



# ELEVATED BRIDGE

Read the General Rules in the manuals and on [www.soinc.org](http://www.soinc.org) as they apply to every event.

1. **DESCRIPTION:** The objective of this event is to design and build the most efficient bridge meeting the design specifications. Each team may enter only one bridge, which must be built prior to the competition. Teams are encouraged to maintain a practice log containing data to help improve future designs. This is an engineering event; therefore, bridges that fail to meet the requirements of the rules will be ranked after those that do.

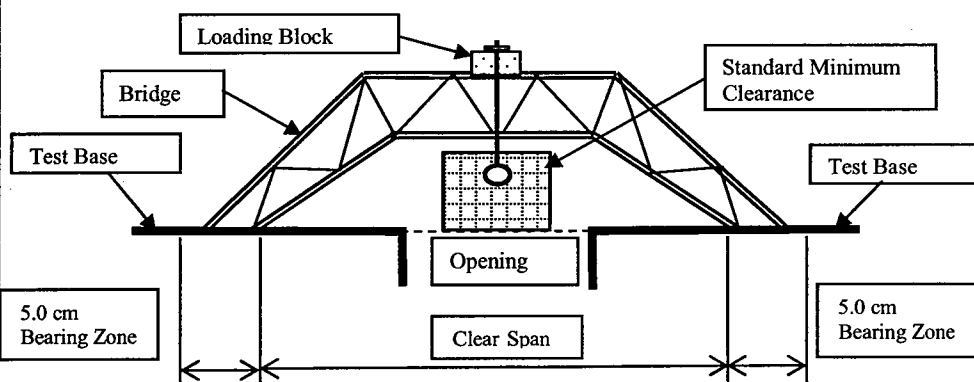
**A TEAM OF UP TO: 2**

**IMPOUND: NO**

**MAXIMUM TIME: 10 minutes**

## 2. EVENT PARAMETERS:

- The bridge must have a **Clear Span** of 35.0 cm for Division B or 45.0 cm for Division C on a standard **Test Base** (see 5.c. below). The bridge may only touch the surface of the Test Base within the **Bearing Zone** before loading. The **Bearing Zone** will be 5.0 cm beyond either side of the **Clear Span**. The bridge may not be braced at any time against any edge of the Test Base for lateral support.
- The center portion of the bridge must be raised above the level of the Test Base, so that a Standard Minimum Clearance of 10.0 cm long x 10.0 cm high for Division B, or 25.0 cm long x 7.5 cm high for Division C, exists between the top surface of the Test Base and the underside of the bridge (see 5.d. below).
- The maximum bridge **height** for both Division B and Division C will be 15.0 cm.
- The bridge must support a Loading Block (see 5.b. below) above the center of the opening in the standard Test Base, above the Standard Minimum Clearance. The Loading Block may be placed on or within the bridge structure.
- The loading point on the bridge must be constructed to permit placement of a chain or threaded eyebolt through the bridge and Loading Block, to support the bucket. The load applied to the Loading Block shall consist of a bucket, suspending hardware, and sand provided by the event supervisor (see 5.g. below).
- There is no minimum or maximum **width** for the bridge.
- The bridge must be a single structure, with no separate or detachable pieces.



## 3. MATERIALS:

- The bridge is to be constructed of wood and bonded by glue. No other materials may be used.
- All construction materials are to be provided by the team.
- Particleboard, wood products, bamboo, paper, or commercially laminated wood may not be used.
- Individual pieces of wood used in the bridge must be  $\frac{1}{4}$ " x  $\frac{1}{4}$ " or less in cross-section dimensions and may be any length. Dowels must be  $\frac{1}{4}$ " or less in diameter.
- Any type of commercially available bonding material (glue) may be used.

## 4. CONSTRUCTION:

- All construction must be completed prior to the tournament.
- Sound engineering construction practices (i.e., truss construction, gussets, mitered joints, etc.) are encouraged.
- Wood may be laminated without restriction by the team. Laminations may be any size provided the individual pieces of wood used in the lamination comply with line 3.d.

