



2024 POPSICLE STICK BRIDGE CONTEST

Overview

The Richmond Branch of the American Society of Civil Engineers (ASCE) is pleased to sponsor the 2024 Popsicle Stick Bridge Contest on **Sunday, February 25, 2024**. Students will design and build their own bridges out of popsicle sticks and will compete for several awards. The competition will be held at:

Dewey Gottwald Center at the Science Museum of Virginia

2301 W. Leigh St., Richmond, VA

11:30 am to 3 pm (Competition starts at 12:30 pm)

Eligibility

The competition is open to all greater Richmond area Middle School students (grades 6th-8th) and High School students (grades 9th-12th). Students may submit entries as individuals, or as a Team. Team sizes will be limited to three (3) students per team.

Students do not need to be from the same school or in the same age group to be on a team together; however, any team consisting of both middle and high school students will have to compete in the high school division.

Registration

All students interested in competing should complete the registration form online at:

www.ascerichmond.org.

The deadline for all team registrations is **February 16, 2024**. The competition is limited to 100 submissions. If this limit is reached before the registration deadline, any additional students wishing to register will be placed on a waiting list. Please direct any questions to:

Isabelle Stern, P.E.
Simpson Gumpertz & Heger
Email: isstern@sgh.com

Competition

The competition takes place during the Richmond Joint Engineers Council's "**Celebrating Engineering Ingenuity Day**" which will include a variety of STEM-based activities by different Richmond area engineering societies.

Team check-in times and award ceremony times for the event will be announced at a later date. Teams will bring their completed bridge to the announced location at the specified time to be inspected. After the inspection is complete, testing will begin.

Admission to the competition and the other Celebrating Engineering Ingenuity Day events, which are all in the Dewey Gottwald Center, will be free for everyone. The Science Museum is providing participants and one chaperone free admission to the Science Museum on CEI Day. Please use the Dewey Gottwald main entrance at 2301 W. Leigh Street when attending CEI Day.

Awards

The following awards will be given separately to both Middle and High School Divisions:

- **Highest Efficiency Rating:**
\$100 and Certificate
- **Second Highest Efficiency Rating:**
\$50 and Certificate
- **Third Highest Efficiency Rating:**
\$25 and Certificate

Both divisions will compete together for the following awards:

- **Most Aesthetically-Pleasing Bridge*:**
\$100 and Certificate
- **Innovation Contest**:**
\$100 and Certificate

All participants will receive a Certificate of Participation

** A team of judges will evaluate each bridge before load-testing.*

***Optional – See below for details on the Innovation Contest.*

General Competition Requirements

- **Objective:** To span a clear distance of 19 inches using a bridge constructed of only standard, craft-variety popsicle sticks and Elmer's glue. Each bridge will be scored in accordance with an Efficiency Rating (ER), which will be calculated by the following equation:

$$ER = L + \frac{L}{W}$$

where:

L = Load to failure (lbs.)

W = Weight of structure (lbs.)

- **Maximum Weight of Bridge** = 450 g (about 1 pound, or approximately 250 sticks plus glue)

