To do ...

- Quiz 4 this week!

- HW 14 PL due **Wed**
- HW 15 ME due **Thurs**

Chapter 7: Internal Forces
Main goals and learning objectives

- Determine the internal loadings in members using the method of sections

- Generalize this procedure and formulate equations that describe the internal shear and moment throughout a member

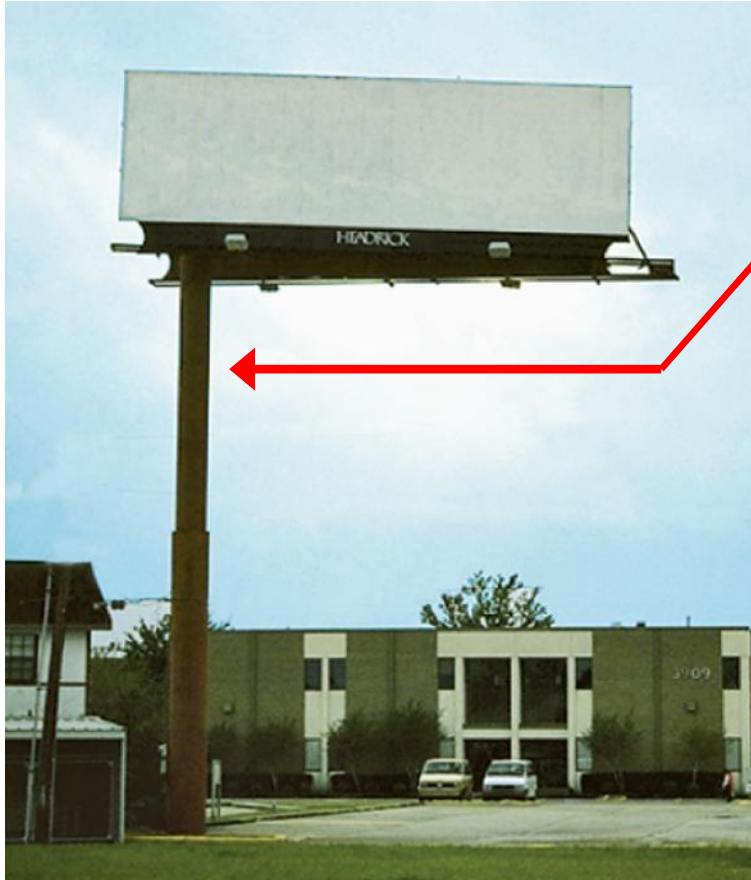# Internal loadings developed in structural members

Beams are structural members designed to support loads applied perpendicularly to their axes.

Beams can be used to support the span of bridges. They are often thicker at the supports than at the center of the span.

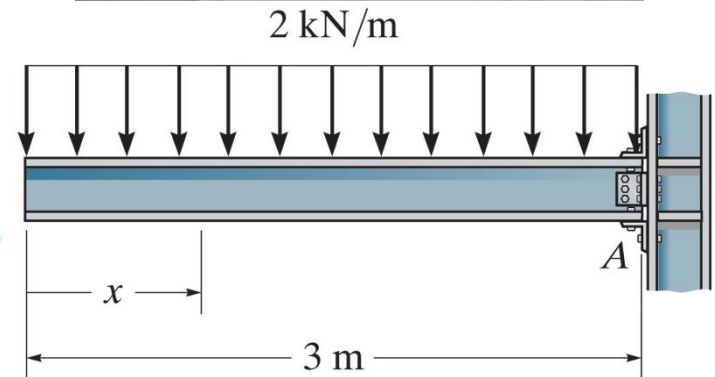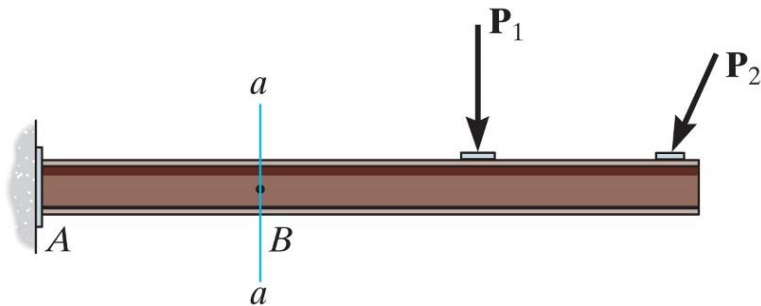Why are the beams tapered?   Internal forces are important in making such a design decision.
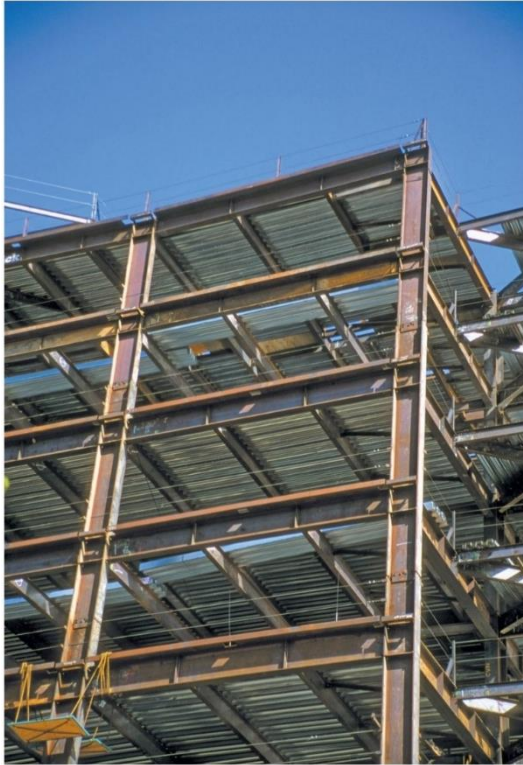
Internal loadings developed in structural members

