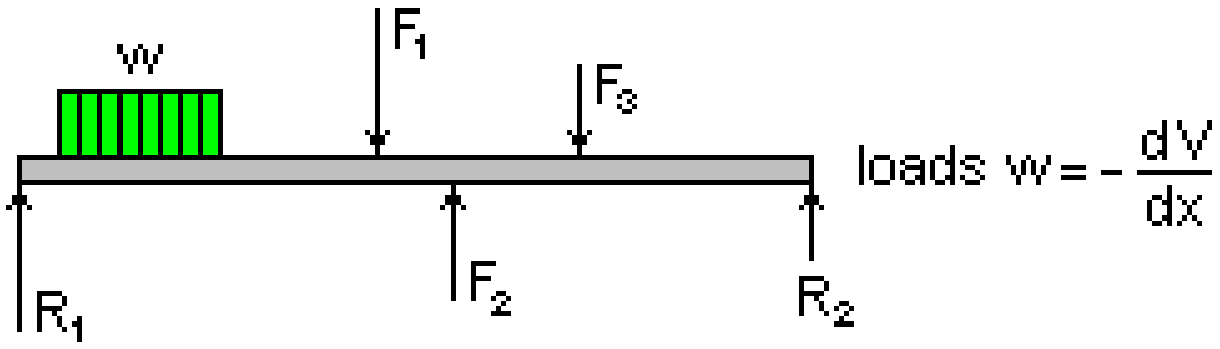
1) Determine external reactions on beam

2) “Walk” along beam with your pen

3) Pen goes up and down with the loads

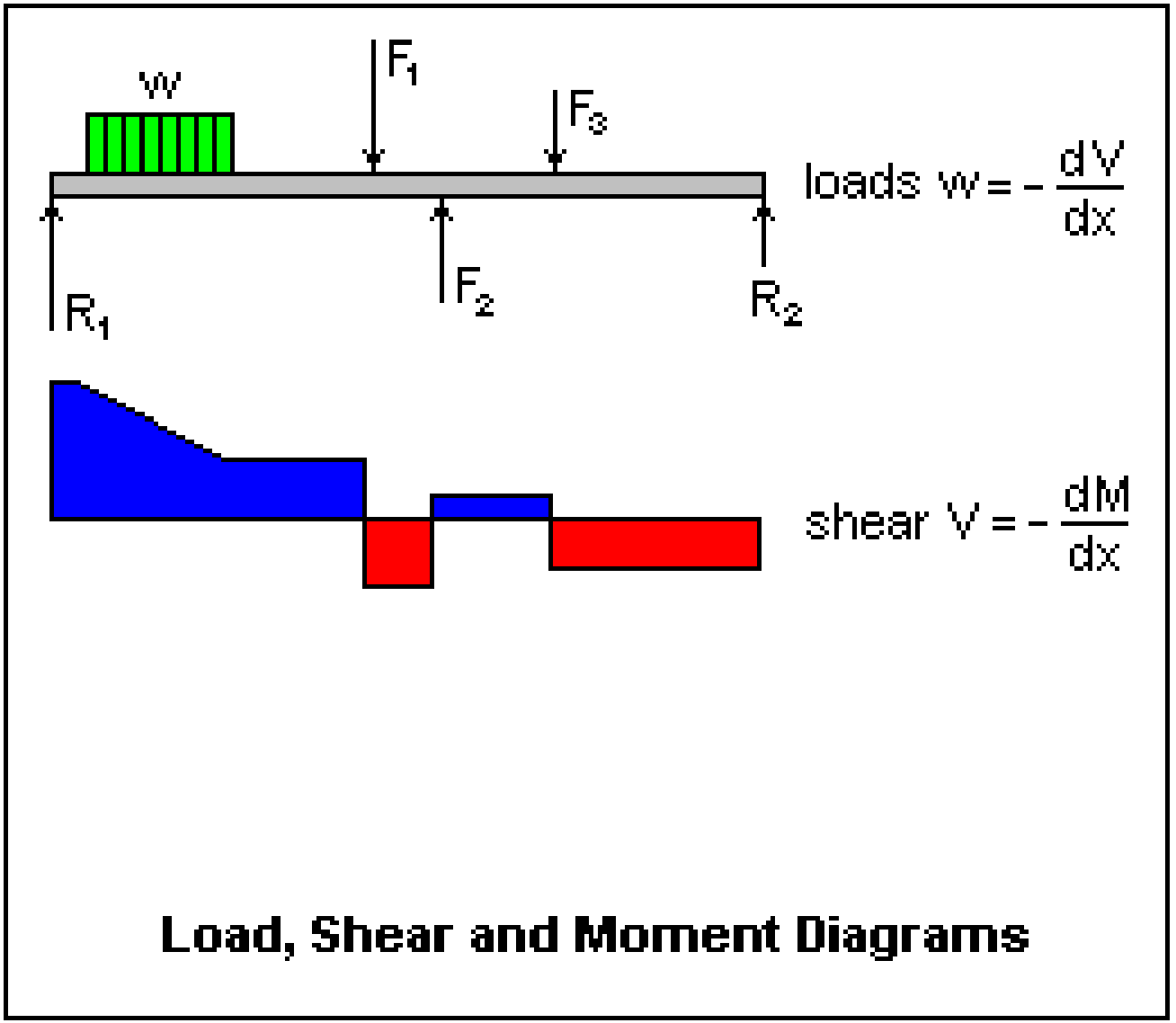
4) Must “close” diagram at the ends of the beam

