Curiosity Guide #207
Bridges

Accompanies Curious Crew, Season 2, Episode 7 (#207)

Make a Straw Truss Bridge

STEM Challenge

Description

Find out what happens when you add triangles to your bridge design!

Materials, per team

- 20 stiff straws about 10 and $\frac{1}{4}$ inches in length
- Scissors
- Ruler
- Scotch tape
- Paper cup
- Washers or pennies
- Container to hold washers
- Dry erase board
- Marker
- Erasers
- Truss designs. Search the internet for "truss bridge designs."
- Stack of books, wooden blocks, or two desks for supports

Procedure for making a straw truss bridge

1) The objective is to build a straw truss bridge.
    - The bridge should span 9 and $\frac{3}{4}$ inches, with a total length of 10 and $\frac{1}{4}$ inches.
    - The bridge must attach to at least two long straws that will span the 9 and $\frac{3}{4}$ inches.

- The center of the bridge must support a freestanding paper cup, where weight will be added.

2) Establish the bridge supports, using desks, books, or blocks. Separate the two supports with a 9 and $\frac{3}{4}$-inch gap.
3) Examine the samples of truss designs.
4) Brainstorm and draft a picture of a straw truss design on your dry erase board.
5) Working from the finished design on your white board, build a straw truss bridge.
6) You will measure and cut straws to match your design. Use tape to join straws together.

Procedure for testing the straw truss bridge

1) Test the bridge for balance on the piers and space to support the cup. Adjust as necessary.
2) Test the strength of your bridge by filling the cup with washers or pennies.
3) How many washers or pennies could your bridge hold before collapsing? If you are doing this in a class or large group, compare your results with those of other bridge-builders.

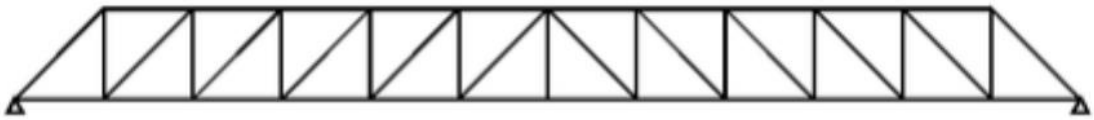
My Results

Explanation

Beam bridges are the most common and least costly bridge to build. Beam bridges consist of horizontal beams, called girders, which rest on end supports. The top side of the beam is under compression force. The underside of the beam that is attached to the end supports is under tension force. The beam itself must be able to withstand its own weight and any load placed upon it, so the material used plays an important role. Although wood can be suitable, steel and concrete are common. Regardless of the material, the beam itself might be solid, hollow, or engineered.

Truss bridges consist of horizontal and vertical beams with fastened triangles. This type of bridge became popular in the 1800s, particularly for railroad bridges. The truss design increased the strength of beam bridges considerably by dissipating the forces along the beam.

See next page for more to think about!



Howe truss illustrated - the diagonals are under compression under balanced loading

Think about it: Have you ever seen a train go across a bridge that looked like this? If you did, perhaps you were looking at a Truss bridge designed by William Howe in 1840. Notice how he included both diagonals to carry the compression force and vertical parts to handle the tension. These were wooden bridges, but they were strong enough to carry a train. William Howe's Truss design became really popular in the railroad industry. All aboard!

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