



## ACE MENTOR PROGRAM

ARCHITECTURE • CONSTRUCTION • ENGINEERING

# STRUCTURAL ACTIVITIES

## PAPER BRIDGE

DEVELOPED BY:

THE ACE MENTOR PROGRAM OF GREATER NEW YORK

**Educational Goals** Introduce students to major types of bridges. Develop an understanding of basic forces and materials used in bridge design and construction.

**Description** Student teams build a paper bridge that is loaded with weight. The goal is for each bridge to support a design weight using the least amount of the materials provided.

**Time** 90-120 minutes

**Materials** Each team should be provided with the following:

- ▶ 15 sheets of 8 ½" x 11" paper (20 lb.) (Note: teams may only use the paper 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 the "truck"
- ▶ Measuring tape

**Additional Resources** The PPT presentation *Bridges: How Do They Work and Why Do We Care?*, which can be found in the Bridges section of this website, shows different types of bridges and explains their structural forces.

At the beginning of the session, mentors should give a summary presentation about alternate types of bridges, the structural forces affecting them, and the materials used in their design and construction. Next, mentors tell student teams the rules for the bridge construction and the event, and then over the next 60 minutes, the teams design and construct bridges made from the materials provided. Finally, mentors test the bridges.

### Rules for Construction of Bridge

- ▶ Each team must sketch a "plan" of their bridge design prior to construction.
- ▶ It must be constructed from no more than fifteen 8½" x 11" sheets of paper, tape and staples only. Paper will be 20 lb. long grain white "copy" paper.

## Paper Bridge

created by John Chirco,  
with PB, for the  
Greater New York affiliate



BRIDGES



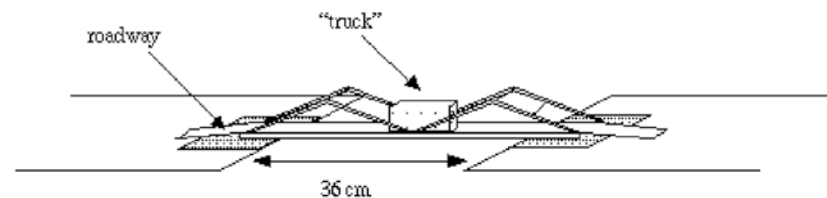


- ▶ An unlimited number of staples are allowed, but every staple used in the bridge must pierce some piece of paper.
- ▶ The paper may be cut into any shape and as many pieces as desired.
- ▶ The bridge must have a minimum clear span of 36 cm (approx. 15 inches) and an overall length of no more than 80 cm (approx. 32 inches).
- ▶ The bridge must be constructed in such a way that it can be supported at both ends on a flat horizontal surface.

### Rules for Event

- ▶ Teams will be provided with two horizontal surfaces set a distance of 36 cm/15 inches (minimum) apart. The bridge must sit freely on these surfaces; it cannot be secured to this surface by staples or any other 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 the bridge. It 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 may not be supported in whole or in part by the horizontal surfaces or any other support.
- ▶ Bridges that collapse in less than one minute result in disqualification.

### Scoring



The score for bridges that support the “truck” for at least one minute is calculated by the following formula:

$$W / (P+2)$$

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 will place highest.

*As an additional activity, incrementally increase weight of “truck” and test each of the bridges to determine which bridge design supports the greatest weight. ▽*