

# TIPS & HINTS FOR DESIGN AND CONSTRUCTION

PRESENTED BY THE TRI-CITY BRANCH OF  
ENGINEERS AND GEOSCIENTISTS BC

## BEFORE YOU BEGIN

You will need a large flat space to work on your bridge project for a couple of days or longer. You do not want to move your bridge around frequently, especially while the glue is drying. So, find large a flat space other than the kitchen table to work on your bridge.



Cover your workspace with newspaper or a large piece of cardboard to protect the surface of the table in case you spill glue, and to move your project if necessary while your work is in progress.

Allow lots of time to assemble your bridge. Popsicle stick bridges can have 100's of glued joints. Allow time to repeat the glue process many times.

## RULES

Make sure that you read and understand the rules. To avoid disqualification, the design of your bridge must incorporate the dimensional restrictions explained in the rules. *See Links to Resources at the end of this document.*

## DESIGN

Before starting assembly, plan your bridge on paper or using software for computer-aided drawing. A plan will help you avoid using more sticks in the construction of your bridge than allowed by the rules, or, wasting sticks and not having enough sticks to complete your bridge.

Try to design your bridge using triangles, which are generally stronger than joining the popsicle sticks in squares and rectangles. There are lots of resources online that explain designs based on trusses for bridges, buildings and electric transmission towers.

Consider in the design of your bridge, which sticks will be in tension or compression when your bridge is tested. Compression is the type of force that your arms feel when you do a handstand. Tension is the type of force your arms feel when you hang from the monkey bars. Remember that long structural members will stay straight under tension, but may buckle under compression.

## ASSEMBLY

Popsicle stick bridges can have 100's of joints. Properly glued joints can help avoid your bridge failing due to a weak joint. Apply only enough glue to cover the overlap in each joint. Extra glue will squeeze out of the joint, make a mess and not add strength. Whenever possible, let the glue dry overnight. Be sure to follow the directions on the bottle of glue, do not move the joint until the glue is dry, and, don't rush the glue process.

To create a strong joint, clamp the joint during the glue process. You can use metal spring clips, as shown in the photos. You might find some clips around your home office, or purchase a bunch from an office supply store such as Staples. Plan ahead for thick joints with layers of sticks, purchase large clips.

Also, as shown in the photos, plastic spring clamps can be purchased from building supply stores such as Rona. Clothes pins may work as well.



To build several trusses with the same shape, build the first truss to use as a template. The remaining trusses can be assembled and clamped to the template. Let the glue dry before removing the clamps.

Work on a flat surface to assemble sections of your bridge, for example the top and bottom, or, the sides. Once these sections are complete, figure out a good procedure to assemble the sections, hold in a fixed position, and, let the glue dry. Your finished bridge will be stronger if the bridge sits "true", and does not rock. Avoid the situation with your bridge that you may have experienced sitting on a stool that rocks.

By the time you have completed your bridge project, you will have learned a lot about construction and how you might improve in the future. You might even want to first build a smaller trial bridge with popsicle sticks and white glue from adollar store.

### READY?

Try to keep about a dozen spare popsicle sticks in case you need to modify your bridge once assembled. When you think your bridge is ready, you can test your bridge at home between two tables or a few books placed on a flat surface to match the span of the testing apparatus shown in the rules.



### LINKS TO RESOURCES

Types of trusses: Underload, your bridge should stay nice and straight. Watch carefully as you gently press down on the middle of the deck of your bridge. Use a few spare sticks to help stiffen parts of the bridge that start to change shape. If the trusses start to bend along the length of the bridge, as shown in the photo, the structure of the bridge is already starting to fail.

You can also test your bridge for stiffness by holding each end and gently twisting. If the bridge twists easily, the structure may not remain straight when tested underload. Also, try squeezing the top edges of the trusses towards each other. The trusses should stay vertical to maintain the strength of the bridge. This is similar to a cereal box, which is more sturdy before it is opened. The glued flaps keep the top of the cereal box square and rigid.

- Types of trusses: <https://nedhalebrahimalshomeli.wordpress.com/2012/04/16/truss-bridge-14/>
- Design a Truss Bridge with a Computer: <http://bridgecontest.org/assets/2013/09/la4.pdf>
- Rules, competition webpage, event details, etc.: [CLICK HERE](#)