Shear Diagrams



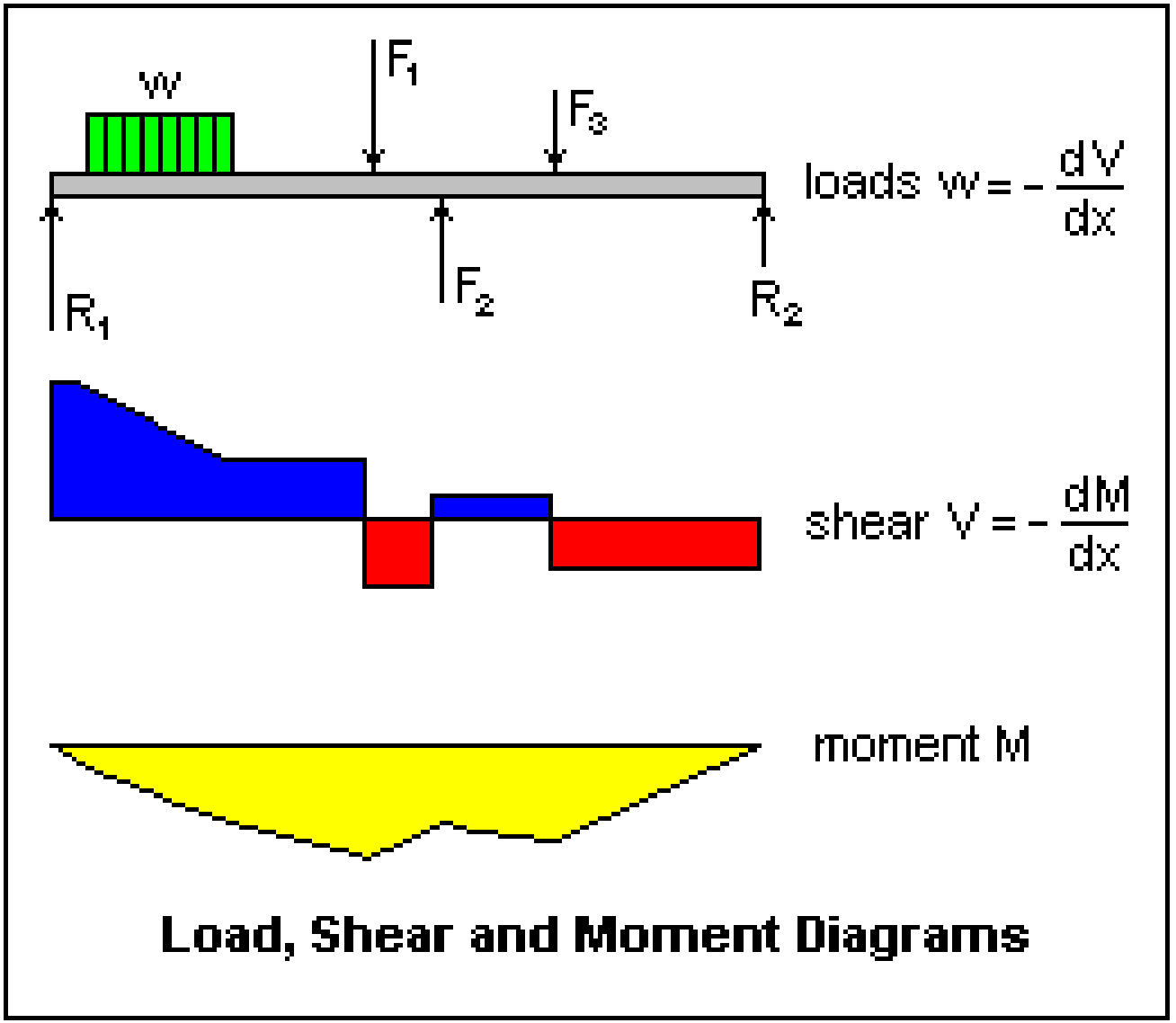
Load, Shear and Moment Diagrams

Shear Diagrams



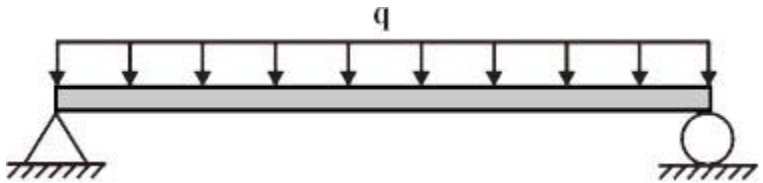
Load, Shear and Moment Diagrams

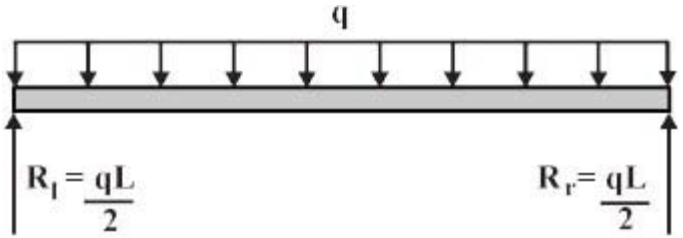
Shear Diagrams

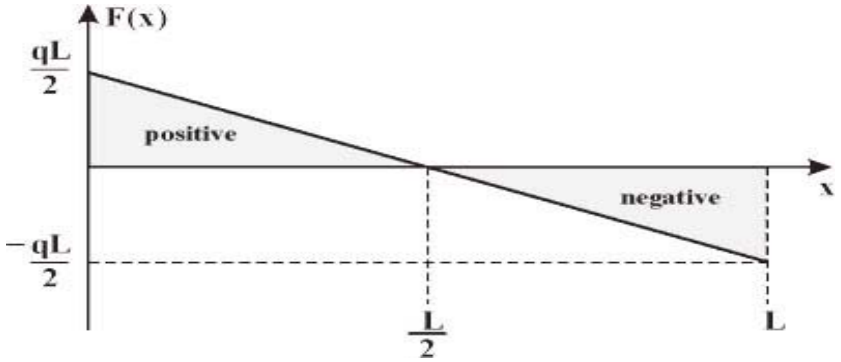


Load, Shear and Moment Diagrams

Shear Diagram for Uniform Load



