# 7th Grade Toothpick Bridges

**Objective**
Work together in teams to build a bridge made of toothpick and marshmallows.

**Tips:**
- Open the bag of marshmallows a couple days before the activity is to be done, dry marshmallows provide a more stable link between toothpicks (and less sticky) than moist ones.
- Plan to allow 20 minutes of discussion and building time. As the teams begin to build, notice the shapes they are using. Many will begin with squares, a weak shape.
- Bring up the concept of triangles and their inherent strength, and encourage them to start again using triangles. Or they may want to keep the existing structure but strength it by cross-bracing existing squares (which will sub-divide the squares into triangles). Or, they may want to add stabilizing "legs."
- Don't forget to allow at least 5 minutes to clean up time before the class period ends.

**Materials needed for each group of 3 kids:**
- ½ bag of mini marshmallows per group
- 1 bag of toothpicks per group
- Two heavy chairs or tables, placed about 1 ft apart
- Lightweight cup with string attached
- 1 marble
- 1 cup
- 1 piece of string

**Procedure:**
Divide the group into teams of 3 people each. Gather your materials and talk about how your bridge should be designed. Which shape lends the most strength? Sketch a few ideas and talk about how strong each might be. Choose the one that you think will be the strongest.

Using marshmallows and toothpicks, construct a bridge about one foot long. Try a few different approaches and start over, if you like.

Once it is done, allow it to sit undisturbed for a few minutes to set. Structurally, does it resemble real bridges you've seen? How much weight do you think it would hold?

When all teams are ready, place the two chairs or tables a little less than a foot apart. The chairs represent the shorelines that your bridge must span. Place your bridge across the span. Does it buckle under the force of gravity? Try pressing down a bit on the top of the bridge. Does it hold? What forces is the bridge experiencing?

If your bridge holds steady, try testing its strength. Loop the string over the bridge with the cup empty. If it holds, add a glass marble (or penny), one at a time, and see how many your bridge will hold.

When the bridge begins to buckle, you will know its load limit. Whose bridge holds the most weight? You can compare by measuring the number of pennies in each bucket.

**Reflections:**
- What new things did you learn about bridges?
- What is the force?
- What is the difference between compression and tension?
- What other types of structures have you seen that use triangles or trusses?
- What did the strongest bridges have in common? What did the weakest have in common? Try to use the new terms you have learned.
- Did you final design look like your initial design? If not, what changes did you make and why?