Statics - TAM 210 & TAM 211

Lecture 20

March 2, 2018

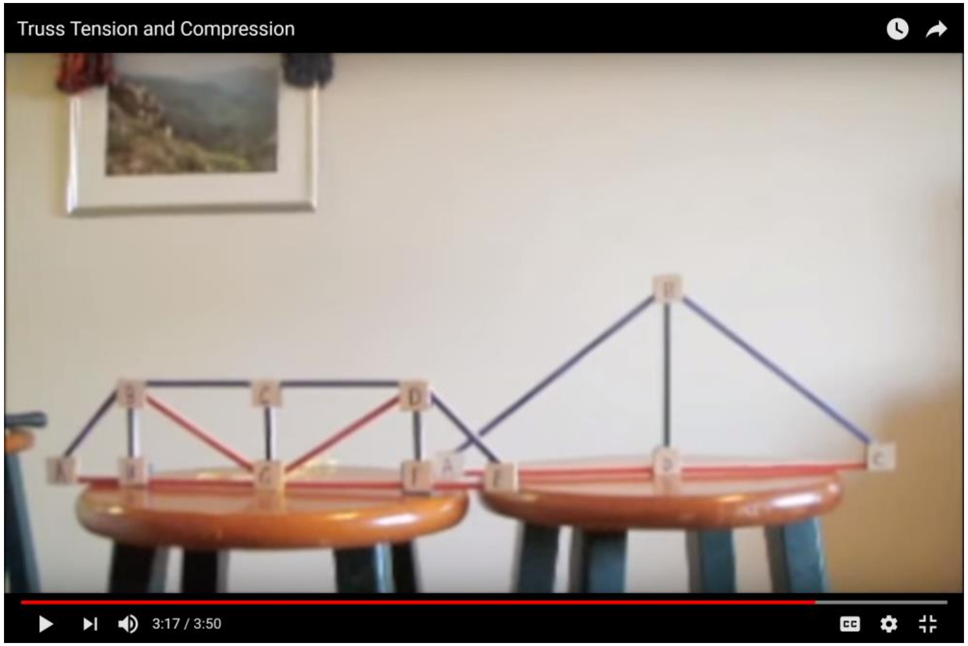
Chap 7.1

Announcements

- Structured office hours of working through practice problems will be held during Sunday office hours in 429 Grainger
  - 3:00 - 4:30 pm
  - Starting this Sunday March 4

- Upcoming deadlines:
- Monday (3/5)
  - Mastering Engineering Tutorial 8
- Tuesday (3/6)
  - PL HW 6
- Quiz 4 (3/7-9)
  - Sign up at CBTF

The following short video provides simple explanations of truss structures, members in tension & compression, and zero-force members https://youtu.be/8DdOy5ftxRc



Recap: Procedure for solving for forces/moment in frames and machines

1. Identify two-force member(s) and zero-force members to simplify direction of unknown force(s).
2. Identify external support reactions on entire frame or machine. Draw FDB of entire structure.
3. Draw FDBs of individual subsystems (members). (Solve respective equations of equilibrium $\sum F_x = 0$, $\sum F_y = 0$, $\sum M_{most\ efficient\ pt} = 0$.)
4. Solve for the requested unknown forces or moments. (Look for ways to solve efficiently and quickly.)

Chapter 7: Internal Forces

Goals and 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

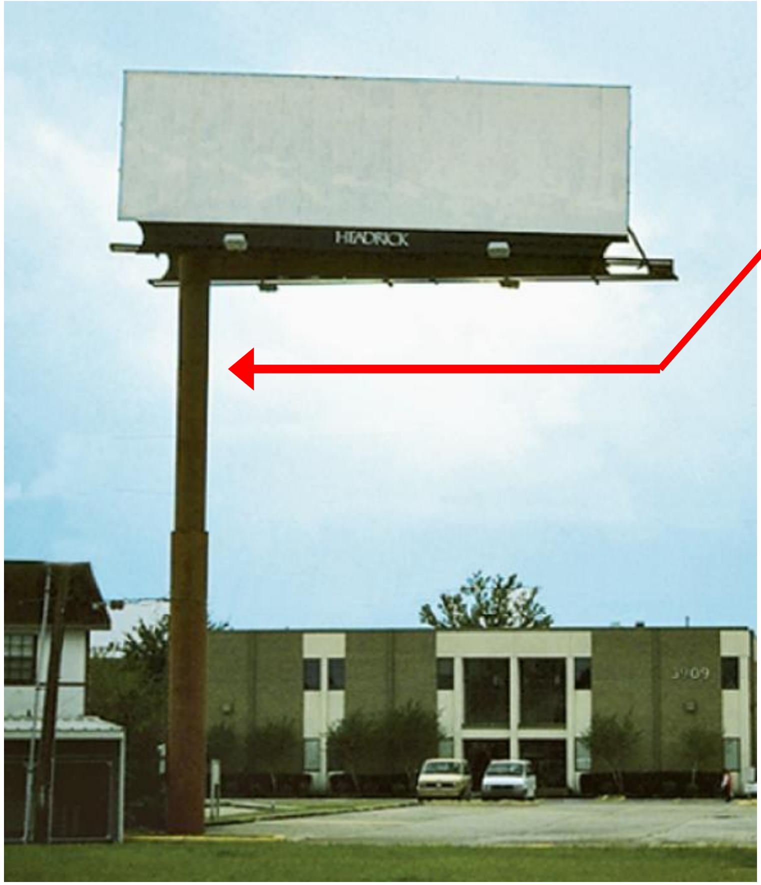
Internal loadings developed in structural members

