

Paper Bridge

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Educational Goals: Introduction to types of bridges and an understanding of the basic forces and materials used in bridge design and construction.

Description: Each ACE team builds a paper bridge that is loaded with weight. Goal is for each bridge to support a design weight using the least amount of the materials provided.

Time: 2 hours / one mentoring session.

Materials: Each ACE team will be provided with the following materials:

- 15 sheets of 8 ½" x 11" paper (Note: teams may only use the paper that is provided)
- standard staples (1/2" crown, 1/4" leg, chisel point)
- scotch tape
- scissors
- test weight (e.g., books) defined by mentors, and referred to as 'truck'
- Measuring tape
- Camera for final presentation and ACE website photos

Additional Resources: *Bridges: How Do They Work and Why Do We Care?* PowerPoint file that can be downloaded from ACE website

Activity: Presentation / Group Activity

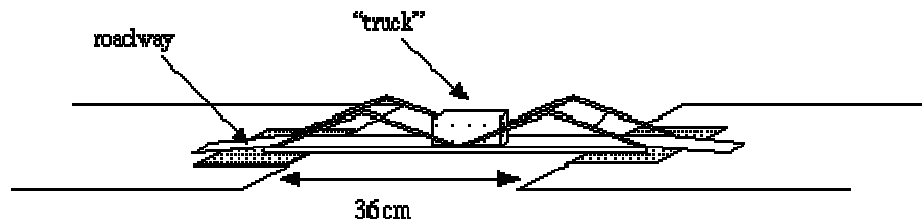
Session begins with a summary presentation of alternate types of bridges and the types of forces and materials used in the design and construction of bridge structures. Following, ACE Teams design and construct bridges made from materials provided.

Rules for Construction of Bridge:

- Each team must sketch a "plan" of their bridge design prior to construction.
- Bridges are constructed from no more than fifteen 8½ in. by 11 in. sheets of paper, tape and staples only. Paper will be 20 lb. long grain white 'copy' paper.
- An unlimited number of staples are allowed, but every staple used in the bridge must pierce some piece of paper.
- The paper may be cut into any shape and as many pieces as desired.
- The bridge must have a minimum clear span of 36 cm (approx. 15 inches) and an overall length of no more than 80 cm (approx. 32 inches).
- Bridge must be constructed in such a way that it can be supported at both ends on a flat horizontal surface.

Rules for Testing of Bridges:

- Teams will be provided with two horizontal surfaces set a distance of 36 cm / 15 inch (min) apart. The bridge must sit freely on these surfaces; it cannot be secured to this surface by any means. The horizontal surfaces must provide the sole source of support for the bridge; the bridge cannot be supported by the floor, ceiling or vertical edges of the surfaces.
- Teams will have 60 minutes to design and construct the bridge to demonstrate that it will hold the "truck" for one minute.
- When completed, teams will place the truck on bridge. Truck will be centered on the span on top of the roadway with no part hanging below the roadway. It must be supported only by the paper bridge; it must not be supported in whole or in part by the horizontal surfaces or any other support.
- Bridges that collapse in less one minute result in disqualification.



Scoring:

- score for bridges that support the "truck" for at least one minute are determined by the following formula:

$$\text{Score} = W / P$$

where W is the weight of the 'truck' and P is the number of sheets of paper used in whole or in part by the contestants. The bridge with the maximum score 'wins'. In the event of a tie, the bridge with the fewest staples and/or least amount of tape places highest.

Alternate Activity:

- Incrementally increase 'weight' of truck. Test each of the bridges to failure to determine which bridge design supports the greatest weight.