

### Boomilever

1. **DESCRIPTION:** A Boomilever is a cantilevered wood and **adhesive** structure, mounted to a vertical Testing Wall, carrying a load at a distance from the Wall. The objective of this event is to design and build the most efficient Boomilever meeting the requirements specified in these rules.

**A TEAM OF UP TO: 2** **IMPOUND:** None **EYE PROTECTION:** #2 **MAXIMUM TIME:** 10 Minutes

2. **EVENT PARAMETERS:**

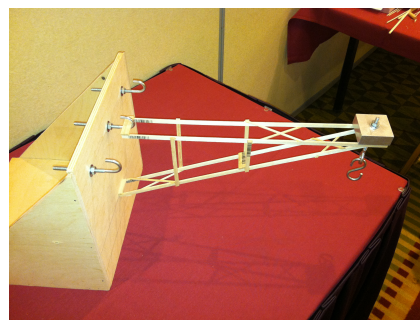
- a. Each team is allowed to enter only one Boomilever built prior to the competition.
- b. Team members must wear proper eye protection during the set-up and testing of the Boomilever. Teams without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows. Teams without eye protection must not test and must be ranked in Tier 4.
- c. The Event Supervisor must provide all assessment devices, testing apparatus, hardware, **level**, **two bucket stabilization sticks (refer to [www.soinc.org](http://www.soinc.org))**, and clean, dry sand or similar dry, free-flowing material (hereafter “sand”).

3. **CONSTRUCTION PARAMETERS:**

- a. The Boomilever must be a single structure designed to attach to **one mounting hook (Div. C); one, two or three (Div. B) mounting hook(s)** in the Testing Wall (4.b.), support a Loading Block (4.a.) with a load up to 15.0 kg at a distance from the Wall **as specified (3.c.)**.
- b. **The Contact Depth of the Boomilever is the lowest distance that the Boomilever touches the Testing Wall, measured below the center of the holes for the hook(s). The Contact Depth must not be more than 20.0 cm (Div. B) or 15.0 cm (Div. C) prior to loading.**
- c. The center of the Loading Block measured horizontally from the face of the Testing Wall must be between **45.0 cm - 50.0 cm (Div. B/C) and approximately centered horizontally on the Testing Wall.**
- d. **The Loading Block must be supported at a height higher than 5.0 cm below the Contact Depth.**
- e. **The Boomilever must be attached by means of the mounting hook(s) in the Testing Wall (4.b.iii.). The Boomilever must be able to be set up for testing without adjusting the mounting hook(s).**
- f. The Boomilever must not be attached or hooked to any edge of the Testing Wall. All tensile and shear connection to the Testing Wall must be through the mounting **hook(s)**.
- g. All parts of the Boomilever 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 shall be 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 Loading Block Assembly must consist of:
  - i. A square block measuring 5.0 cm x 5.0 cm x approximately 2.0 cm with a hole in the center of the square faces for a ¼” threaded eyebolt.
  - ii. ¼” threaded eyebolt no longer than 4” long and a ¼” wing nut
- b. The Testing Wall must be as follows:
  - i. It must be a vertical, solid, rigid surface with dimensions minimum of 40.0 cm wide x 30.0 cm high. It must a minimum of ¾” high grade plywood or other suitable material, with a smooth, hard, low-friction surface, and must not bend when loaded.
  - ii. **Mounting hook(s) shall be 4” steel J-bolts made of ¼” nominal round stock, have a 5/8” nominal inside hook diameter with a threaded ¼” mounting end.** National Hardware bar code stock number N232-892 (UPC 038613228917), ¼” by 4” **or exact equivalent shall be used.**
  - iii. **Mounting hook(s)** must be attached to the Testing Wall by the Supervisor with the “opening” up and installed to allow 2.5 cm +/- 0.1 cm clearance between the wall and the closest edge of the hook. The hook(s) must be secured in place with a hex nut and flat washer on the front side and a wing nut and flat washer on the back side of the Testing Wall. Division C must have one hook, horizontally aligned, and centered between the sides of the Testing Wall 5.0 cm below its top. Division B must have three hooks horizontally aligned and centered 5.0 cm below the top of the Testing Wall. The middle hole must be centered between the sides of the Testing Wall, with the other holes centered 10.0 cm on each



side of the middle hole. Supervisors must insure that the hook(s) remain securely in position during the competition. The centerlines of the holes must be visible on the face of the Testing Wall.