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.

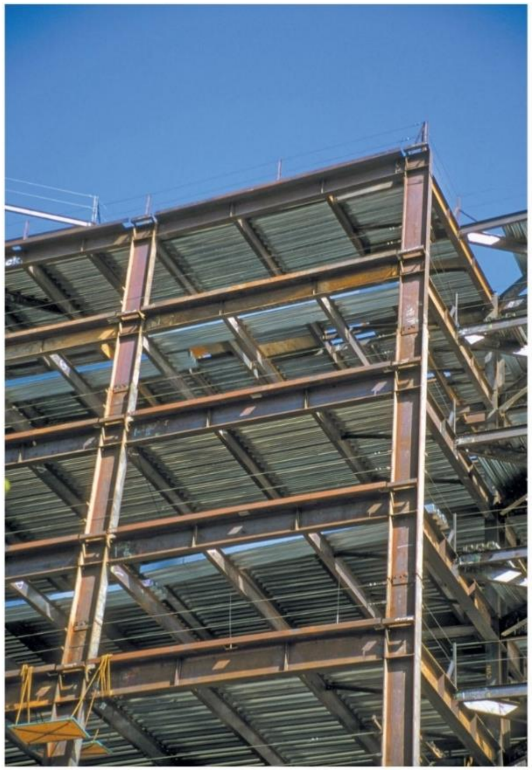
Internal loadings developed in structural members

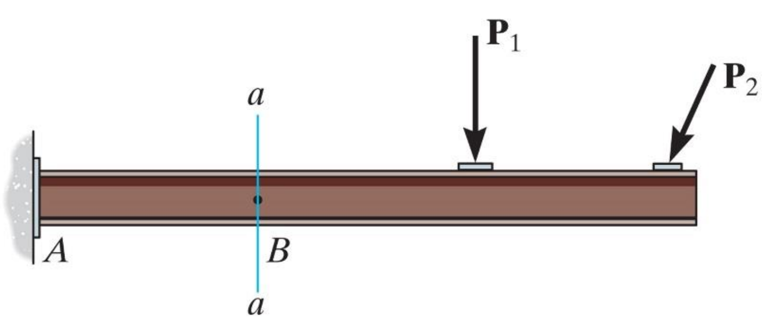


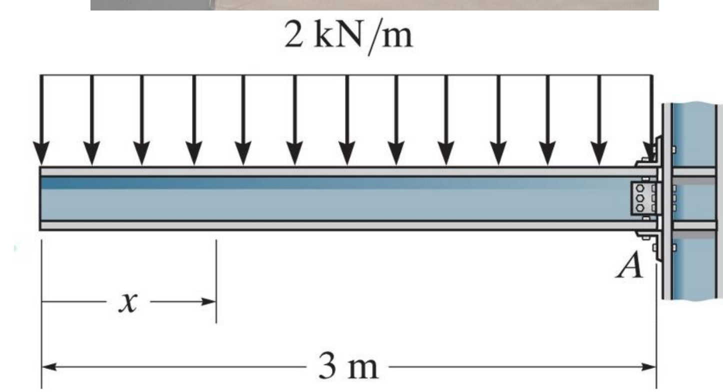
A fixed column supports these rectangular billboards.