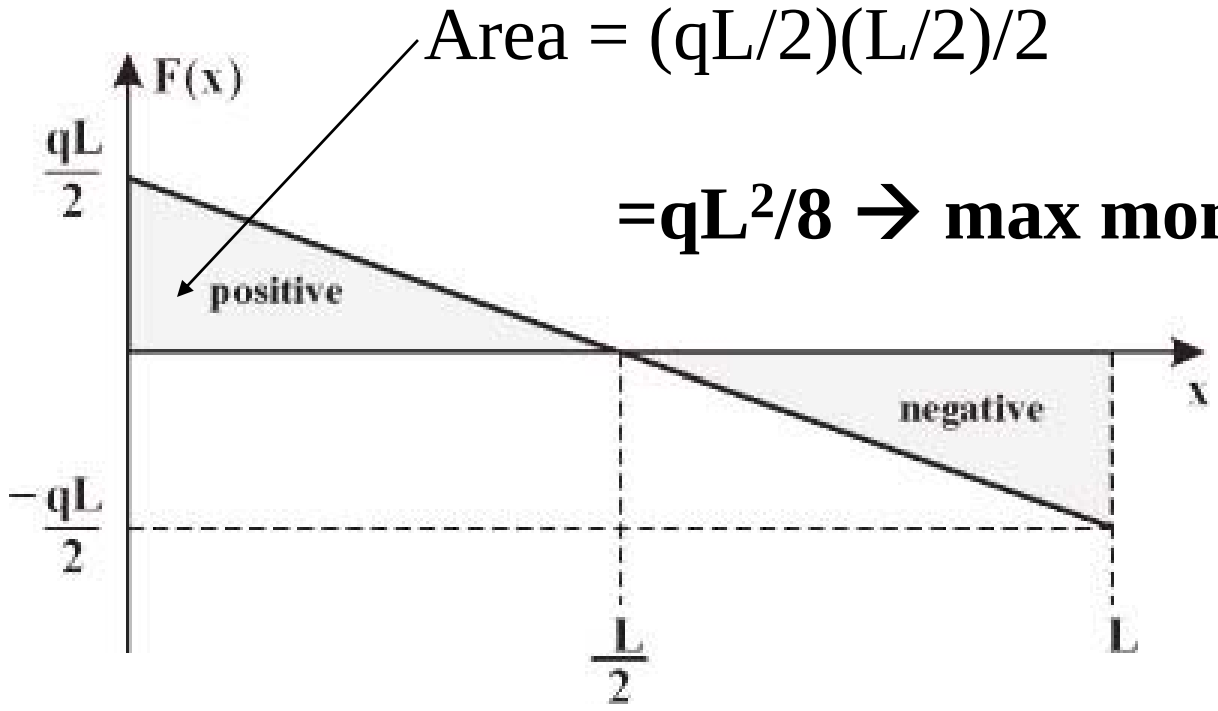




Lecture 6: Beams

- **Beams carry loads in *bending*, with compression and tension on opposite sides**
- **Visualize trusses within the depth of a beam**
- **Shear and moment diagrams are used to illustrate internal forces in beams**

Shear Diagrams



=qL²/8 → max moment value

Shear diagram equals the slope of moment diagram