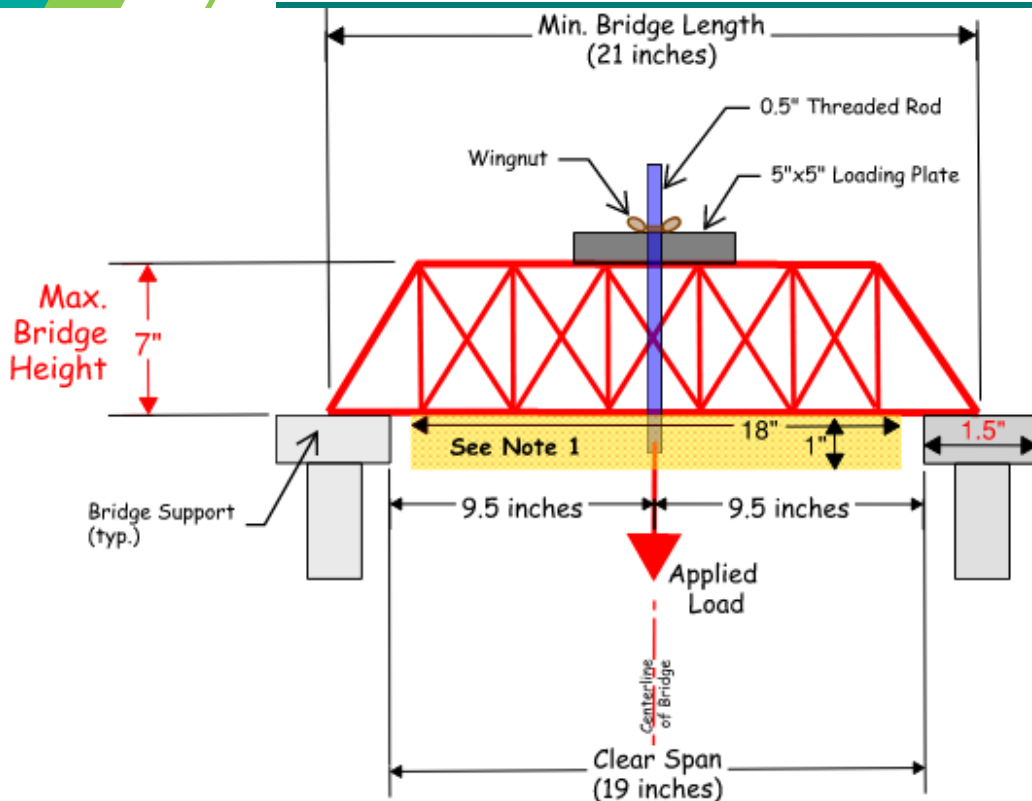
Minimum Length of Bridge = 21 inches (any portion of the bridge below the supports must not be longer than 18½ inches). Please note that the bridge must be designed to rest on the two supports, which measure 4½ inches by 1 ½ inches. Bearing against the front, rear or sides of the supports will not be allowed. Refer to the drawings for more information.

- **Required Sticks:** Standard, 4½" x ¾" x 1/12" craft-type Popsicle sticks (readily available at all craft and department stores).
- **Required Glue:** Elmer's ® Glue-All Multi-Purpose Glue
 - This is the white, craft variety of glue. Bridges using any other glue such as wood glue, super glue, epoxy, or any other type of adhesive *will be disqualified*).
- The bridge must be able to accommodate a 5"x5" loading plate resting on top of the structure and a ½ inch diameter threaded rod extending through the center of the bridge for testing. Please refer to the drawings.
- Popsicle sticks are limited to a glued ½" overlap (maximum) at all connections. Open gaps are allowed between adjacent sticks.
- Unlike in previous years, bridges will be loaded from the top of the structure, not at the roadway surface using a 5"x5" loading plate connected to the tester using a ½" diameter threaded rod that freely extends through the center of the bridge. All bridges must be able to accommodate this rod and loading plate (refer to the figures and photos shown on the following pages).
- Bridges must meet the additional requirements shown on the following pages for connection and geometric limitations.
- **Disqualification:** Bridges not meeting the requirements listed in these rules will be subject to disqualification. Disqualified bridges will still be eligible for the innovation or aesthetic awards but will not be considered for the efficiency score awards. Disqualified bridges will be tested until failure as long as it remains safe to do so. The decision of the judges at the time of the event is final.

Helpful Hints

- Sticks can be cut, sanded, trimmed or colored with colored pencils but **all sticks must be visible** to inspection and **may not be painted or stained** in anyway. Sticks cannot be coated with glue so as to laminate them either.
- The glued connection between the sticks is most likely the weakest link in the bridge so be sure to allow at least 24 hours before the competition for the glue to dry.
- Note that the score is influenced by the weight of the bridge. Try to maximize the strength of the bridge while keeping the weight as low as possible.

ADDITIONAL REQUIREMENTS



ELEVATION VIEW
Not to scale

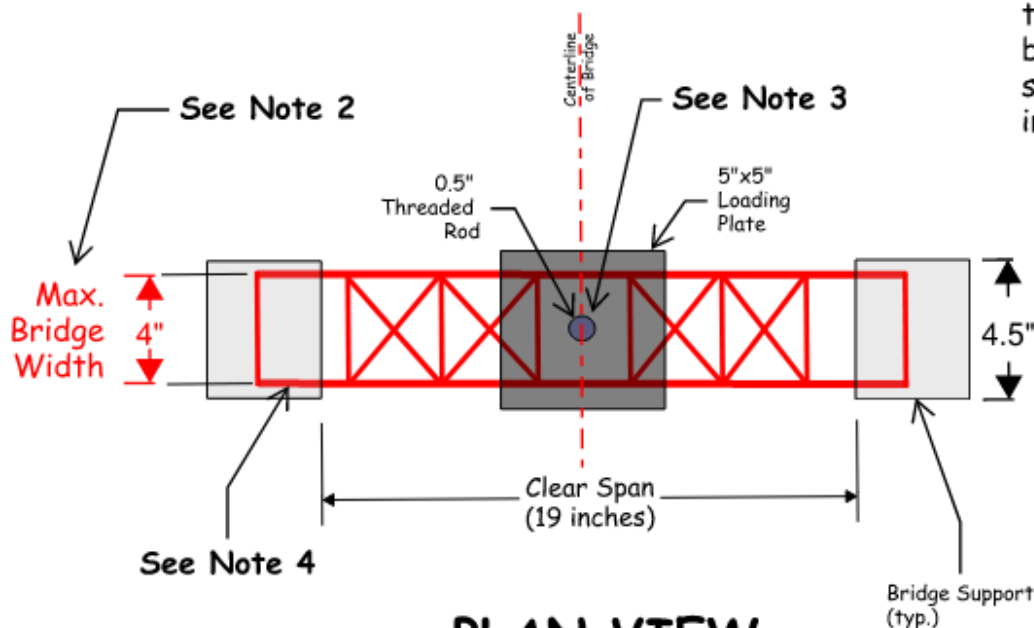
Notes to Bridge Designers:

