RAFT IDEAS

Topics: Forces, Engineering, Design

Materials List

- ✓ Bridge building materials (craft sticks, hanging file folders, paper, newspaper, straws, string, or wire)
- ✓ Glue (white glue, wood glue, or low temp glue gun)
- ✓ Fasteners (tape, staples, brads)
- ✓ Graph paper
- ✓ Supports for bridges (desks, chairs, blocks, bricks)
- ✓ Weights or equal (books, sand)
- ✓ Optional: rope & bucket

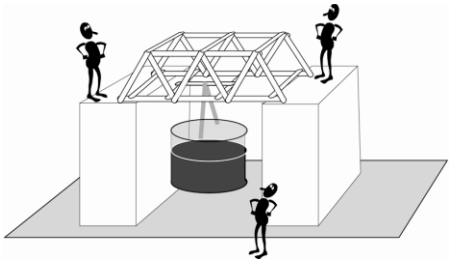
This activity can be used to teach:
Next Generation Science:

- Forces & Motion (Physical Science, Middle School, 2-2; High School, 2-1)
- Gravity (Grade 5, Physical Science 2-1)
- Compare solutions (Eng. Design, Grades 3-5, 1-2; Middle School, 1-2, 1-4)
- Test variables & Design Criteria (Grades 3-5, Eng. Design, 1-1, 1-3)
- Science & Eng. Pract. (Grades 4-12)

raft resource area for teaching www.raft.net

Bridging the Gap

How to strengthen spans, bridges and attention!



How strong can a bridge be made using a limited set of materials?

To Do and Notice

Teacher Suggestion: Before the activity, teachers should discuss basic ideas of bridge design - what do the students think is important? Provide any design constraints on dimensions and/or materials.

1. Working individually, in pairs, or in small groups, create a plan for the bridges on graph paper. Plans can include sketches of the top, front, and side views of the bridge with the dimensions listed.
2. Build bridges using chosen materials, glue, and/or fasteners in accordance with any design constraints established for the activity.
3. Once a bridge is completed test each bridge either by setting a load limit or by loading (adding weights to) the bridge until it fails. First, place the bridge across two supports. Then place a load on the bridge using one of the following methods:
   a. Smaller, lighter bridges can be tested by stacking weights on top.
   b. For larger bridges use a strong rope to hang a bucket from the bridge. Note: keep feet and other body parts away from the "drop zone"

The Science Behind the Activity

A successful bridge requires a design incorporating specific materials with a strong method of connecting the pieces together. Design factors include the force of gravity acting upon the bridge, the forces acting on the structural beams, moving loads such as people or vehicles on the bridge, and stresses such as the force of winds and earthquakes. These forces can subject the entire bridge and/or individual parts to tension (pulling forces), compression (pushing forces), torsion (twisting forces), and shear forces that act directions that are not parallel to the bridge or individual parts.

Taking it Further

- Calculate the efficiency ratio: weight of the supported load / weight of the bridge
- Hold a class competition/challenge: Given agreed upon constraints, which team can create a bridge that supports the greatest load. Constraints can include bridge dimensions: length, width, height, distance between support members, and weight. Constraints can also be set for the types and amounts of materials and fasteners.

Web Resources (Visit www.raft.net/raft-idea?isid=9 for more resources!)

- Design ideas and details - www.garrettsbridges.com/
- Interactive program to design trusses - www.jhu.edu/~virtlab/bridge/truss.htm

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