A fixed column supports these rectangular billboards.

Usually such columns are wider/thicker at the bottom than at the top. Why?

Internal loadings developed in structural members

2 kN/m

3 m

Internal loadings developed in structural members

Structural Design: need to know the loading acting within the member in order to be sure the material can resist this loading

Cutting members at internal points reveal **internal forces and moments.**

Normal force

Shear force

Broken stem
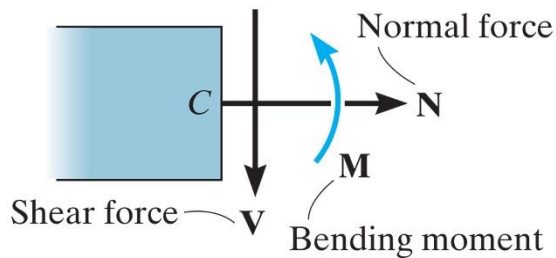
Steel Rebar Tensile Test

Sign conventions:

Positive normal force

Positive shear force

Positive moment
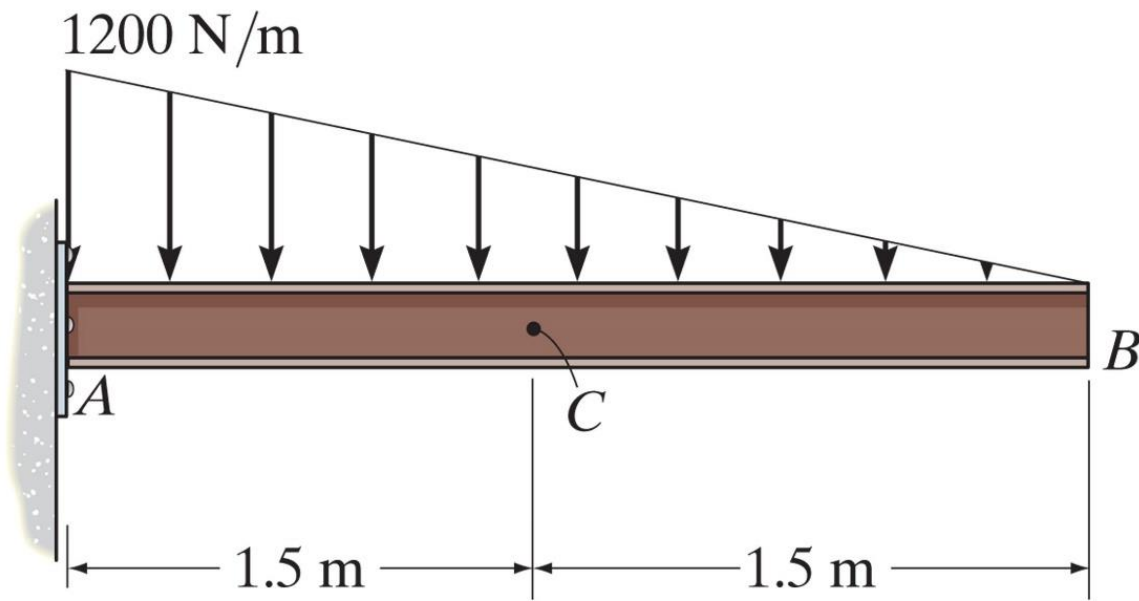
Procedure for analysis:

