

1. **DESCRIPTION:** Prior to the competition, teams design and build a Bridge meeting these requirements to achieve the highest structural efficiency **while being tested at an angle.**

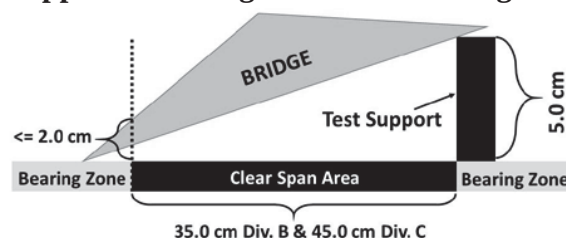
A TEAM OF UP TO: 2 **IMPOUND:** No **EYE PROTECTION:** B **MAXIMUM TIME:** 6 Minutes

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 eye protection must not test and must be ranked in Tier 4.
- c. The Event Supervisor must provide all assessment devices, testing apparatus (4), two bucket stabilization sticks (5.b.vii), and clean, dry sand or similar dry, free-flowing material (hereafter “sand”).

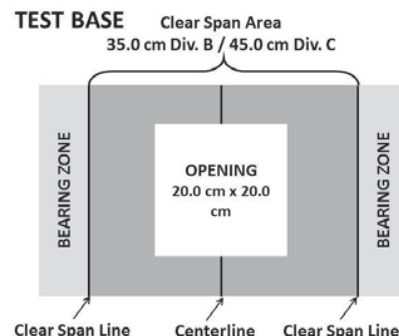
3. **CONSTRUCTION PARAMETERS:**

- a. The Bridge must span a **horizontal** opening of 35.0 cm (Division B) or 45.0 cm (Division C) and be designed to sit on a **single Test Support (4.b)** set at 5 cm high in one of the **Bearing Zones (4.a.iv)** of the Test Base. The low end of the Bridge must rest in the opposite **Bearing Zone** and the height of the Bridge can be no higher than 2 cm perpendicular to the Test Base surface within that **Bearing Zone**. The Bridge must be capable of meeting the Competition requirements for Testing (5.b).
- b. There is no maximum length, **maximum width or minimum width.**
- c. No portion of the Bridge may extend below the top surface of the Test Base (4.a) prior to testing.
- d. No portion of the Bridge may be braced against the sides of the Test Support (4.b) at any time.
- e. The Bridge must accommodate a Loading Block Assembly (4.c) placed in the center of the Bridge span.
- f. The Bridge must be a single structure constructed only 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).
- g. 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, polyurethane and super glues. Adhesive tapes are not allowed.
- h. Students must be able to answer questions regarding the design, construction, and operation of the device per the Building Policy found on www.soinc.org



4. **TESTING APPARATUS:** Supplied by the Event Supervisor

- a. The Test Base must be a solid and 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) and be stiff enough so it does not bend noticeably when loaded.
 - iii. Must have an opening approximately at its center approximately 20.0 cm x 20.0 cm.
 - iv. Parallel lines are marked across the width of the surface of the Test Base to indicate the Centerline and the Clear Span Lines. The Centerline divides the Test Base in half perpendicular to the span. The Clear Span Area of 35.0 cm for Division B and 45.0 for Division C is marked by two Clear Span Lines which are drawn equal distance to the left and right of the Centerline. The Bearing Zones are the test base surfaces outside the Clear Span Lines.
- b. **One Test Support must be provided matching the Loading Block specifications (4.c.i).**
- c. The Loading Block Assembly must consist of:
 - i. Loading Block: a square block measuring 5.0 cm x 5.0 cm x approximately 2.0 cm high with a hole **no larger than 8 mm diameter drilled perpendicular** to and centered on the 5.0 cm x 5.0 cm faces for a ¼” threaded eyebolt.
 - ii. A ¼” threaded eyebolt (1” nominal eye outside diameter), no longer than 3” and a ¼” 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 15.100 kg but no more than 15.300 kg prior to testing.
- g. At the Event Supervisor’s discretion, more than one testing apparatus may be used.



5. THE COMPETITION:

- a. **Check In** - All Bridges must be assessed prior to testing for compliance with construction parameters.
 - i. Team members must place their Bridge on the scale for the Event Supervisor to determine its mass in grams to the nearest 0.01 grams.
 - ii. No alterations, substitutions, **storage**, 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. **Testing**
 - i. Teams must have a maximum of 6 mins. to setup and test their Bridge to the max. load or to failure.
 - ii. **Team members must set the Test Support (4.b) in one of the Bearing Zones (4.a.iv). The Test Support must sit on one of the 2.0 cm x 5.0 cm faces. Team members must place one end of the Bridge on the Test Support (4.b) and that end of the Bridge may not contact the Test Base. The other end of the Bridge must be set in the opposite Bearing Zone (4.a.iv).**
 - iii. **The Event Supervisor will check the height of the bridge at the Clear Span Line of the Bearing Zone where the bridge directly touches the Test Base to assure it does not exceed 2.0 cm. If the bridge exceeds 2.0 cm it is counted as a construction violation.**
 - iv. Team members will place the Loading Block approximately at the center of the test base opening.
 - v. Team members 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.
 - vi. Team members must be allowed to adjust the Bridge until they start loading sand. No adjustment may be made after sand loading has begun.
 - vii. 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. Only the tip of the stabilization stick may touch the bucket. Refer to example on www.soinc.org
 - viii. 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 **outside of the Bearing Zone (4.a.iv), any contact of the Bridge with the Bearing Zone at the end supported by the Test Support**, 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. **Incidental pieces falling off the bridge is not failure.**
 - ix. 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 time has expired or failure.
 - x. Teams who wish to file an appeal must leave their Bridge with the Event Supervisor.

6. **SCORING:** The Load Supported is the measured load supported (including the Loading Block, chain, hooks, eyebolt, wing nut, bucket, and sand) but may not exceed 15.000 kg. The least possible Load Supported must be the mass of the Loading Block. Bridges that cannot support the Loading Block must be ranked in Tier 4.

- a. $\text{Score} = \text{Load Supported (g)} / \text{Mass of Bridge (g)}$
- b. Bridges must be scored and ranked in the first 3 tiers by the highest Score.
- c. Bridges must be scored in four tiers as follows:
 - i. Tier 1: Bridges meeting all the Construction Parameters and no Competition Violations.
 - ii. Tier 2: Bridges with one or more Competition Violations.
 - iii. Tier 3: Bridges with Construction Violations or both Competition and Construction Violations.
 - iv. Tier 4: Bridges unable to be loaded for any reason (e.g., cannot cross the Clear Span, cannot accommodate Loading Block, or failure to wear eye protection) must be ranked by lowest mass.
- d. Ties are broken by this sequence: 1. Lowest Bridge Mass; 2. Widest Bridge, measured at the widest point of the Bridge prior to loading.

7. **SCORING EXAMPLES:** a. Load Supported = 13,235 g, Bridge Mass = 14.27 g, Score = 927.47; b. Load Supported = 15,000 g, Bridge Mass = 16.92 g, Score = 886.52

Recommended Resources: The **Bridge Building DVD** and the **Problem Solving/Technology CD (PTCD)** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>

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