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

Internal loadings developed in structural members



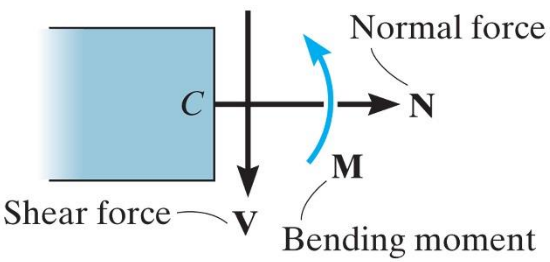




Internal loadings developed in structural members

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.**



https://www.youtube.com/watch?v=hLfNCAHPL8c BCT540 Truss Test, Group 2

https://www.youtube.com/watch?v=YdqvGGFlbfc Steel Rebar Tensile Test

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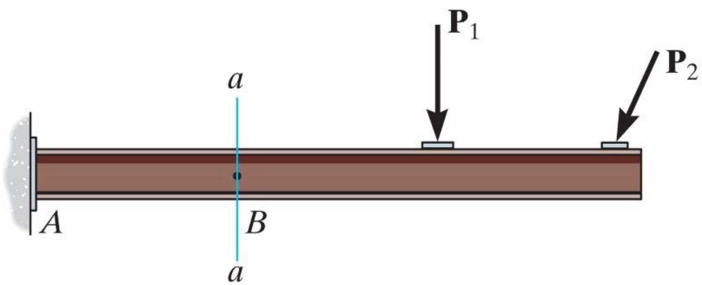
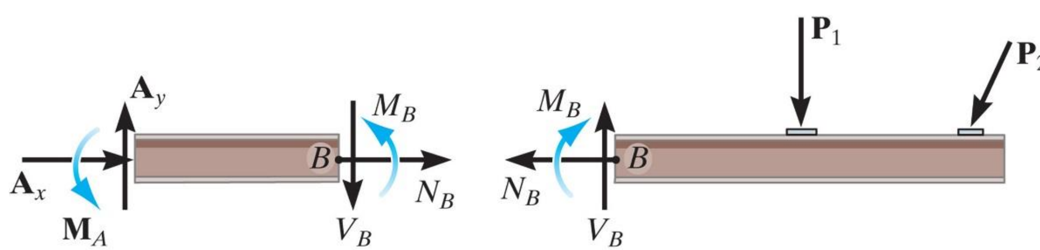
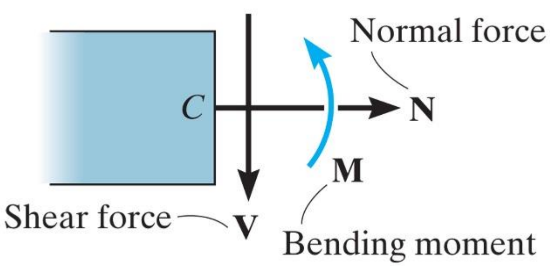
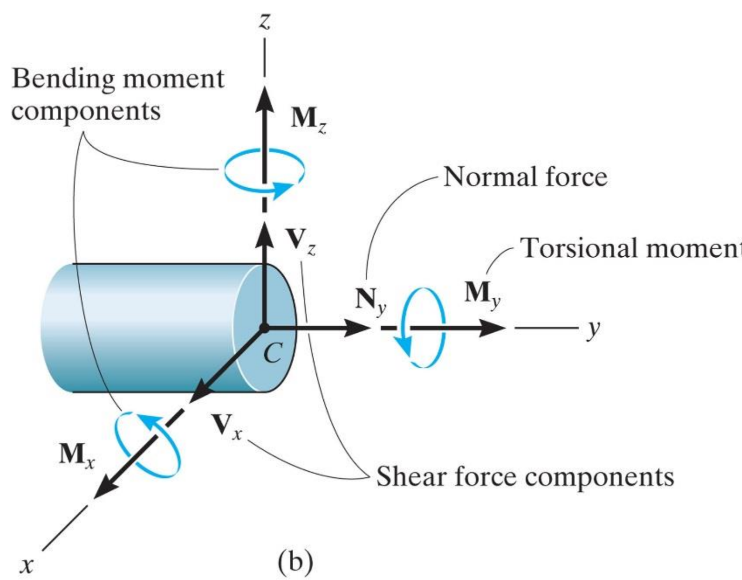


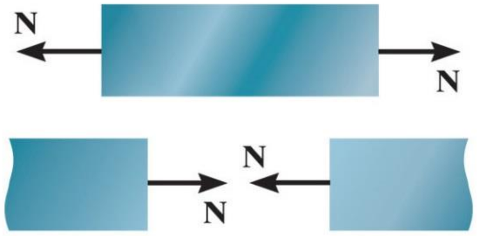






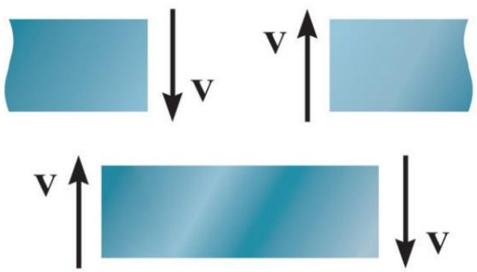
Sign conventions:

