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@tntech.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.

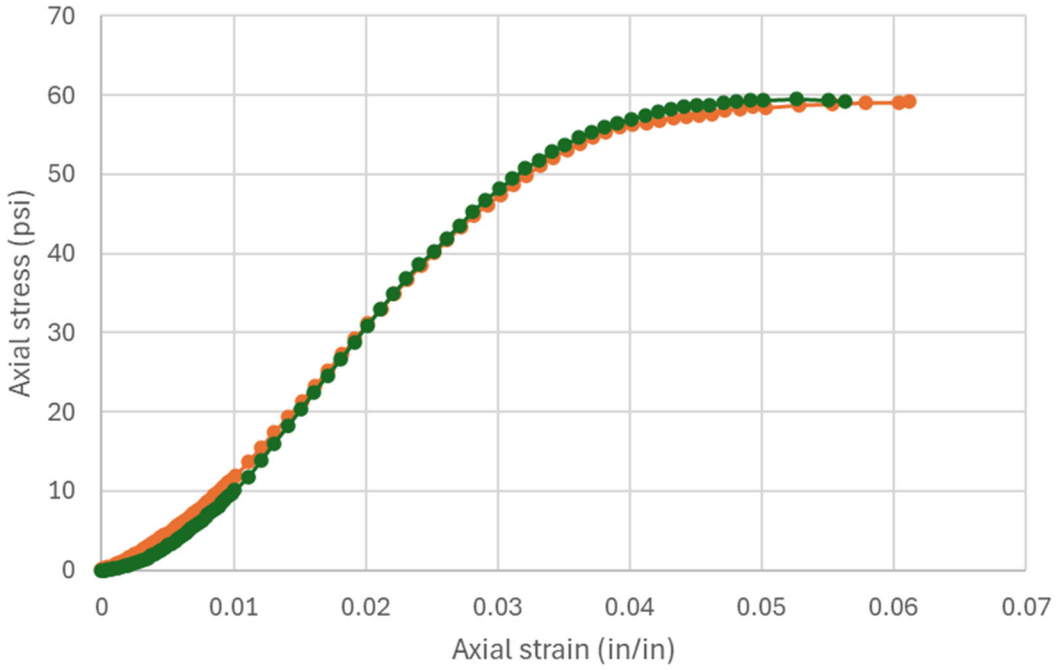
Loading Process

- 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

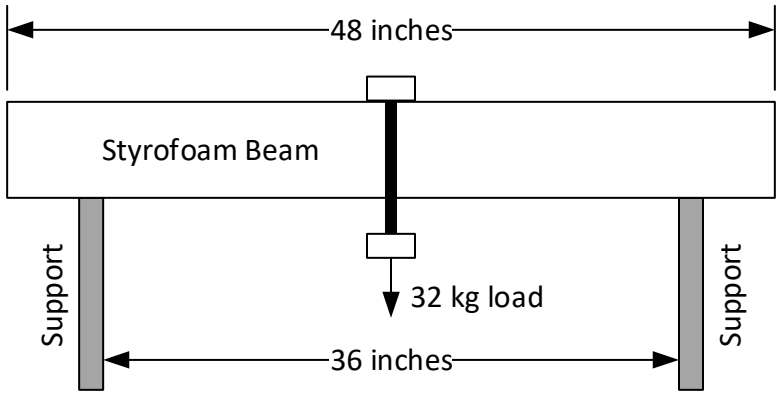
Compression Test Results

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@tntech.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. Measure the unloaded vertical measurement. 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, $d = \lvert d_1 - d_2 \rvert$ (in)	

Scoring

Your beam will be scored using the following formulae:

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

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

Requests for Information (RFI)

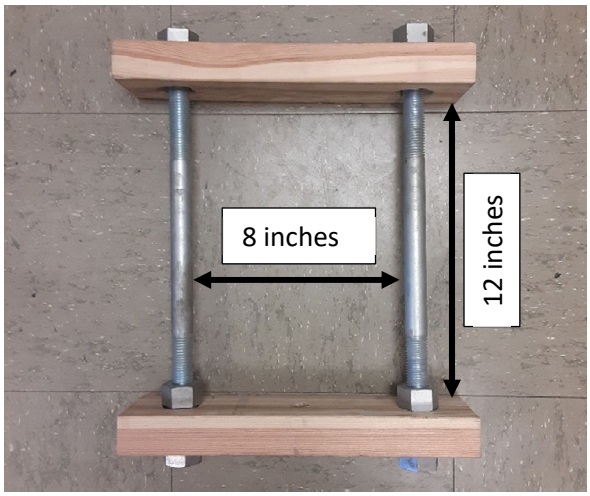
The following RFI's were received. Responses follow each RFI.

1. The beam must be 48 inches long, but the support span is only 36 inches. Are teams permitted to reduce, taper, or otherwise modify the beam's cross-section outside the support span, provided the beam remains 48 inches in total length?

   The cross-section of the beam may vary along its length. The competition helpers will have some ability to help teams perform additional cuts on their materials using a hot wire saw. Teams may also provide their own non-powered equipment (e.g., utility knives). However, safe construction practices are required. Teams must provide appropriate PPE, such as cut resistant gloves, for the equipment used. Safety decisions will be made by the Safety Officer Team.

2. The rules reference a loading strap. Can you provide additional details, such as the strap width, thickness, and the vertical clearance available for the strap to wrap around or hang from the beam during testing?

   The loading apparatus is shown below. The opening is 8 inches wide and 12 inches high. The beam should fit within this opening. The weights will be hung from the lower board. The weight of the loading apparatus will be included in the applied 70 lb load.



3. Are localized reinforcements (e.g., additional foam layers or caps) permitted in specific regions of the beam, or must the cross-section remain uniform along the entire 48-inch length?

   Yes, localized reinforcement is allowed, provided the loading apparatus fits around the beam. Such reinforcement must be cut from your provided materials.

4. To confirm: the beam must be exactly 48 inches in length, even though the support spacing is 36 inches, resulting in approximately 6 inches of overhang on each side. Is this interpretation correct?

   Yes, 6 inches of the beam extend beyond the supports. Note that the supports are each 1.5 inches wide (2x4 wood).

5. Are there any maximum allowable dimensions for beam depth or width? The rule sheet does not appear to specify limits beyond the provided foam stock dimensions. It is inferred that the strap geometry will limit maximum dimensions for the beam.

   The only dimension requirements for depth and width are for the loading apparatus (see RFI 2)

6. To clarify, no additional score is granted for supporting significantly more than 70 lb. The 70 lb load serves as the minimum required weight to be eligible for scoring, with the score determined solely by beam weight and deflection at the 70 lb load.

   Correct. The score is solely based on the deflection under the 70 lb load and the beam weight. Teams will be allowed to break their beams after the competition, if desired. But this loading will not be part of the official score.

7. The scoring formula appears to heavily favor very small deflections. Because deflection values are much smaller than weight values, the term becomes much larger in magnitude, causing small reductions in deflection to increase the score far more than similar percentage reductions in weight.

   We will continue to use the provided scoring formula. It was based on prior experience with this activity. It may be possible (within the dimension limits) to optimize your design to the score. That said, we encourage teams to design a realistic beam shape, particularly for steel sections.

8. What type of Styrofoam is being provided? If you got it from Lowe's, what color?

   The foam will most likely be the Kingspan GreenGuard from Lowes.