The Challenge: Construct a bridge using only Popsicle sticks and Elmer’s glue that will have the largest load carrying capacity-to-bridge weight ratio and do a presentation of your bridge design.

Goals:
- To inspire students to pursue a career in civil engineering.
- To promote teamwork, technical growth, and communication skills.
- To create opportunities for interactions among students, teachers and the engineering community.

Truss bridges

A truss bridge is a bridge whose load-bearing superstructure is composed of a truss. This truss is a structure of connected elements forming triangular units. The connected elements (typically straight) may be stressed from tension, compression, or sometimes both in response to dynamic loads. Truss bridges are one of the oldest types of modern bridges.

Built in 1932, the Karsten Thot Bridge (see photo) in Wahiawa, Oahu is an example of a Warren truss bridge.
2017 Student Popsicle Bridge Building Contest Rules

1. General

A. Each team shall consist of two to four students from the same school.

B. A student shall only be on one team.

C. Each team may only submit one bridge for the competition.

D. Students may receive supervisory help from teachers and mentors, but actual bridge design and construction must be performed by students. Obtaining assistance from a structural and/or civil engineers is discouraged, other than basic lessons on the theory of truss design.

E. Bridges shall be constructed prior to arrival at the competition. No modifications shall be allowed after registration unless authorized and approved by the judges. Modifications made after registration are subject to receive a penalty. See Penalties Section 5 below for additional information.

2. Bridge Construction Materials

A. Building materials shall be provided to the team by ASCE Hawaii, which are limited to:

1. Popsicle sticks of dimensions 4½ inch x 3/8 inch x 1/12 inch (brand name - Woodies Sticks, Economy or equal – sold in packs of 1,000)

2. Elmer’s Glue-All (use of other types of glue is not allowed), three 4 ounce bottles

3. Presentations

A. Each team shall make a short oral presentation (approximately 5-8 minutes long). Judges will be allowed time after the presentation to ask presenters questions. Every team member shall participate in the presentation. Teams shall prepare a display board (maximum size 40" x 30") that will be used in their presentation. Presentations will be judged on:

1. Personal bearing (i.e. poise, eye contact, voice level, clarity)

2. Quality of the presentation (i.e. organization, rehearsed, presentation aids)

3. Proper use of technical language (e.g. tension, compression)

4. Ability to clearly and correctly answer questions
B. The presentation should cover the following points:

1. Design (e.g. How was the bridge design chosen, were there other designs considered but eliminated? How does your design work i.e. which members in tension or compression?)

2. Fabrication/Construction (e.g. What process and techniques did the team use to construct the bridge? What challenges were encountered and how were they overcome?)

3. Schedule (e.g. What was the planned project schedule? Were any adjustments needed in the final design?)

4. Engineering (e.g. What did the team learn about structural engineering during the design and construction process?)

4. Bridge Design Specifications

A. Width of the bridge shall not be less than 4 inches and shall not exceed 5½ inches, measured from the outside-to-outside face of the bridge (see diagrams on page 6).

B. Height of the bridge shall not be less than 3½ inches or taller than 6 inches, measured from the top to the bottom extremities of the bridge (see diagrams on page 6)

C. No part of the bridge truss shall be constructed below the bridge deck.

D. The “travel way” of the bridge must be open to “traffic” the entire length, and it must allow for a 3½” x 3½” block of wood, or “vehicle”, to freely pass through it (see attached photo 2 on page 5 for clarity).

E. Bridges shall allow for a 2-inch-wide by 8-inch-long x ¼ inch thick steel plate to be placed transversely across the bridge deck between vertical/diagonal members, approximately at mid-span. Bridges can be modified to allow for the installation of the steel loading plate, however a load carrying reduction penalty will be imposed (see Penalties Section 5 below for additional information).

F. Total weight of the bridge shall not exceed 1 pound in total weight. Bridges exceeding 1 pound shall receive a load weight reduction (See Penalties Section 5 below for additional information).

G. The bridge shall have a minimum clear span of 24 inches. The recommended total bridge length of the bridge is approximately 28 inches to 32 inches (See diagrams on page 6).
H. Each bridge will be weighed and measured at station 4, for general conformance.

I. All bridge joints shall be glued, the use of pinned and slotted joints are not allowed. The use of pinned or slotted connections will result in an automatic dis-qualification.

5. Penalties

A Load Carrying Capacity Reduction will be applied to any bridge that does not conform to the bridge design criteria (dimensions, weight and materials) will be issued. See below for a breakdown of the various penalties:

1. Bridge Weight Exceeds 1.00 pound
   a. A load carrying reduction penalty of 25 pounds per each 0.1 pound (which is 400 pounds/pound) exceeding 1.0 pound will be subtracted from the load your bridge carried

2. Does Not Allow for Installation of Steel Loading Plate
   a. A load carrying reduction penalty of 10 pounds will be subtracted from the total load your bridge carried.