## 5. TESTING APPARATUS:

- The judging devices, testing apparatus, hardware, and sand will be provided by the event supervisor. No other items or materials may be used for testing.
- The Loading Block shall be a square block measuring precisely 5.0 cm x 5.0 cm x approximately 2.0 cm high with a hole in the center of the square faces for a  $\frac{1}{4}$ " threaded rod or eyebolt.
- The Test Base shall be a solid, level surface as follows:



## ELEVATED BRIDGE (CONT.)

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- i. The Test Base shall be least 55.0 cm long x 32.0 cm wide.
  - ii. The Test Base shall have an opening at its center approximately 20.0 cm x 20.0 cm, for suspension of the bucket. The opening may be any shape.
  - iii. Five parallel lines shall be marked across the width of the surface of the Test Base: a centerline dividing the Test Base in half; lines at 17.5 cm and 22.5 cm on each side of the centerline, to indicate the **Bearing Zone for Division B**; and lines at 22.5 cm and 27.5 cm on each side of the centerline to indicate the **Bearing Zone for Division C**.
  - iv. The Test Base shall have a smooth, hard surface such as metal, high-pressure plastic laminate (Formica), Melamine, etc. The Test Base shall be stiff enough that it does not bend noticeably when loaded.
- d. The Standard Minimum Clearance between the underside of the bridge and the Test Base shall be verified by sliding or placing a **Clearance Block** under and completely through the bridge, centered on the opening, without touching the bridge. The Clearance Block shall be 10.0 cm long x 10.0 cm high for Division B and 25.0 cm long x 7.5 cm high for Division C. The Clearance Block may be made of any material and may be any convenient thickness. The Clearance Block is removed for testing; it is used only for judging purposes.
  - e. A chain or S-hooks shall be suspended from the Loading Block through the bridge by means of a ¼" threaded eyebolt or short threaded rod.
  - f. An ordinary five-gallon plastic bucket shall be suspended from the chain by means of one or more hooks, with enough clearance above the floor to allow for bridge deflection.
  - g. Clean, dry sand or similar dry, free-flowing material shall be provided for loading the bridges, which shall be added to the bucket by the team members. Judges shall verify that the combined mass of the Loading Block, chain, bucket, sand, and attaching hardware is at least 15.000 kg prior to testing.

### 6. TESTING:

- a. No alterations or repairs may be made to the bridge after check-in for competition.
- b. All bridges will be assessed prior to testing for compliance with the design and construction specifications by the event supervisor.
- c. Team members must bring and wear Safety Spectacles with Side Shields (at a minimum), during the set-up and testing of the bridge, or they will not be allowed to compete.
- d. The mass of the bridge will be determined for scoring purposes at the time of testing.
- e. Team members shall check and judges shall confirm that the proper Standard Minimum Clearance exists using the Clearance Block.
- f. Team members shall place the bridge on the Test Base and assemble the Loading Block, eyebolt, chain, etc, and hang the bucket from the chain, as required to load the bridge. The center of the Loading Block must be over the center of the opening in the Test Base. The bridge may only touch the Test Base in the appropriate Bearing Zone prior to loading.
- g. The team members shall add sand to the bucket, until the bridge fails or until the maximum load is reached. The maximum load scored is 15.000 kg; this includes the sand, bucket, Loading Block, and suspending hardware.
- h. Bridges that fail before supporting 15.000 kg will be scored by Structural Efficiency according to the actual weight supported at time of failure.
- i. Failure is defined as complete breakage of the bridge, or deflection so that the bridge or the Loading Block touches the Test Base within the Clear Span, extends below the top surface of the Test Base, or the bucket rests on the floor.
- j. Bridges may be released and taken away by the competitors after testing, assuming there is no pending arbitration. If a bridge is removed there can be no further challenges for scoring or ranking.

### 7. SCORING:

- a. Bridges will be scored and ranked by Structural Efficiency, as defined by the following equation: **Structural Efficiency = Load supported/Mass of bridge**. All masses are expressed in grams.
- b. Load scored cannot exceed 15,000 grams (15.000 kg).
- c. Bridges which meet all the rules shall be ranked in the first tier by Structural Efficiency.
- d. Bridges which fail to meet one or more rules shall be ranked in the second tier by Structural Efficiency.
- e. Bridges which cannot be loaded will be ranked by increasing mass in the third tier.
- f. In the event of ties for Structural Efficiency, the bridges shall be ranked favoring the lighter bridge. Bridges which are still tied shall be ranked favoring lowest overall bridge height.

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