# Activity Guide: Building Bridges

**Purpose:** Design and build a bridge and understand how they work. Different types of bridges can serve different purposes depending on how they are built.

**Museum Connection:** We are curious, creative and playful!

**Main Idea:** Bridges must be able to withstand several types of forces. The two most common to model bridges are compression and tension, pushing and pulling respectively. The other two are torsion (twisting) and shear. Learn what these forces mean so that you can build a better model bridge.

**Background Information for Educator:** Ask open ended questions to see what experience the student(s) have with bridges.

Have them spend time drawing bridges in their journals.

Show student a variety of bridges. Why would this be called an Arch? What does suspension mean? Do you know what a cable is? Have you ever heard of a truss? (what shapes do you see in the truss?)

While looking at pictures of bridges try to make observations to see what type they might be and what might they be used for. Is it for pedestrians, vehicles, animals?

What shapes do you see? How do you think they built this bridge. How heavy do you think something could be to safely cross this bridge?

Next, have them build a bridge using just a piece of paper and a few blocks. Have them try so support various objects on the bridge (markers, crayons, etc.)

**Sources:**

https://kidskonnect.com/science/bridges/

www.garrettsbridges.com

**Age:** Grades pre-k-6

**Prep (Time):** 10 minutes

**Activity Time:** 30 minutes

**Materials:**

| Item |
|---|
| Cups |

| |
|---|
| Craft sticks |
| Plastic animals |
| Blocks |
| Paper |
| Counters to pile on top |

**Talking Points:**

- Encourage kids to reflect back on the bridge pictures when they are creating their designs.
- For older kids, ask them to recall what pushes and pulls the bridge (compression and tension)
- Ask: *Where else have you heard or pushing and pulling/compression and tension? Why are those things important to know about with bridges? What bridges have you seen before? What makes them unique?*
- *Keep an eye on small counters…usually kids at younger age are beyond the eating toys phase but you never know ☺

**Step-by-Step Instructions:**

1. Cut out a long piece of paper to serve the top of your bridge. This piece should be able to withstand the weight of your plastic animals.
2. Connect your bridge buy using arches, trusses, tension, etc.
3. Add weight to the top of your bridge. Your bridge should be able to withstand the weight.
4. Experiment with different materials such as spaghetti, popsicle sticks, rubber bands

**Picture of Final Project:**

## Build A Brige – Additional information

**Background information:**

Bridges must be able to withstand several types of forces. The two most common to model bridges are compression and tension, pushing and pulling respectively. The other two are torsion (twisting) and shear. Learn what these forces mean so that you can build a better model bridge.

Compression:

Compression is a pushing (compressing) force. The shorter a piece of wood is, the more compression it can hold. The longer a piece of wood is, the less compression it can hold. When you compress a long stick of wood you will notice that it starts to bend. When a piece of wood breaks because of compression, we say it failed from buckling. Typically the top chord of a bridge, including model bridges, will be in compression. Different truss designs spread out the force so that various internal parts will be in compression as well.

Compression

Tension:

Tension is a pulling force. Wood has the ability to resist a lot of tension. It would be hard to break a popsicle stick if you held both ends and pulled apart. Tension may be applied parallel to the grain of the wood, but should be avoided perpendicular to the grain. Wood is very strong in tension parallel to the grain, but much weaker in tension perpendicular to the grain. Also, unlike in compression, the ability of wood to resist tension does not change with its length. A shorter piece of wood should hold the same amount of tension as a longer piece.

Tension

Torsion:

Torsion is a twisting force. When you wring out a cloth, you are applying torsion to the cloth. If you take a stick pretzel, twist one end, and hold the other end still, it will break very easily. If you do that with a baseball bat, it will not break. However, if you take a piece of licorice and apply torsion to it, the licorice will twist around several times before it breaks. Each of these materials has a different way of responding to torsion. Bridge designers must watch for torsion and try to reduce it as much as possible.

Torsion

Shear:

Shear is an interesting force. It happens when there are two opposing forces acting on the same point. If you hold a piece of wood with both hands next to each other, and push up with one hand and down with the other, you are applying shear to that piece of wood. Shear usually occurs horizontally, and not vertically.

www.garrettsbridges.com