
Bridge Building

A team of up to 3

1. **DESCRIPTION:** The objectives of this event are for the team to design and build the lightest bridge with the highest structural efficiency that can span a given opening meeting the requirement specifications.

2. **EVENT PARAMETERS:**

- A. Each team is allowed to enter only one Bridge built prior to the competition.
- B. Team members must wear proper eye protection during the set-up and testing of the bridge. Teams without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows. Teams without eye protection must not test their bridge.
- C. The Event Supervisor must provide all assessment devices, testing apparatus, two bucket stabilization sticks, and clean, dry sand or similar dry, free flowing material (hereafter "sand").

3. **CONSTRUCTION PARAMETERS:**

- A. All construction must be completed prior to competition.
- B. The Bridge must be a single structure designed and built by the team to sit upon two Test Supports (4.B.) at either end of the bridge and support a Loading Block (4.C.).
- C. The bridge must span an opening of 35.0 cm.
- D. There is no maximum length or height.
- E. The outside width of the Bridge must be at least 5.0 cm at any height along its span. No portion of the bridge may extend below the top surface of the Test Supports (4.b) prior to testing.
- F. The bridge must accommodate a Loading Block Assembly placed in the center of the bridge span.
- G. All parts of the Bridge must be constructed of wood and bonded by adhesive. No other materials are permitted (e.g., no particle board, wood composites, bamboo or grasses, commercial plywood, structural members formed of sawdust and adhesive, paper price labels or paper).
- H. There are no limits on the cross section sizes or lengths of individual pieces of wood. Wood may be laminated by the team without restriction.
- I. Any commercially available adhesive may be used. Adhesive is defined as a substance used to join two or more materials together. Adhesives include, but are not limited to:

glue, cement, cyanoacrylate, epoxy, hot melt, polyurethane and super glues. Adhesive tapes are not allowed.

4. TESTING APPARATUS:

- A. The Test Base must be a solid, level surface as follows:
 - i. Must be at least 55.0 cm long x 32.0 cm wide.
 - ii. Must have a smooth, hard surface (e.g., hardwood, metal, or high-pressure plastic laminate). The Test Base must be stiff enough so it does not bend noticeably when loaded.
 - iii. Must have an opening at its center approximately 20.0 cm x 20.0 cm, for bucket suspension.
 - iv. Parallel lines must be marked across the width of the surface of the Test Base to indicate the Clear Span. A centerline dividing the Test Base in half must be marked on the Test Base; lines at 17.5 cm for Division B, or 22.5 cm for Division C, on each side of the centerline will indicate the Clear Span.
- B. The Test Supports supplied by the Event Supervisor must meet the following requirements:
 - i. Two identical supports at least 3.0 cm x 3.0 cm x 15.0 cm.
 - ii. Made of a material that does not noticeably compress when loaded.
 - iii. Have smooth, hard surfaces (e.g., hardwood, metal, or high-pressure plastic laminate)
- C. The Loading Block Assembly must consist of:
 - i. A square block measuring 5.0 cm x 5.0 cm x approximately 2.0 cm high with a hole in the center of the 5.0 cm x 5.0 cm faces for a 1/4" threaded eyebolt.
 - ii. 1/4" threaded eyebolt (1" nominal eye outside diameter), no longer than 4" and a 1/2" wing nut.
- D. A chain and S-hooks that are suspended from the Loading Block assembly.
- E. An approximately five gallon plastic bucket with a handle to be suspended from the chain and hook.
- F. The Event Supervisor must verify the combined mass of the Loading Block assembly, chain, hooks, bucket, and sand is at least 15,000 kg and no more than 15,500 kg prior to testing.

5. THE COMPETITION:

- A. No alterations, substitutions, or repairs may be made to the Bridge after check-in. Once teams enter the event area to compete, they must not leave, receive outside assistance, materials, or communication.
- B. All bridges must be assessed prior to testing for compliance with construction parameters.
- C. Team members must place their Bridge on the scale for the Event Supervisor to determine its mass in grams to the nearest 0.01 g.

-
- D. Team members must have a maximum of 8 minutes to setup and test their Bridge to the maximum load, to failure, or the 8 minutes elapses.
 - E. The Test Supports must sit on one of the 15 cm long faces.
 - F. Team members will place the loading block approximately at the center of the test base opening.
 - G. Teams must assemble the Loading Block assembly, eyebolt, chain and S-hooks, and hang the bucket to load the Bridge. Team members may disassemble the loading block assembly to set up the test. The bucket must be mounted to allow enough clearance above the floor to allow for Bridge deflection.
 - H. Team members must be allowed to adjust the Bridge until they start loading sand. No adjustment may be made after sand loading has begun.
 - I. Team members must load the sand into the bucket and be allowed to safely and effectively stabilize the bucket from movement caused by sand loading. Direct contact with the bucket by team members is not allowed. Teams choosing to stabilize the bucket must use the bucket stabilization sticks provided by the Event Supervisor.
 - J. Bridges that fail before supporting 15.000 kg must be scored according to the actual load supported at time of failure, measured to the nearest gram or best precision available. Failure is defined as the inability of the bridge to carry any additional load, any part of the bridge touching the test base or any part of the load supported by anything other than the Bridge. Incidental contact between the chain/eyebolt and the device is not failure.
 - K. Loading must stop immediately when a failure occurs or when time expires. The Event Supervisor must remove any parts of the Bridge that fell into the bucket and sand added after failure. Sand added after failure will be removed by the event supervisor.
 - L. The Load Supported includes the loading block, chain, hooks, eyebolt, wing nut, bucket, and sand. m. Teams who wish to file an appeal must leave their Bridge with the Event Supervisor.

6. SCORING:

- A. The Load Scored is the measured load supported, but must not exceed 15.000 kg. This includes the mass of all the testing apparatus supported by the Bridge. The least possible load scored must be the mass of the Loading Block.
- B. Bridges must be scored and ranked by the highest Score.
- C. **Score = Load Scored (g)/Mass of bridge (g)**

7. SCORING EXAMPLES:

- A. Load scored = 13,235 g, Bridge Mass = 14.27 g, Score = 927.47
- B. Load scored = 15,000 g, Bridge Mass = 16.92 g, Score = 886.52

Recommended Resources: <http://www.soinc.org>