Announcements

- Check course schedule for assignments, activities and written exams dates (especially if you’re in TAM 210)

- Upcoming deadlines:
  - Friday (10/19)
    - Written Assignment
  - Tuesday (10/23)
    - PrairieLearn HW
Recap: Internal Loadings

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

Objective

- Determine the internal loadings in members using the method of sections
Internal Forces and Moment

Normal force ($N$):

Shear force ($V$):

Bending moment ($M$):
Sign conventions

Positive normal force

* Pointing away from the body

Positive shear force

* Creates a clockwise rotation on the body

Positive moment

* Smiley face

\[ \sum F_x = V = 0 \]
\[ \sum M_a = M + V_a = 0 \]
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

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

\[ \sum F_x = D_x = 0 \]
\[ \sum F_y = A - 6\text{kN} + D_y = 0 \rightarrow D_y = 1\text{kN} \]
\[ \sum M = (6\text{kN})(6\text{m}) - A(9\text{m}) + 9\text{kN}\cdot\text{m} = 0 \]
\[ \rightarrow A = 5\text{kN} \]

2) For point B, make a cut at B.

\[ \sum F_x = N = 0 \]
\[ \sum F_y = 5\text{kN} - V = 0 \rightarrow V = 5\text{kN} \]
\[ \sum M_A = -V(3\text{m}) + M = 0 \]
\[ M = 3V = 15\text{kN}\cdot\text{m} \]
Determine the normal force, shear force, and bending moment at \( B \).
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Do not use the "equivalent" system to generate the section FBD!
Determine the normal force, shear force, and bending moment at D.

1. **FBD (left piece)**
   - \( \sum M_A = -8 \text{kip} \cdot (8 \text{ft}) + B (24 \text{ft}) + 40 \text{kip} \cdot \text{ft} = 0 \)
   - \( B = 1 \text{ kip} \)

2. **FBD (right piece)**
   - \( \sum F_x = -N = 0 \)
   - \( \sum F_y = V + 1 \text{ kip} = 0 \)
   - \( \sum M_B = 40 \text{ kip} \cdot \text{ft} - M - V(8 \text{ft}) = 0 \)
   - \( N = 0 \)
   - \( V = -1 \text{ kip} \)
   - \( M = 48 \text{ kip} \cdot \text{ft} \)

Focus on the right piece: we only need B support.