(1) A portion of the bridge may extend below the supports, provided these members are within the 18" by 1" zone shown here. No part of the bridge can bear against the front of the support.

(2) It is extremely important that the bridge be 4" in width or less, otherwise it will not fit on the supports and cannot be tested.

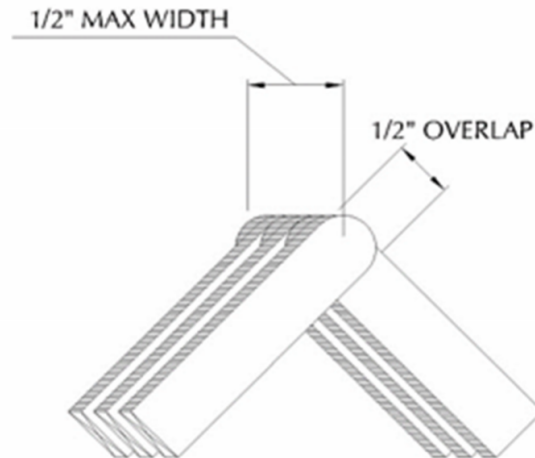
(3) The center of the structure must allow the 0.5" loading rod to pass freely through the center. Please make sure none of the members will impede the loading rod. Otherwise, the bridge cannot be tested.

(4) Please make sure your bridge is long enough to span the clear opening PLUS the distance required to bear on both supports. Min. suggested length = 21 inches.



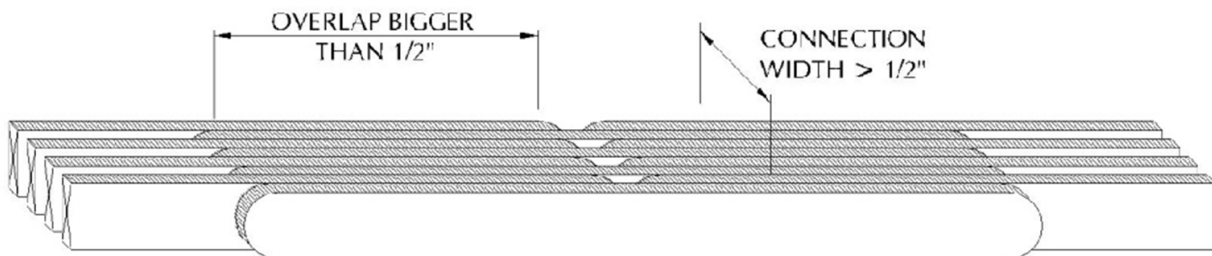
PLAN VIEW
Not to scale

Additional Requirements Cont.



