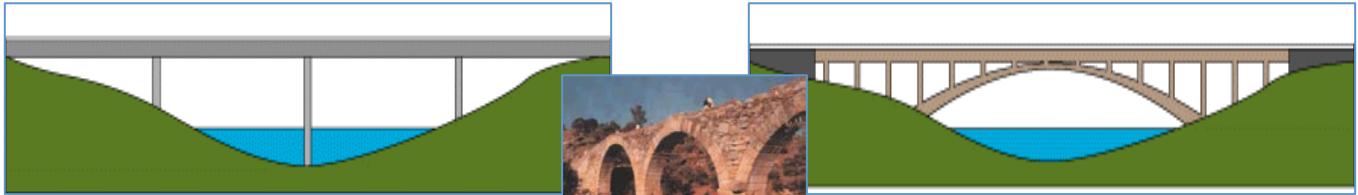


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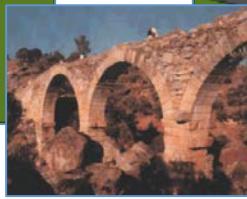
# Ship-Shapes! (Teacher Version)

## Building Bridges

Think about different bridges you've seen. There are three main types of bridges: **beam**, **arch**, and **suspension**. Label the following bridges according to what type you think they are:



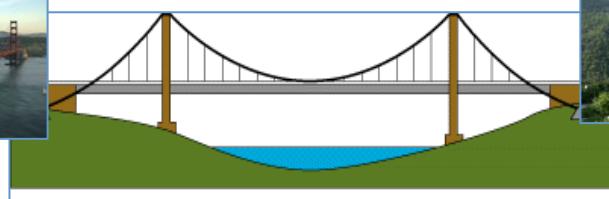
a) \_\_\_\_\_



b) \_\_\_\_\_



c) \_\_\_\_\_



d) \_\_\_\_\_

e) \_\_\_\_\_

f) \_\_\_\_\_

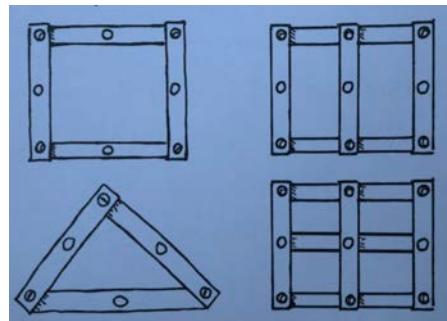
a) and e) are beam; b) and c) are arch; d) and f) are suspension.

What sorts of shapes do you recall noticing on the bridge's supports?

## Which is Strongest?

### Materials:

- Hole punch
- Paper fastener
- Lightweight cardboard cut into strips: (18 – 5cmx23cm, 2 – 5cmx30.5cm)



### Instructions:

1. Punch three holes into each strip.
3. Test each shape by holding the bottom two corners or the shape while a partner pushes against one upper corner with a finger. Review the results.

2. Build the blue shapes above using the 18 strips of cardboard.
4. Add diagonal supports to the square using the 2 long strips. First add just one, then add both. Are these stronger than the plain squares?

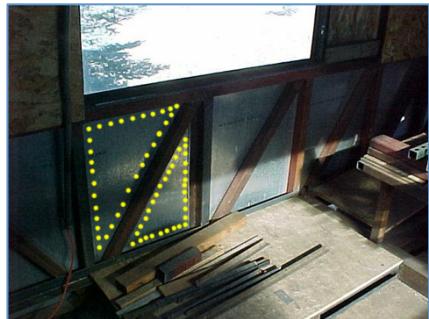
Name: \_\_\_\_\_

## Talk About It!

Which shape was strongest? The triangle and the square with trusses should have been the strongest.

What made it stronger? The sides were able to support the entire shape, instead of collapsing. This is due to the fixed size of the sides, which in turn fixes the size of the angles, so the triangle cannot be adjusted like a hexagon or pentagon could.

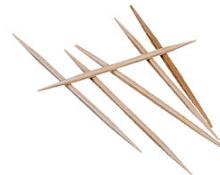
Why do you think diagonal beams are often added to otherwise square frames? To split the shape into two stronger triangles.



## Strong Shapes!

### Materials:

- Toothpicks
- Marshmallows



### Instructions:

1. Obtain 20 toothpicks and 10 marshmallows. Design and build a house that will stand by itself, keeping in mind what you just learned about which shapes are strongest.

2. When you're done, go see what other people are building. Share some ideas that worked well with you if they would like help.

### Follow-Up:

Do you think your house will last overnight? Why or why not?

What do the strongest houses have in common? They take advantage of strong shapes and aim for stability.

If you were to build your structure again, what would you do differently? Keep in mind what you have learned about strong shapes.



Name:

### **Image Sources:**

### **Building Bridges:**

1. Science Tech:  
[http://www.sciencetech.technomuses.ca/english/schoolzone/Info\\_structures.cfm](http://www.sciencetech.technomuses.ca/english/schoolzone/Info_structures.cfm)
2. eGFI: <http://teachers.egfi-k12.org/lesson-bridge-swe/>
3. Highest Bridges:  
[http://www.highestbridges.com/wiki/index.php?title=Shuanghekou\\_Bridge](http://www.highestbridges.com/wiki/index.php?title=Shuanghekou_Bridge)

### **Which Is Strongest?**

1. Office Depot: <http://www.officedepot.ca/paper-fasteners/acco-round-head-paper-fastener-71709.asp>
2. English Forum: <http://www.englishforum.ch/daily-life/184734-one-hole-hole-punch-2.html>
3. Food Family Finds: <http://foodfamilyfinds.com/candy-cane-ornament-holiday-craft-for-kids-giveaway/>

### **Talk About It:**

1. Roger's Connection: <http://www.rogersconnection.com/triangles/>

### **Strong Shapes!**

1. Pitsco: <http://www.pitsco.com/Toothpicks?SKU=51742>
2. Business Week: <http://www.businessweek.com/articles/2012-10-17/what-does-the-marshmallow-test-actually-test>

### **Follow-Up:**

1. The Idea Room: <http://www.theidearoom.net/2009/08/marshmallow-and-toothpick-buildings.html>