1. Find support reactions (free-body diagram of entire structure)
2. Pass an imaginary section through the member
3. Draw a free-body diagram of the segment that has the least number of loads on it
4. Apply the equations of equilibrium

Find the internal forces and moments at B (just to the left of P) and at C (just to the right of P)

6 kN

9 kN·m

A

D

B   C

—3 m—   —6 m—

3 kip/ft

A   C   B

6 ft   4.5 ft   4.5 ft
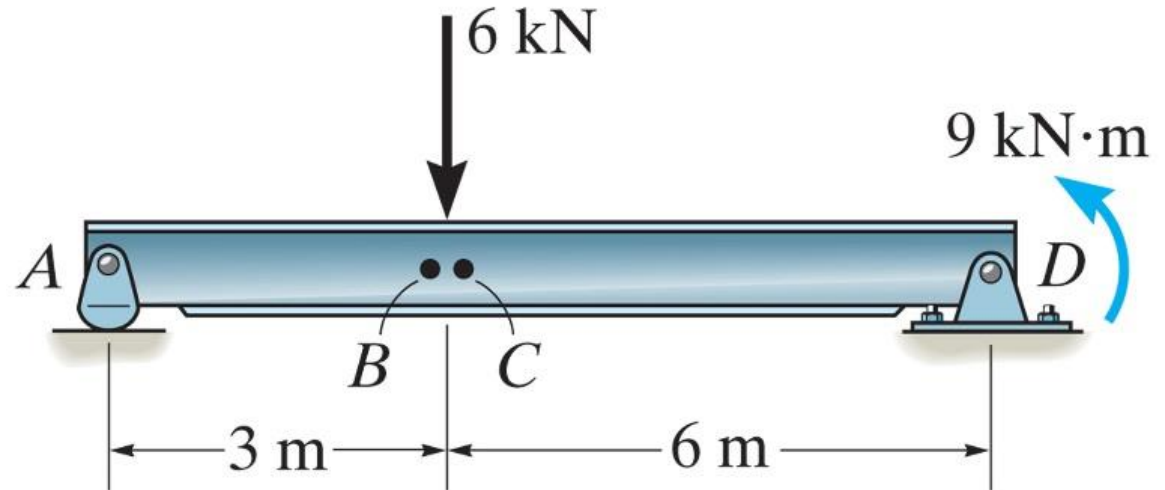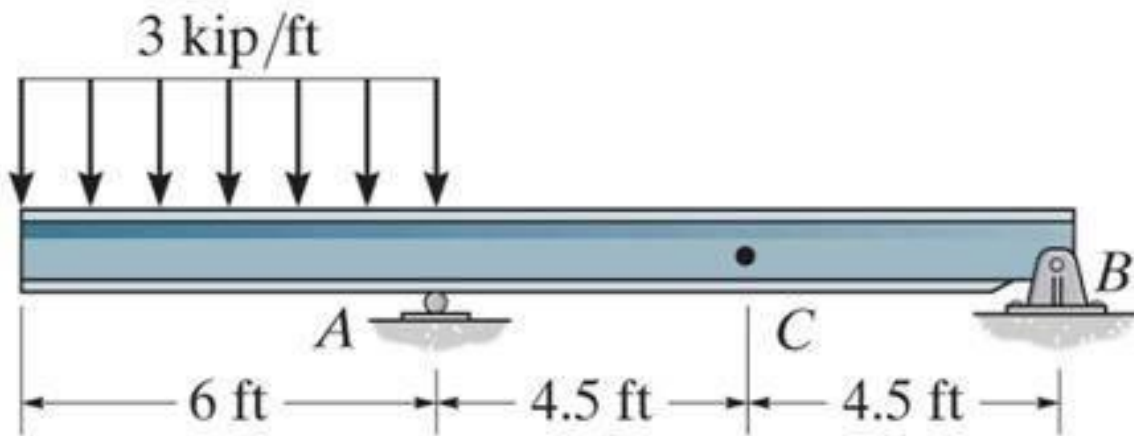
Find the internal forces at point C.

1200 N/m

A

C

B

|← 1.5 m →|← 1.5 m →|

Determine the normal force, shear force, and bending moment at C of the beam.