

## **Balsa Bridge**

**Objective:** To design and build the lightest bridge capable of supporting the heaviest load when weight is placed on a given span, using specified materials and guidelines.

**Purpose:** To encourage research and development prior to the contest, and to practice good construction technique.

### **Means:**

Individual students or teams of students will have to determine how to build a bridge using balsa wood. This event allows students a chance to behave as real world scientists and engineers when faced with a problem that has to be solved.

Each student (either alone or as part of a team) will essentially follow scientific method when seeking the answer to the question of “how does one build the most efficient bridge?” By the time the students come to the Expo, they will have learned through trial and error how to use the materials in the most efficient way. This advanced preparation will be demonstrated at the competition when the team presents its best effort.

### **Rules:**

1. Students can compete as individuals or as part of a team with a maximum of three students per team.
2. Materials:
  - a. Teams purchase their own materials.
  - b. Each bridge must be made entirely of balsa wood.
  - c. White glue, wood glue, or a glue gun may be used to fasten the pieces together.
  - g. No materials other than the ones listed may be used.
  - h. The bridge will be brought to the site already completed and ready for testing.
3. Structure: (The following is a brief description. For more detail, see **Diagram.**)
  - a. The bridge can be no longer than 30 cm, but must be able to span an opening 25 cm wide..
  - b. The bridge must be no more than 10 cm high, and no more than 7 cm wide.
  - c. The roadbed must allow passage from end to end of a “vehicle” that is 5 cm wide and 5 cm high. The roadbed surface must be flat, level and horizontal
4. A notebook is required for each project. If working as a team, each student may use his/her own notebook, or they may use a single notebook. The notebooks are for the team members to enter their ideas, research information and sources, experimentation procedures and data, graphs, analyses, and conclusions. Once an entry is made, it is not destroyed. An incorrect entry will be crossed out with a single line, and followed by a corrected entry. For more specifics on how the entries are to be made, go to Home Page > For Students > Resources > Keeping an Experimental Notebook.
5. At the end of the project, details from the notebook(s) will be extracted and combined to make a single presentation on the display poster. All of the notebooks are required to be at the display. A summary sheet of notebook contents can be placed on top of each notebook to assist judge review.
6. Each team is to provide a project display that must be within the following maximum sizes:  
**Depth** (front to back): 30 inches or 76 centimeters  
**Width** (side to side): 48 inches or 122 centimeters.

Height (floor to top): 108 in or 274 cm. Tables provided will not exceed a height of 36 in (91 cm)

Project display should follow these guidelines:

Title and objective at the top;

Display is neat, organized & appealing;

Should use proper spelling and grammar.

Poster board content should include the following:

- The logic used when designing the bridge and a discussion of the principles of science involved.
- Discussion of what was learned from the trial and error period, and why the bridge was constructed as it was.
- Discussion of possible problems or weak points, and how they might be dealt with.
- Prediction for how well the bridge will perform. (Based on experimental data)

Have notebooks available for the interview.

