

# **Popsicle Stick Bridge Design and Construction**

Bengal STEM Day 2019

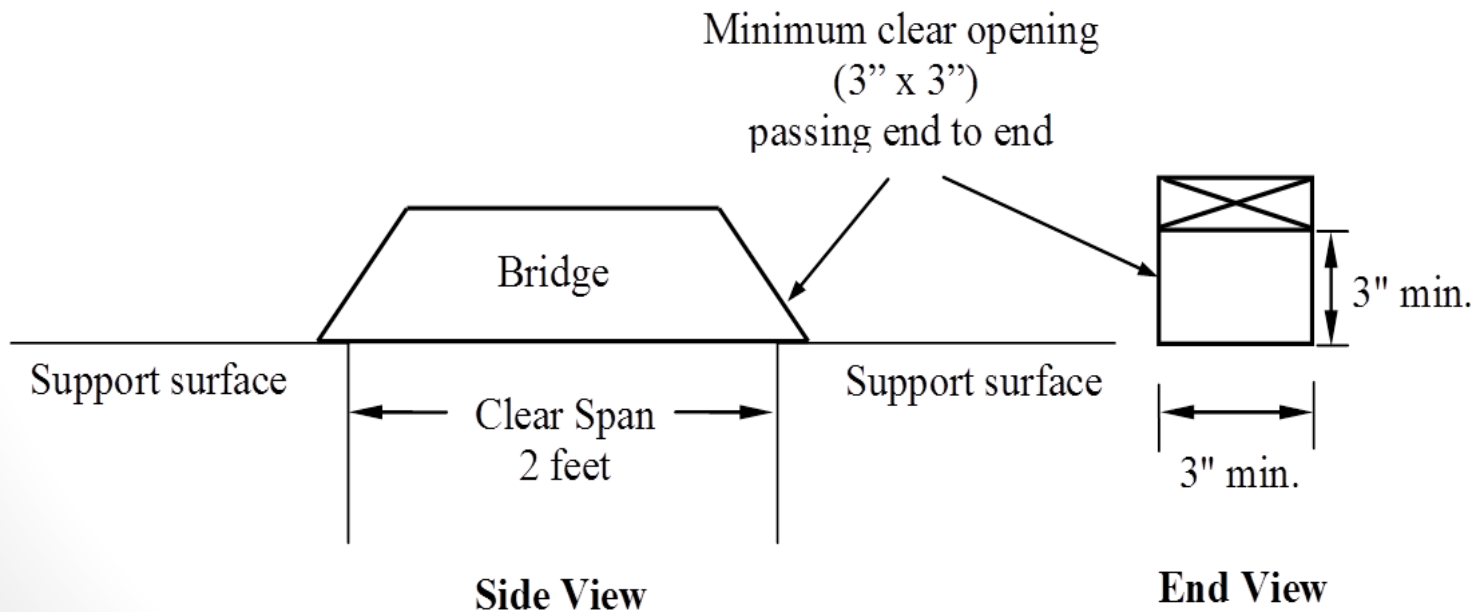
**Idaho State University**

# Bridge Rules

- Maximum Allowable Bridge Weight = 12 oz (340 grams).  
Note that a typical 4½ inch popsicle stick weighs approximately 1.3 grams.
- Bridges will be compared on a strength to weight ratio. The weight of the testing device (deck and connections) are not included in the final weight.
- Glue: Only wood glue (or Elmer's glue) and hot glue (hot glue gun) are allowed. Elmer's wood glue is recommended. Hot glue gun may also be used for propping up the panels and a few joints, but wood glue is the best choice for the majority of joints.
- It is recommended that you weigh your popsicle sticks before assembling your bridge and also weigh the final bridge before testing.