iv. **A horizontal Contact Depth line** must be clearly visible below the centerline of the holes **for the mounting hooks at 20.0 cm (Div. B) or 15.0 cm (Div. C).**

- c. A chain and hook must be suspended from the Loading Block **assembly**.
  - d. An approximately five gallon plastic bucket with a handle must be suspended from the chain or hook with enough clearance above the floor to allow for Boomilever deflection.
  - e. The Event Supervisor must verify that the combined mass of the Loading Block, chain, bucket, sand, and attaching hardware is at least 15.000 kg and no more than 15.500 kg prior to testing.
  - f. At the Event Supervisor's discretion, more than one testing apparatus may be used to ensure all teams can compete in a timely manner.
5. **COMPETITION:**
- a. No alterations, substitutions, or repairs may be made to the Boomilever after check-in. Once teams enter the event area to compete, they must not leave or receive outside assistance, materials, or communication.
  - b. All Boomilevers must be assessed prior to testing for compliance with construction parameters.
  - c. Team members must place their Boomilever 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 ten minutes to set up and test their Boomilever either to the maximum load or **to failure**.
  - e. Team members must attach their Boomilever to the Testing Wall using the mounting **hook(s)**. **Teams must not adjust the mounting hook(s).** Teams must assemble the Loading Block **assembly**, eyebolt, chain and/or S-hooks, and hang the bucket as required to load the Boomilever. Team members may disassemble the block and eyebolt if necessary to set up the test.
  - f. Teams must set the Loading Block on the Boomilever within the **specified range** from the Testing Wall.
  - g. **The Event Supervisor must measure and record the Boomilever's Contact Depth and verify that it does not exceed the limit before loading sand.**
  - h. Team members must be allowed to adjust the Boomilever until they start loading sand. No adjustment may be made after loading of sand has begun.
  - i. Team members must be allowed to safely and effectively stabilize the bucket from movement caused by loading of the sand. **Direct contact of 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. Boomilevers 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 Boomilever to carry any additional load, or any part of the load supported by anything other than the Boomilever. **Incidental contact between the chain and the device is not failure.** Loading must stop immediately when a failure occurs or when time expires. The Event Supervisor must remove any **parts of the Boomilever that fell into the bucket and** sand added after failure.
  - k. **Teams who wish to file an appeal must leave their Boomilever with the Event Supervisor.**
6. **SCORING:**
- a. The Load Scored must be the **measured** load supported, but must **not** exceed 15.000 kg. This includes the mass of all the testing apparatus supported by the Boomilever. The least possible load scored must be the mass of the Loading Block. Boomilevers that cannot support the Loading Block must be ranked in Tier 4.
  - b. Boomilevers must be scored and ranked in the first 3 tiers by the highest **Score**:  
**Score = Load Scored (g)/Mass of Boomilever (g)**
  - c. Boomilevers must be scored in four tiers as follows:
    - i. Tier 1: Boomilevers meeting all the Construction Parameters and no Competition Violations.
    - ii. Tier 2: Boomilevers with one or more **Competition** Violations.
    - iii. Tier 3: Boomilevers with **Construction** Violations or both Competition and Construction Violations.
    - iv. Tier 4: Boomilevers unable to be loaded for any reason (e.g., cannot be mounted on testing Wall, 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** Boomilever Mass; 2. **Least** Contact Depth prior to loading.
7. **SCORING EXAMPLES:**
- a. Mass = 14.27 g, load scored = 13,235 g → **Score = 927.47**
  - b. Mass = 16.92 g, load scored = 15,000 g → **Score = 886.52**
  - c. Mass = 10.30 g, load scored = 15,000 g, **Contact Depth = 21.4 cm** → **Score = 1456.31** (Tier 2)
- Recommended Resource:** The **Boomilever DVD** and training resources are available at [www.soinc.org](http://www.soinc.org)