**Competition:**

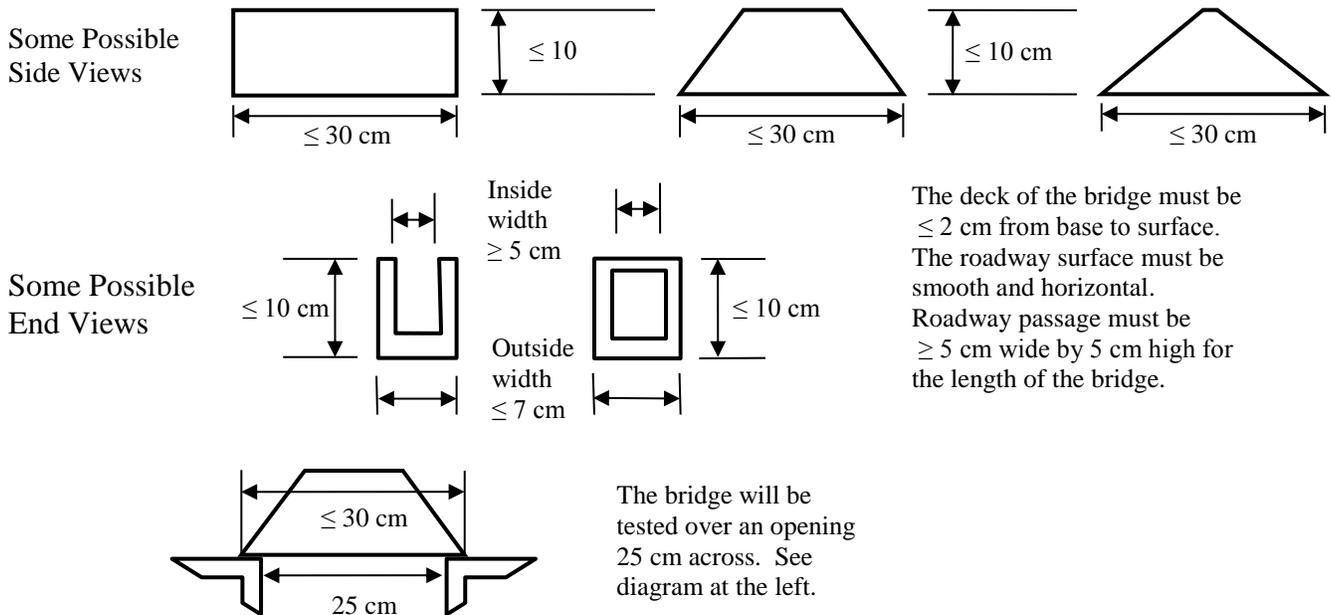
1. Each entry will be inspected to insure compliance with the specifications. Failure to adhere to measurements as given in the rules will cause penalty points to be assigned to your bridge for the structure scoring, and a score of zero for the strength scoring.

2. The weight of the bridge will be recorded for use in the scoring of the strength competition.

3. For strength testing, the bridge will be placed into a Bridge Loader. A block 5 cm x 5 cm will be placed on the roadbed and a load will be applied to the block. The load will be increased in a continuous fashion until the bridge fails. Failure is defined as the inability of the bridge to carry any additional load.

4. The Official Load is the maximum load that the bridge withstood prior to destruction. This will be recorded for use in the scoring of the strength competition.

**Diagrams:**



**Descriptions for diagrams:**

Size of bridge (max dimensions) 30 cm long, 10 cm high, 7 cm wide

The bridge must span an opening 25 cm across.

The deck can be hollow and framed, or it can be solid, but must be no more than 2 cm from the base of the bridge to the top of the roadway.

The roadway surface must be horizontal and smooth and the roadway passage must allow a “vehicle” 5 cm wide and 5 cm high to pass through the bridge from end to end.

The top center of the bridge must have an opening large enough to allow a block 5 cm x 5 cm to pass through it down to the deck so the testing load can be applied.

### **Scoring of the competition:**

The maximum score possible for the competition will be 70 points, and will be in two parts: The structure is worth 30 points, and the strength is worth 40 points.

### **Competition scoring part I - Scoring of the structure:**

If all measurements of the bridge are within limits, the team will earn 30 points. Five points will be subtracted for every measurement that is not within limits.

### **Competition scoring part II - Scoring of strength:**

1. If any dimension of the bridge is outside of the limitations, the bridge earns zero points for strength, no matter how much it might hold. Only fully qualified bridges may earn points for the strength competition.
2. The strength winner is the legal bridge with the highest Efficiency (Ratio of load to bridge weight). Efficiency is calculated by the following:

$$\text{Bridge Efficiency} = \text{Maximum load applied to bridge} \div \text{Weight of the bridge}$$

3. Strength winner is the bridge with the highest efficiency.
4. Strength score is calculated by the following:

$$\text{Strength score} = (\text{Bridge Efficiency} \div \text{Winning Efficiency}) \times 40$$

### **Scoring of Poster Board, Notebook and Interview:**

The maximum score is 30 points and considers the following:

1. Display is within size limitations
2. The poster shows Title and Objective at the top.
3. The display was neat, organized, and appealing.
4. Use of proper spelling and grammar
5. The team made a compelling case for their prediction of how well they would do.
6. The team was able to point out any newly discovered flaws in their original plan and to offer suggestions on how these flaws might be overcome.
7. Notebook(s) is(are) present and done well
8. Answers to judges questions

### **Overall Scoring of the Event:** (Maximum possible 100 points)

The overall score will be based on the sum of the points earned by a team during the competition and the poster board judging.

$$\text{Structure Score} + \text{Strength Score} + \text{Poster-Notebook-Interview Score} = \text{Total Score}$$