# Bridge Rules, continued

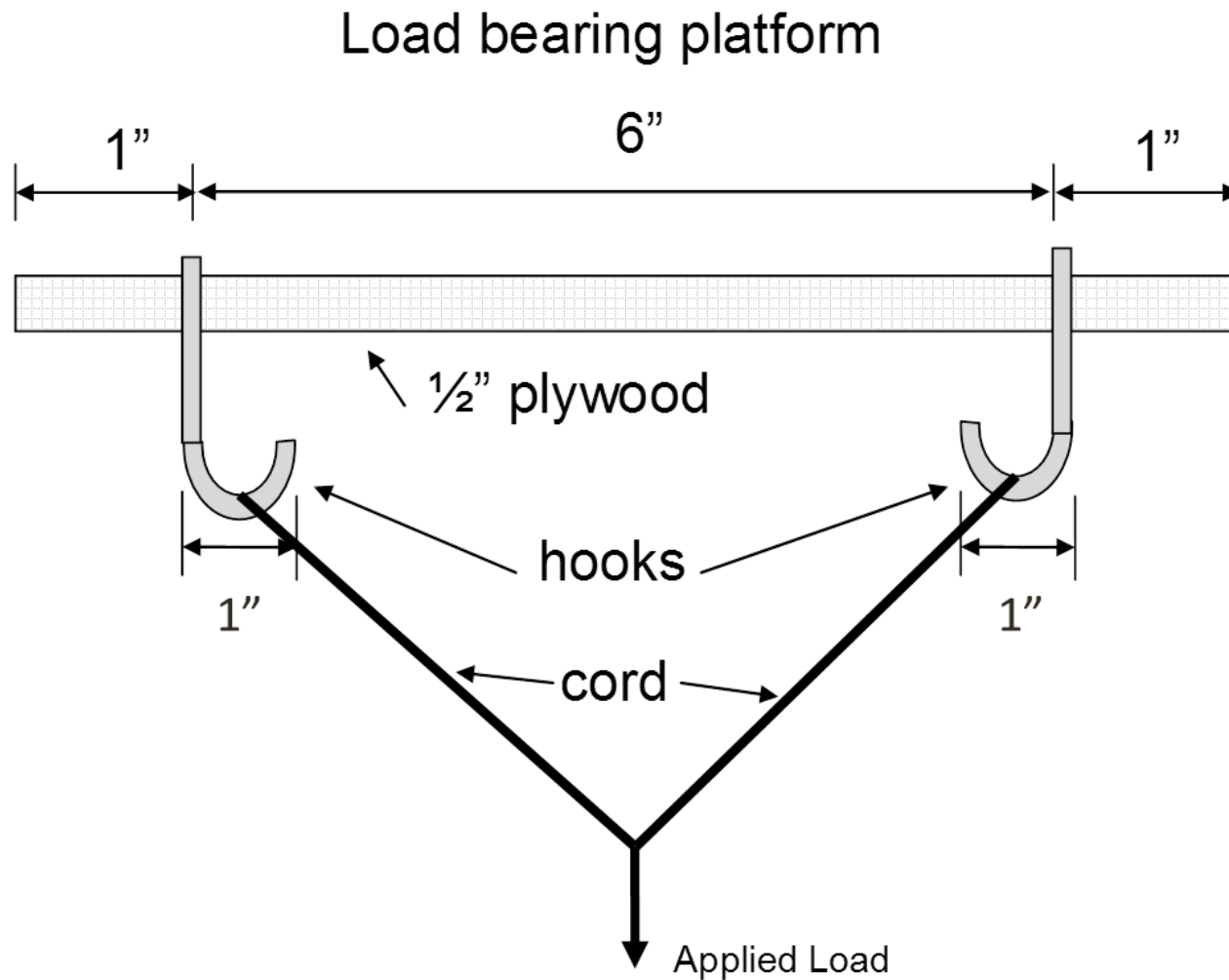
- The bridge shall be **free-standing** and must span two flat surfaces with a clear span of two feet or 24 inches.
- The bridge shall be no more than one foot (12 inches) in height, measured vertically from the lowest point to the highest point.



# Bridge Rules, continued

- The bridge shall have a clear 3 inches wide by 3 inches high opening passing through the bridge (end to end) to allow for the passage of a vehicle or the deck must be constructed on the top of the bridge.
- The loading deck/device will consist of a piece of plywood  $\frac{1}{2}$  inch x 3 inches wide x 8 inches long with connection hooks placed in the middle (centerline) 1 inch from each end. The bridge must have two clear openings (hole/slot) of at least 1" for the hooks of the loading deck to pass through the bridge deck. **The loading deck will be placed on the bridge in the middle** with hooks extending below the bridge deck from which a load measuring device will be hung. The loading deck may be placed parallel or perpendicular to the bridge on the top. See diagram on the next page.

# Bridge Rules, continued



# Bridge Rules, continued



Load bearing platform



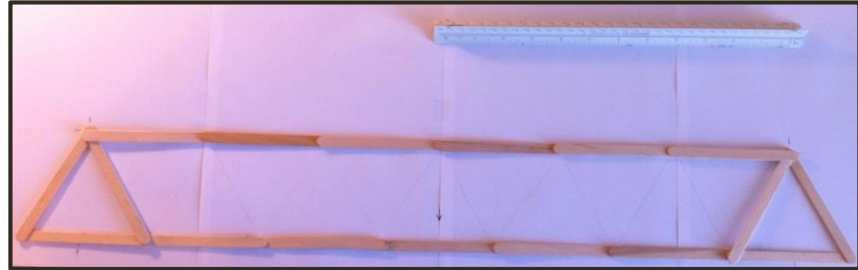
Cables applying the load

# Bridge Rules, continued

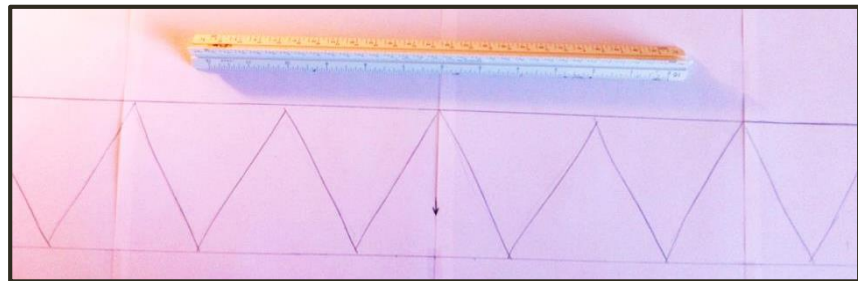
- Bridges will be weighed prior to loading and their load capacity compared with the overall weight. **The winning bridge will be determined by the highest ratio of applied load to bridge weight.**
- An incremental load will be applied to the loading platform using the hooks. Failure is defined when the bridge breaks or the structure twists or deflects too much such that it can no longer support the load.

