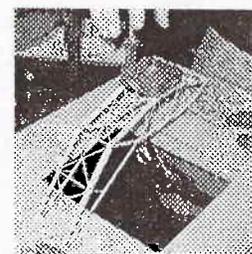


## ELEVATED BRIDGE

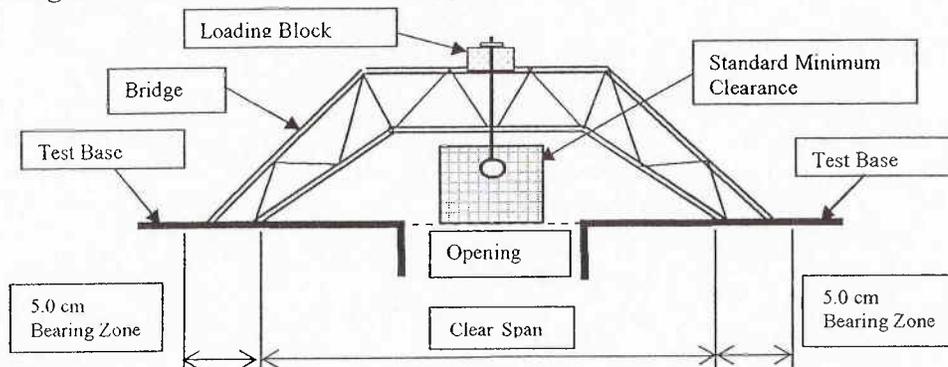
1. **DESCRIPTION:** The objective of this event is to design and build the most efficient bridge.
 

**A TEAM OF UP TO: 2** **IMPOUND:** No **EYE PROTECTION:** #2 **MAXIMUM TIME:** 10 minutes
2. **EVENT PARAMETERS:** (See Eye Protection #2 on [www.soinc.org](http://www.soinc.org))
  - a. Each team may enter only one bridge, which must be built prior to the competition.
  - b. Team members must bring and wear Safety Spectacles with Side Shields during the set-up and testing of the bridge or they will not be allowed to compete.
  - c. The **assessment** devices, testing apparatus, hardware, and **clean, dry sand or similar dry, free-flowing material (referred to subsequently as “sand”)** will be provided by the Event Supervisor. No other items or materials may be used for **assessment or** testing.
3. **CONSTRUCTION PARAMETERS:**
  - a. The bridge must have a Clear Span of 35.0 cm in Division B, or 45.0 cm in Division C, on a Test Base.
  - b. 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.
  - c. The center portion of the bridge must be raised above the level of the Test Base, so that a Standard Minimum Clearance of **15.0 cm long x 15.0 cm high in Div. B, or 30.0 cm long x 12.5 cm high in Div. C**, exists between the top surface of the Test Base and the underside of the bridge (see 4.c. below).
  - d. The maximum bridge height for both Division B and Division C will be **20.0 cm**.
  - e. The bridge must support a Loading Block (see 4.a. below) above the center of the Test Base, above the Standard Minimum Clearance. **Teams** may place the Loading Block on or within the bridge structure.
  - f. 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 4.f. below).
  - g. There is no minimum or maximum width for the bridge.
  - h. The bridge must be a single structure, with no separate or detachable pieces.
  - i. The bridge is to be constructed of wood and bonded by glue. No other materials may be used (e.g. no particleboard, wood products, bamboo, paper, or commercially laminated wood). **There are no limits on the cross section sizes of individual pieces of wood (the ¼” x ¼” limitation has been removed).**
  - j. Any type of commercially available bonding material (glue) may be used.
  - k. Wood may be laminated without restriction by the team.
  - l. **Bridges that fail to meet one or more of the requirements of the Construction Parameters will be ranked after those that meet all Construction Parameter requirements.**
4. **TESTING APPARATUS:**
  - a. 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 ¼” threaded rod or eyebolt.
  - b. The Test Base shall be a solid, level surface as follows:
    - 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. 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 in Division B, or 22.5 cm and 27.5 cm in Division C, on each side of the centerline, to indicate the Bearing Zones.
    - iv. The Test Base shall have a smooth, hard surface (e.g. metal, high-pressure plastic laminate (Formica, Melamine, etc.). The Test Base shall be stiff enough that it does not bend noticeably when loaded.
  - c. 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 **15.0 cm long x 15.0 cm high in**



Division B, or 30.0 cm long x 12.5 cm high in Division C. The Clearance Block may be made of any material and any convenient thickness. It is removed for testing since it is only for **assessment** purposes.

- 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.
- 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.
- Sand shall be provided for loading the bridges, which shall be added to the bucket by the team members. **The Event Supervisor** 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.



### 5. COMPETITION:

- No alterations or repairs may be made to the bridge after check-in for competition.
- All bridges will be assessed prior to testing for compliance with design and construction parameters.
- Team members shall place their bridges on the scale for the Event Supervisor to determine the bridge mass, to the best available precision (0.1 g or better), for scoring purposes at the time of testing.**
- The Clearance Block will be given to the team members to pass under their bridge so that the Event Supervisor can confirm the Standard Minimum Clearance.**
- 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. Team members shall be allowed to adjust the bridge until they start loading sand.**
- Team members shall add sand to the bucket, until the bridge fails or the maximum load is reached (**teams are allowed to steady, not support, the bucket with their fingertips**). The maximum load scored is 15.000 kg (which includes sand, bucket, Loading Block and attached hardware).
- Bridges that fail before supporting 15.000 kg will be scored by Structural Efficiency according to the actual weight supported at time of failure. **Loading shall stop immediately when a failure occurs.**
- Failure is defined as complete bridge breakage, deflection so that the bridge or Loading Block touches or extends below the top surface of the Test Base within the Clear Span, or the bucket rests on the floor.
- 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.

### 6. SCORING:

- Bridges will be scored and ranked by Structural Efficiency, as defined by the following equation:  

$$\text{Structural Efficiency} = \frac{\text{Load supported}}{\text{Mass of bridge}}$$
 All masses are expressed in grams.
- Load scored cannot exceed 15,000 grams (15.000 kg).
- Bridges which meet all the **Construction Parameters** are ranked in the first tier by Structural Efficiency.
- Bridges which do not meet one or more **Construction Parameters** shall be ranked in the second tier by Structural Efficiency.
- Bridges which cannot be loaded will be ranked by **the lower** mass in the third tier.
- 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 the lowest overall bridge height.