3. Height does not comply with Design Specifications
   a. A load carrying reduction penalty of 25 pounds will be subtracted from the total load your bridge carried.

4. Width does not comply with Design Specifications
   a. A load carrying reduction penalty of 25 pounds will be subtracted from the total load your bridge carried.

5. Unable to pass a 3 ½ inch x 3 ½ inch wood block to pass through
   a. A load carrying reduction penalty of 25 pounds will be subtracted from the total load your bridge carried.

6. Bridge Load Testing

A. Bridges are scored based on the ratio of max load carried to bridge weight ratio.

   1. For example, a bridge carrying 100 pounds weighing 0.50 pounds would have a ratio of 200, and would be rated higher than a bridge carrying 200 pounds weighing 2 pounds, which would have a ratio of 100.
B. A bridge will be considered failed once the loading device touches the ground whether or not the bridge has broken.

C. A 2-inch-wide by 8-inch-long x ¼ inch thick steel plate will be placed transversely across the bridge deck between vertical/diagonal members, approximately at mid-span (See photo 4 on page 5).

D. Students will be asked by a Popsicle Bridge loading judge to approve of steel plate loading assembly location prior to applying any load.

E. Bridges will be loaded incrementally to the loading device at the discretion of the Popsicle Bridge Loading Judges.

7. Other

A. All contestants shall allow the American Society of Civil Engineers, the University of Hawaii, College of Engineering, and the local media to publicize the events of the competition.

B. ASCE also reserves the rights to use the photos taken during competition and presentation board for promotion purposes.

C. Practicing Engineers will be available to answer structural questions in regards to their bridge designs.

D. If there are any questions, comments, or clarifications on the rules or for the Bridge Competition in general, please do not hesitate to contact the chairperson.

E. Most of all have fun and be creative with your designs. Good Luck!

If there are any questions, comments, or rule clarifications for the bridge competition, please do not hesitate to contact the chairperson:

Eric Tomishima, P.E.
Phone: 808.228.9637
Email: asce.pbb.contest@gmail.com
2017 Popsicle Bridge Building Contest Testing Device Photos

Photo 1: Bridge Dimension Testing Device

Photo 2: Bridge travel way Testing Device

Photo 3: Bridge Load Testing Device

Photo 4: Bridge Loading Plate Assembly
2017 Popsicle Bridge Building Contest Bridge Diagrams

ELEVATION VIEW
NOT TO SCALE

PLAN VIEW
NOT TO SCALE

SECTION "X"
NOT TO SCALE
Competition Day Schedule

• Registration starts at 8:30 a.m. The Competition Day Team Check List form will be given to each team when they register. Take the form to each station to be completed by the contest volunteer. After registration, a team photo will be taken. Teams will hold on to their bridges until the start of judging.

• During registration teams will be assigned a time for their presentation. Please report to the presentation area 5 minutes before the assigned time.

The top three teams for the presentation will be asked back to do their presentation for the entire panel of judges. These teams will be notified by 11:05 AM. Presentations for top three teams will begin at 11:15 AM.

• The bridge conformance check will follow immediately after the team completes their oral presentation. The bridge will be weighed and checked for conformance with the rules. Teams will be asked for the estimated load carrying capacity of their bridge.

Only students will be allowed within the presentation and the bridge testing areas. For safety reasons the use of closed toed shoes are required, long pants are recommended. Safety glasses will be provided to the teams at the time of testing.

• University of Hawaii College of Engineering will present awards to the top 3 teams for the following categories:
  o Highest carrying capacity-to-weight (of the bridge) ratio
  o Best oral presentations
Competition Day Team Check List

Team No. _______ Contact No. (For the day) _________________

Team Name: ______________________________________________________________________

____ Station 1: Team registration

____ Station 2: Team photo

____ Station 3: Oral presentation (on the 2nd floor)

Scheduled time ___:___ a.m.

____ Station 4: Bridge conformance check

Team members’ estimate of load the bridge will carry _____ lbs.

Compiles with rules: YES  NO (to be circled by bridge volunteer)

If NO check reasons below

____ Weight Exceeds 1.00 lbs by _____ lbs

____ Does not allow for Steel Loading Plate Assembly to be installed

____ Height does not comply with bridge design specifications

____ Width does not comply with bridge design specifications

____ Does not allow for 3 ½ inch x 3 ½ inch wood block to freely pass through

____ Station 5: Load Test Bridge

Weight carried _______ lbs. (to be completed by bridge volunteer)

After completing all steps turn in this form to the official ASCE Hawaii scorer (the person by the laptop).