

## Build a Bridge

Bridges can be extremely simple. For example, a log laying across a stream is an example of a beam bridge! To make this kind of bridge, all you need is a horizontal deck supported by piers on each end. Beam bridges are an easy option when you need a short bridge, however, they become weaker as the beam becomes longer. As people or vehicles travel across a long beam, their weight makes the center of the beam bend.

Engineers have created designs that better distribute this weight, or force, to produce stronger bridges. By building bridges with triangle shapes (trusses), supportive cables (suspension and cable-stayed), or arches, the forces acting on the bridge are spread out and distributed to strong anchors.

The materials used to build bridges also matters. Strong bridges are usually made of iron and steel rather than wood. In fact, the key to earthquake resistant bridges may be in the materials. Flexible joints and materials might allow a bridge to move and shake, but not break, during an earthquake. How would you design a strong bridge that can withstand an earthquake?

### Materials needed:

- Paper and pencil
- Popsicle sticks
- Glue
- Tape
- Books
- 2 chairs

### Step-by-step instructions:

1. Research common types of bridges, such as beam, arch, truss, cantilever, suspension, and cable-stayed.
2. Design your bridge! Draw your design on paper.
3. Using popsicle sticks and glue, build a bridge that is at least 12 inches long.
4. Wait several hours for your bridge to fully dry.
5. Tape your bridge between two chairs.
6. Place a book or two on the center of your bridge.
7. Test your bridge! Simulate an earthquake by shaking the chairs back and forth.
8. If your bridge didn't stay up, redesign it and try again.

### Additional exploration:

- Try creating your bridge using different materials. What materials created the strongest bridge? Why do you think that was the case?

### Discussion questions:

- What type of bridge did you design?
- Did your bridge survive the simulated earthquake? Why or why not?
- If your bridge did not survive, how can/did you improve your design?

## Build a Bridge (continued)

### Types of Bridges

Engineers have discovered many designs that produce strong bridges. Each design has a unique way of distributing the forces (weight from cars, people, and trains) that act upon it.



#### Beam

A basic bridge supported by vertical pillars called piers. Beam bridges are used for short distances only.



#### Arch

Arch bridges transfer forces acting on the center of the arch into abutments on each side.



#### Truss

A truss bridge is supported by connected triangle units. The triangles evenly distribute force from a single point to a wide point.



#### Cantilever

Cantilevers are supported on one end but not the other, like a diving board! Bridges typically use two cantilevers, allowing the middle span to be supported by large piers on either side.



#### Suspension

Suspension bridges are supported by long cables that drape between tall piers. The longest bridges use suspension.



#### Cable-stayed

Similar to a suspension bridge, cable-stayed bridges are supported by cables. However, the cables are directly attached to the bridge rather than draped between piers.