

Styrofoam Beam Competition
Saturday Morning (4/11)
Memorial Gym stage

You are part of a team of engineers working together to design and build a Styrofoam beam. The beam should be lightweight, should support a load of 32 kg with as little deflection as possible, and should be constructed within 60 minutes.

Constraints and Objectives

- The beam will be 48 inches long and will span between supports spaced at 36 inches.
- The 70 lb (32 kg) load will be placed in four increments on the center of the top surface of the beam.
- Beam weight should be minimized.
- Beam deflection should be minimized under the 70 lb (32 kg) load.
- The beam should be constructed within 60 minutes.

Materials / Equipment

Provided per Team

- 48 in long pieces of Styrofoam of varying widths and thicknesses (they can be cut by you during construction)
- Hot glue gun with eight sticks of hot glue
- Emergency materials may be requested during construction but will count for 1.5x weight.

Overview of the Design, Construction, and Testing Process

Design (due 3/15/26)

- Review provided material properties for the Styrofoam.
- Design your beam (using as much or as little theory as you wish)
- Email a copy of the materials list (p. 3) to ASCEMidSouth2026@tnstate.edu by 3/15/26.

Construction (April 11, 2026)

- Assemble and glue your beam pieces together.
- Cut the provided pieces as needed.
- Penalty points will be assessed for construction time over 60 minutes.
- Add up the total weight of provided beam materials.

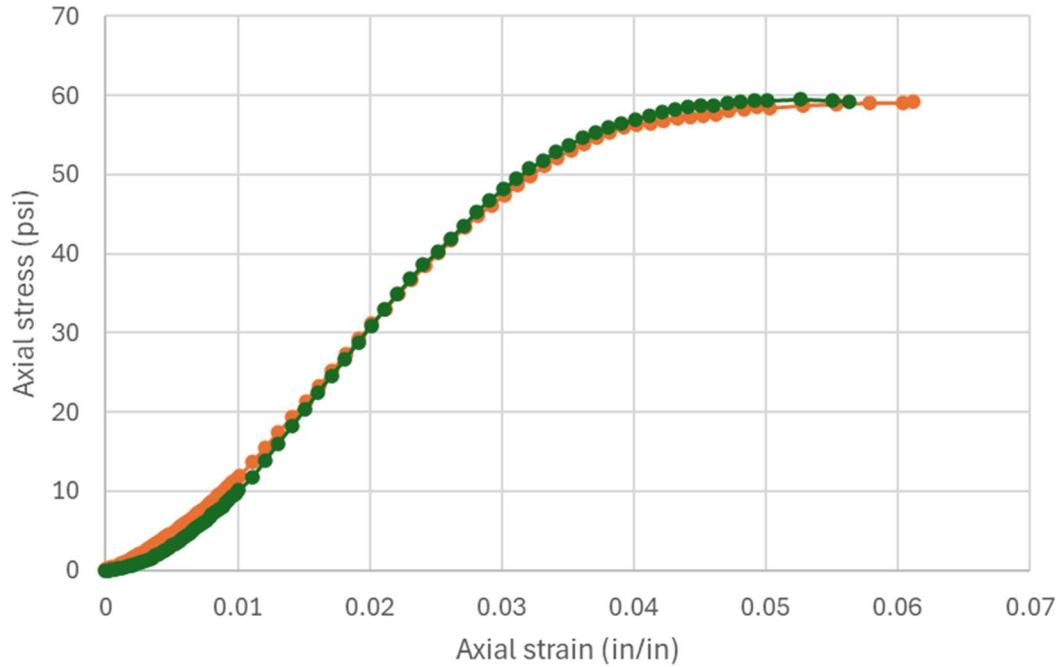
Loading Process

- Place the beam on the provided supports separated by 36 inches.
- Measure the distance to the top of the unloaded beam above the floor.
- Add the 32 kg load in four equal increments.
- Measure the distance to the top of the beam.
- If desired, load the beam until it breaks.