ACCEPTABLE CONNECTION

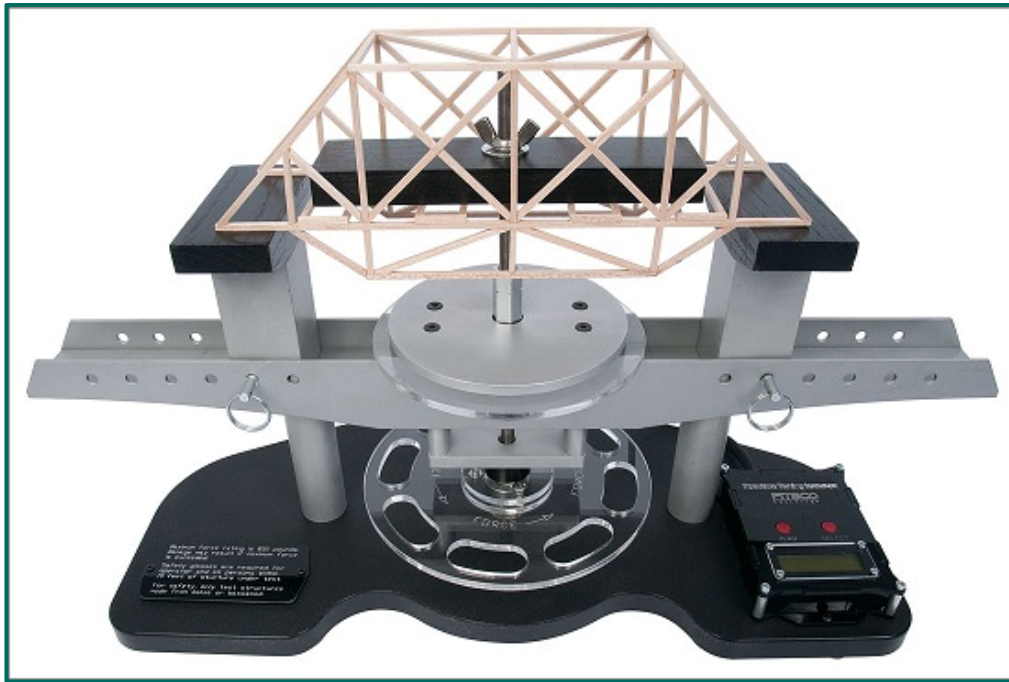
- $\frac{1}{2}$ " MAXIMUM WIDE FOR ANY CONNECTION
- OPEN GAPS BETWEEN ADJACENT PIECES
- $\frac{1}{2}$ " MAX. OVERLAP



UNACCEPTABLE CONNECTION

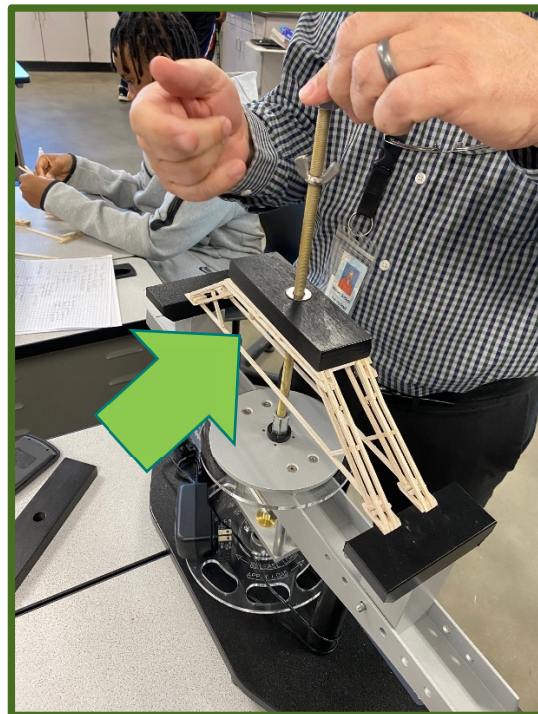
- CONNECTION IS GREATER THAN $\frac{1}{2}$ " WIDE
- TOO MUCH OVERLAP ($> \frac{1}{2}$ ")

Additional Information



BRIDGE TESTING APPARATUS

(Note how bridge will be supported. Required clear span of 19 inches not depicted in photograph. Also, the loading block will be positioned on top of the structure, NOT within it, as shown above.)



PROPER POSITION OF LOADING PLATE

(Note how loading plate will be applied at the top of the bridge with a 1/2" diameter steel rod passing through the center of bridge. All bridges must be able to accommodate this rod. For load plate dimensions, please see additional drawings.)

Innovation Contest

Each team can choose to enter their bridge into a separate Innovation Contest (\$100 prize). Each team wishing to take part in the Innovation Contest can explain the innovation behind their design in a typed report and turn this in on the day of the event. The report should be a **maximum of 2 pages with one additional page for sketches**. Sketches or drawings may be helpful and are encouraged to be used. Some suggestions for items to address in the report are:

- What strategies or concepts did you use when designing your bridge?
- How much do you predict your bridge will hold and why?
- Where do you think your bridge will break and why?
- Did you come up with any other concepts? Why did you decide on your final design over other ideas?
- If you participated in the contest before, what changes did you make to this year's design and why? How do you think this loading apparatus changes the requirements for the bridge design?
- If you were allowed to use any other materials besides Elmer's glue and popsicle sticks, which would you choose?