

## Bridge Building

Bridges are useful structures to carry roads or paths over obstructions like a body of water, another road, or even a big ravine.

Some bridges are small and might help someone walk over a small stream while other bridges are huge and carry many lanes of traffic over parts of the ocean! It's very important that all of these bridges are strong and safe. An engineer is someone

whose job is to design and build these bridges for everyone to use. Their designs may look complicated but there are some simple principles that help the engineers make sure these bridges last under all sorts of stressful conditions like weather, weight, and time.



### Supplies Needed:

- Hot glue gun (will also be needed for Stomp Rocket activity)
- Popsicle sticks
- Hot glue stick refills
- 2 pieces of paper (located in the folder)
- Water bottles (or other small weights) (not included)

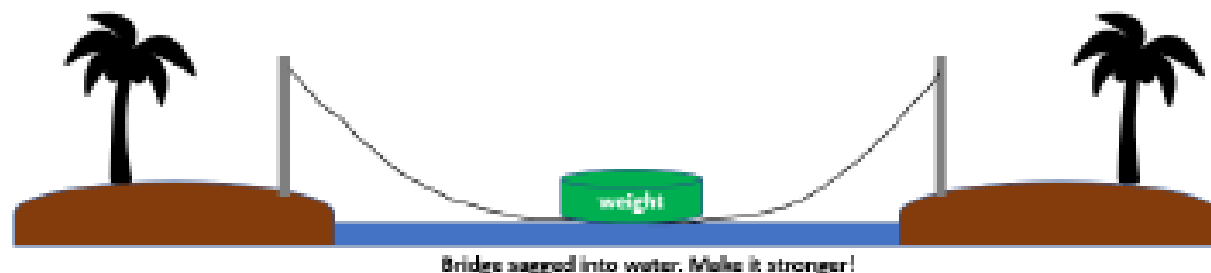
### Set Up:

- Plug in your hot glue gun so that it will warm up and start to melt the glue inside. It takes about five minutes for the glue gun to fully warm up.
- Place two pieces of paper on the floor about 24" apart.

### Building Your Bridge:

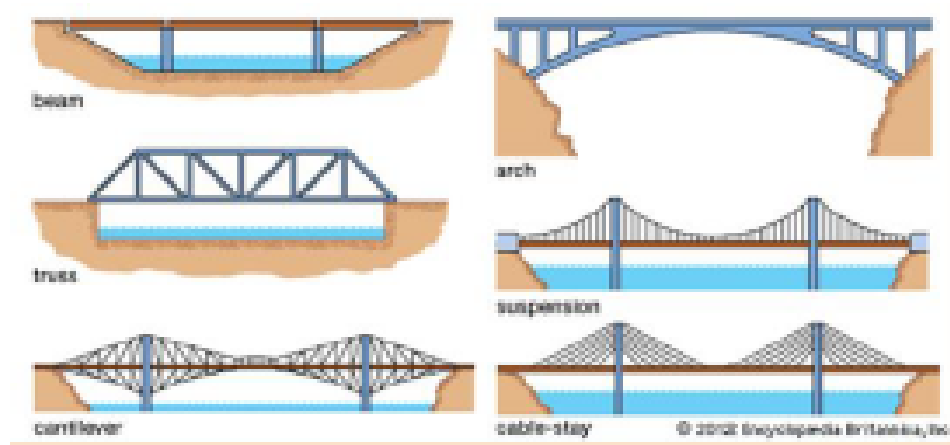
- Imagine these two pieces of paper are islands and everything surrounding them is water. Your job is to create a bridge that will span these two islands but also not touch any water in between, even when exposed to weight in the middle.
  - This can be tricky because your bridge will naturally start to sag when weights are added. You will need to make sure to elevate your bridge a little bit (or a lot) above the floor so that when it sags a bit, it won't touch the floor.

- If you're having a hard time getting started, take a look at the end of this document for some typical bridge designs. You can use these as a starting point, but the whole idea is to be creative and try a new design.
  - Remember that triangles are stronger than squares.
- Once your bridge is complete, confirm that it will span the islands and that it's not touching any water in between.
  - Make sure it's above the floor/water enough that under a little weight stress, it won't sag into the water
  - At this point, allow the glue to cool for about 15 minutes.
  - Then, try adding a small bottle of water to the middle of the bridge and see if it's strong enough to hold it up without collapsing or sinking into the water.
  - Did you succeed? If so, try adding another bottle of water. How many can your bridge hold?



### Tips and helpful info:

- There are many bridge designs that have been used throughout history and a few are shown here. The idea of this project is for you to use your imagination and creativity to build your own bridge design.
  - Just remember the rules... no part of your bridge can touch the water. So, the beam design below, for example, isn't allowed.



- Gluing popsicle sticks end to end will make the connections very weak. Try overlapping the popsicle sticks by about an inch and you'll see how much stronger they can be.



### Safety Tip:

- Hot glue guns, surprisingly, are hot!
- Don't touch the metal tip of the gun or the liquid glue that comes out.
- The glue that leaks out between two popsicle sticks is hot until it dries.
- Don't wipe away excess liquid glue with your finger.

## The Heritage Group Connection:

The Heritage Group has a company called Milestone which designs and builds bridges in the Indianapolis area. If you think you'd like to build bridges as a full time job, check out some of these jobs that Milestone offers:

- **Engineer** – Designs bridges on paper and uses science and math to make sure they are strong and durable.
- **Project Manager** – Develops schedules and budgets to make sure the project runs smoothly.
- **Foreman** – Organizes all the workers and makes sure electrical, structural, plumbing, and carpentry all are done properly.
- **Operators** –Runs heavy equipment like backhoes, cranes, bull dozers, and excavators.



This is Dave Gibson. He is a bridge project manager and works with The Heritage Group. He organizes daily jobs for the construction workers and orders all materials needed to build the bridge. The instruction manual he uses to build the bridge is called the construction plans.