Styrofoam Beam Design

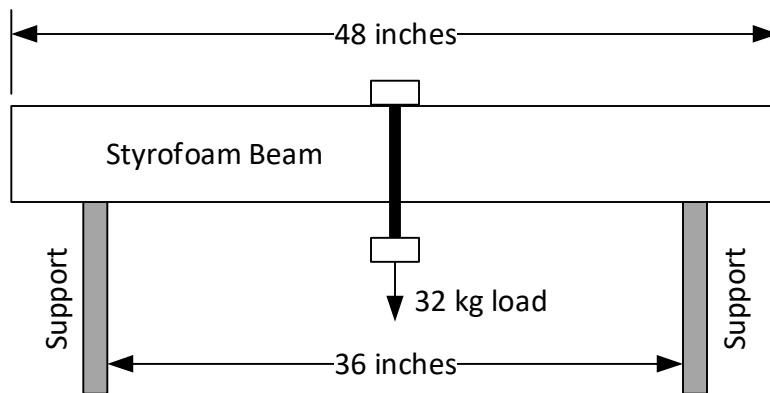
Compression Test Results

Two unconfined compression tests were performed on 1 in. x 1 in. x 2 in. specimens of the same Styrofoam that will be used for your beam. You may use the results of these tests to help you design your beam if you wish.



Loading Setup

A schematic of the loading setup for the beam is shown below.



Styrofoam Beam Material List

Use the table below to make a list of the Styrofoam sizes that your team requires. You can adjust this later and also add more materials during construction.

Available sizes (all pieces are 48 inch long):

| Thickness | Width | Approx. Weight (lb) | Number preordered (during design): FILL IN THIS COLUMN | Emergency order (during construction): FOR JUDGES' USE |
|-----------|----------|---------------------|---|---|
| 0.5 inch | 2 inches | 0.069 | | |
| 0.5 inch | 4 inches | 0.139 | | |
| 0.5 inch | 6 inches | 0.208 | | |
| 0.5 inch | 8 inches | 0.278 | | |
| 1 inch | 4 inches | 0.278 | | |
| 1 inch | 6 inches | 0.417 | | |
| 1 inch | 8 inches | 0.556 | | |

Complete the fourth column above and email a copy to ASCEMidSouth2026@tnstate.edu by 3/15/26.

Event sponsored by Palmer Engineering



Styrofoam Beam – Construction and Testing

Construction Phase

Your requested materials are provided to you. You will be “charged” for the weight of these materials. Construct your beam by hot gluing it together as shown by the judge team. Make any adjustments during construction that you like, asking for additional materials you might need. You will be charged 1.5 times for those materials.

| Construction | Value |
|--|-------|
| Weight of preordered supplies, W_1 (lb) | |
| Weight of emergency ordered supplies, W_2 (lb) | |
| Total weight of supplies, $W = W_1 + 1.5 \cdot W_2$ (lb) | |
| Construction Time, t (min) | |

Testing

Place your beam on the test supporters. Put the load strap over the beam with the hanger. Place the 32 kg of weights on the hanger and measure the deflection (if it holds!).

If desired, you can continue to add weights to the hanger until the beam breaks.

| Test Condition | Value or Measurement |
|--|----------------------|
| Vertical measurement unloaded, d_1 (in) | |
| Vertical measurement with 32 kg weight, d_2 (in) | |
| Displacement with 32 kg weight, $d = d_1 - d_2 $ (in) | |

Scoring

Your beam will be scored using the following formulae:

$$Score = 50 \cdot \left(\frac{1 \text{ lb}}{W} \right) + 25 \cdot \left(\frac{1 \text{ in}}{d} \right) - Penalty$$

$$Penalty = \begin{cases} 0 & \text{if } t \leq 60 \text{ min} \\ t - 60 & \text{if } t > 60 \text{ min} \end{cases}$$