Vermont State University

POPSICLE BRIDGE BUILDING COMPETITION

WHERE: Vermont State University Randolph Campus

WHO: Middle School and High School students.

WHAT IS IT? Teams of students will construct bridges in advance of the competition using only Popsicle sticks, Elmer's glue, tooth picks, and dental floss. Bridges will be judged on aesthetics and originality of design, presentation, ultimate load carrying capacity, strength to weight ratio and predicted failure point. Teams will consist of 1-6 students. Teams will have the opportunity to prepare the bridges to be judged on presentation. Specifications are as follows:

1) Materials permitted
    a. All bridges must be made entirely of these materials:
        i. Wooden Popsicle sticks (non-colored, ~11.5 cm long, ~1 cm wide, ~0.2cm thick).
        ii. White all-purpose glue. Elmer's or equivalent. No epoxy or Superglue.
        iii. Wooden toothpicks (non-colored).
        iv. Dental Floss
2) Specifications
    a. The span under the bridge must be clear. The minimum unsupported clear span must allow a 1000 mm long by 150 mm high box to pass freely underneath the bridge span.
    b. The maximum unsupported clear span cannot exceed 1200 mm.
    c. The maximum length of the entire bridge must not exceed 1300 mm.
    d. The maximum height of the bridge from the bottom of the abutments to the tallest point shall not exceed 420 mm.
    e. The maximum height of the deck or platform from the bottom of the abutments shall not exceed 420 mm.
    f. The maximum width of the bridge at any point shall not exceed 300 mm.
    g. The minimum allowable width of the bridge abutments shall be 115 mm.
    h. A smooth continuous deck for vehicular traffic must be provided along the entire span of the bridge. The continuous deck must run the entire length of the bridge. The continuous deck must be constructed entirely of Popsicle sticks. No solid glue decks.
    i. The load will be applied on the deck of the bridge. A clear opening of at least 100 mm by 200 mm must be maintained above the center of the bridge deck so the loading jack may be applied at that center point of the deck.

POPSICLE BRIDGE BUILDING COMPETITION

j. The maximum bridge weight is limited to 13.23 pounds (6.0 kg) and the minimum weight is 2.20 pounds (1.0 kg).

k. The bridge is considered to have failed once the maximum deflection of 50 mm is reached or any member fails and the carried load at that point will become its ultimate load.

3) Evaluation

    a. **10 points. Aesthetics and Originality of design.**

        i. To be assessed by the judges.

    b. **10 points. Presentation and team spirit.**

        i.   To be assessed by the judges. This will include the presentation (less than 5 minutes) of the bridge to the judges.

    c. **15 points. Predicted Actual load carrying capacity**

        i. The error, $E,$ in predicating the actual carrying capacity will be calculated as follows:

$$E = \frac{|F_u - F_{u,p}|}{F_u}$$

Where,

F_u = Actual load attained in competition.

$F_{u,p}$ = Predicted actual load..

POPSICLE BRIDGE BUILDING COMPETITION

The team with the lowest error will be awarded 15 points and the team with the highest error will be awarded zero points. The remaining teams will receive points based on linear interpolation between the two extremes.

   d. **25 points. Actual load carrying capacity.**

      i. The actual load capacity of the bridge will be evaluated at the point of failure by a point load at the mid-span by a 100 mm by 200 mm plate applied to the deck.

   e. **25 points. Structural Efficiency – Strength-to-weight ratio.**

      i. The structural efficiency, S_e, will be calculated by the following equation:

$$S_e = \frac{F_u}{m}$$

Where,

F_u = *Actual load attained in competition.*

m = *Dead weight of bridge as measured at competition.*

   f. **10 points. Predicted type of failure.**

      i. Teams will predict type of failure (either deflection or structural failure). Points are awarded for correct prediction only.

Vermont State University

POPSICLE BRIDGE BUILDING COMPETITION

TEAM NAME:	NUMBER: _____
EVALUATION	**POINTS AWARDED**
10 POINTS. Aesthetics and Originality of design (judged).	
15 POINTS. Presentation and team spirit (judged).	
15 POINTS. Error in Predicted Actual load carrying capacity (calculated).	**Predicted Load**
	Actual Load
25 POINTS. Actual load carrying capacity (measured).	**Actual Load**
25 POINTS. Structural Efficiency -- Strength-to-weight ratio (calculated).	**Actual Load**
	Weight
10 POINTS. Predicted type of failure: deflection or structural (judges circle one).	**Deflection Structural**
TOTAL POINTS	