Positive normal force



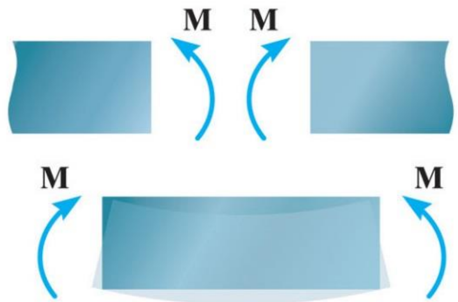
Positive normal force

Positive shear force



Positive shear

Positive moment

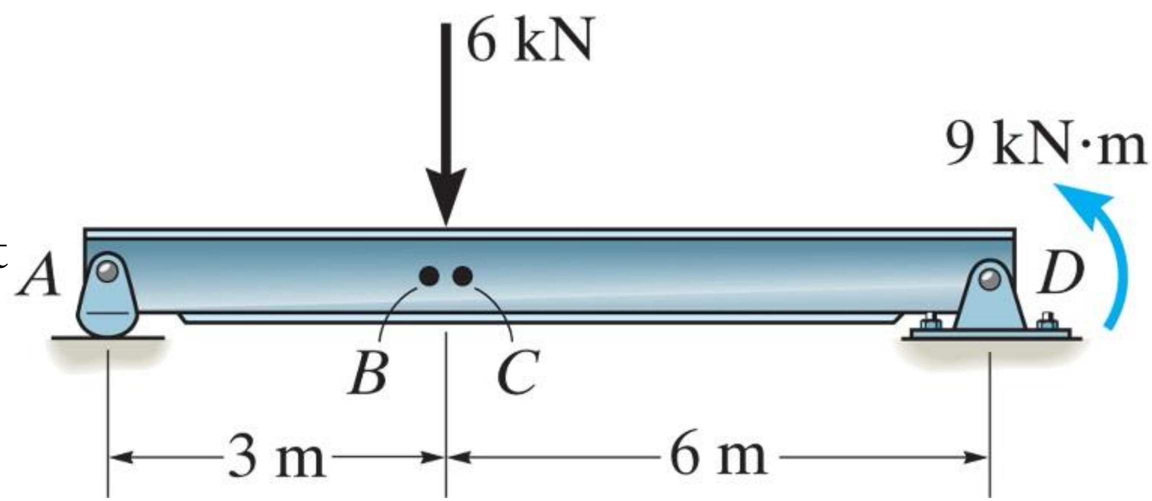


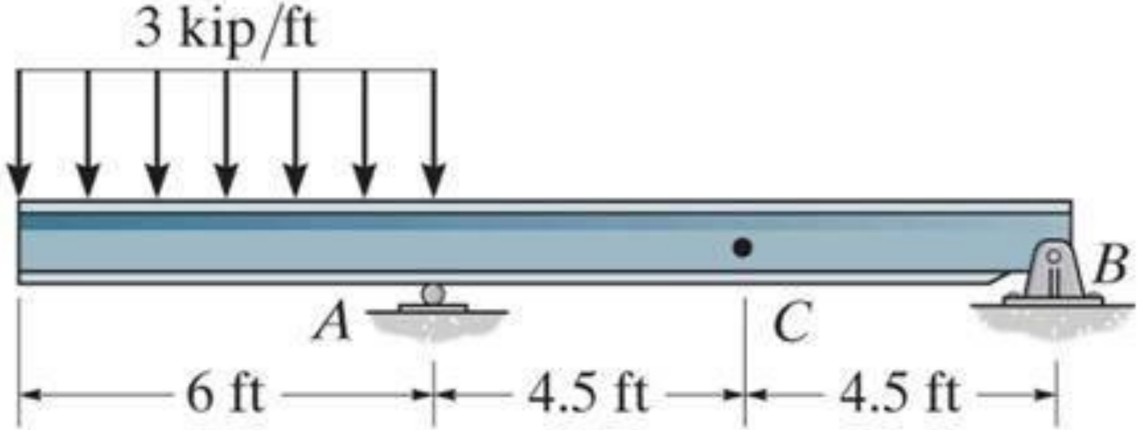
Positive moment

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 load P) and at C (just to the right of load P)





Find the internal forces at point C.