# Recommended Steps

- Place the wood sticks on the paper. It is best to have symmetrical bridge. You may also consider an arch bridge, but remember it cannot be more than 12 inches in height. **Don't glue the sticks yet.**



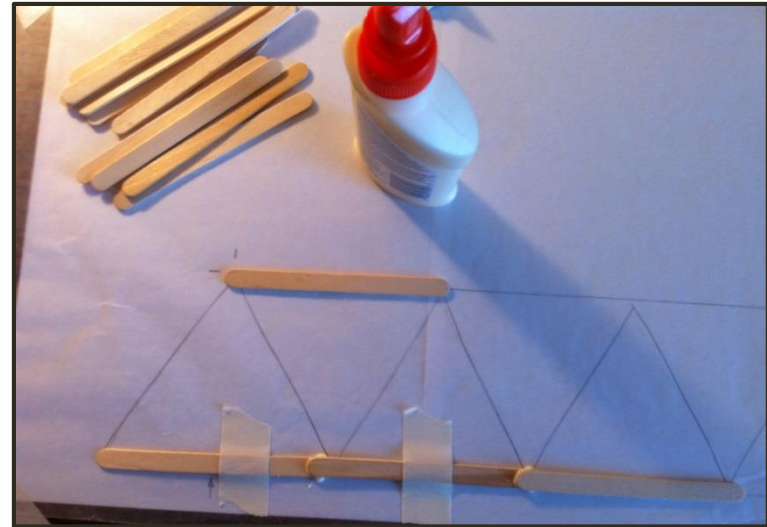
- Remove the sticks and sketch the shape of one side.





# Bridge Construction

- Start gluing the popsicle sticks together. You may want to use masking tape to help hold it in place.
- Once one side is glued, use the same sketch to make the other side.

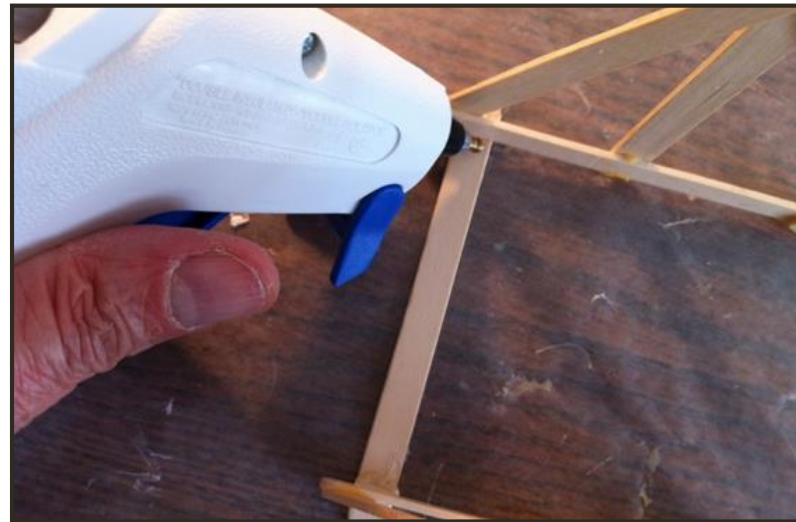


# Bridge Construction, continued

- Wait about 20 minutes for glue to dry. Meanwhile, think ahead and plan for the next step.

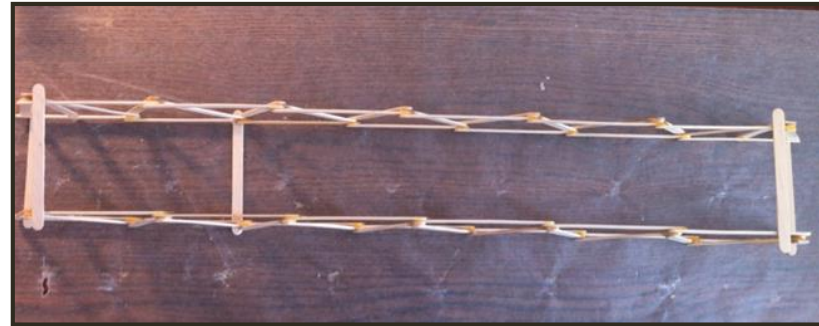


- You may use the glue gun to position each panel in a vertical position and attach a few cross members.



# Bridge Construction, continued

- Use Elmer's glue for the rest of the cross members. **Don't forget to provide two clear vertical openings for the hooks of the loading deck.**



- Put more members and apply more glue, if needed.

