

### **Boomilever**

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

**A TEAM OF UP TO: 2 IMPOUND: NO EYE PROTECTION: #2 MAXIMUM TIME: 10 min**

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 will be ranked in Tier 4.
- c. The Event Supervisor must provide all assessment devices, testing apparatus, hardware, 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 or more mounting hole(s) in the Testing Wall (4.b.), support a Loading Block (4.a.), and test a load up to 15.0 kg at a distance from the Wall.
- b. The Boomilever must not contact the Testing Wall at any time more than 20.0 cm (Div. B) or 15.0 cm (Div. C) below the centerline of the mounting holes.
- c. The center of the Loading Block, measured horizontally from the face of the Testing Wall, must be between 40.0 cm and 45.0 cm.
- d. The Loading Block must be initially supported no more than 25 cm below the center of the mounting holes.
- e. The Boomilever must have an Attachment Base for attaching it to the Testing Wall as follows:
  - i. The Attachment Base may be one or more parts, made from any type or size of wood or wood products (e.g., particleboard, wood composites, commercial plywood, sawdust, and glue, etc.). As long as it does not violate rule 3.b., it may be any size that can be accommodated by the Testing Wall.
  - ii. Mounting holes in the Attachment Base must align with the holes in the Testing Wall.
  - iii. When ready to test, any portion of the Attachment Base extending more than 1.3 cm ( $\frac{1}{2}$ " ) from the face of the Testing Wall must meet the material requirements listed below for the Boomilever.
  - iv. The Attachment Base must be a permanent part of the Boomilever, and is included in its mass.
- f. There is no limit to the height of the Boomilever or Loading Block above the Testing Wall.
- g. 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 bolts.
- h. All parts of the Boomilever more than 1.3 cm ( $\frac{1}{2}$ " ) from the face of the Testing Wall must be constructed of wood and bonded by glue. No other materials are permitted (e.g., bamboo, grasses, or paper).
- i. 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.
- j. Any commercially available bonding material (glue) may be used. Adhesive putty is not permitted.

4. **TESTING APPARATUS:**

- a. The Loading Block must be 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  $\frac{1}{4}$ " threaded eyebolt.
- b. The Testing Wall must be a vertical, solid, rigid surface as follows:
  - i. The Testing Wall must be at least 40.0 cm wide x 30.0 cm high, minimum  $\frac{3}{4}$ " high grade plywood or other suitable material, with a smooth, hard, low-friction surface, and must not bend noticeably when loaded.
  - ii. The Testing Wall must have three mounting holes for  $\frac{1}{4}$ " bolts, horizontally aligned, and centered approximately 5.0 cm below the top of the Testing Wall. The middle hole must be centered on the face of the Testing Wall and the center of the other holes placed 10.0 cm from the center of the middle hole. The centerlines of the holes must be visible on the face of the Testing Wall.
  - iii. Three sets of  $\frac{1}{4}$ " x 3" minimum length bolts with  $\frac{3}{4}$ " O.D. flat washers and wing nuts must be provided to attach the Boomilever to the Testing Wall.
  - iv. The Contact Depth Line is a horizontal line that must be clearly visible below the centerline of the mounting holes at 20.0 cm (Div. B) or 15.0 cm (Div. C).
- c. A  $\frac{1}{4}$ " threaded eyebolt, chain and hook must be suspended from the Loading Block.
- 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 15.300 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.

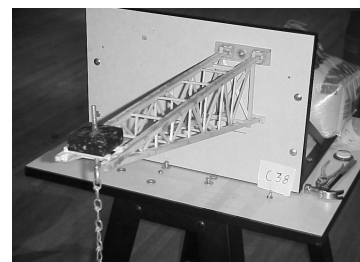
5. **COMPETITION:**

- a. No alterations, substitutions, or repairs may be made to the Boomilever after check-in for competition. Once teams enter the event area to compete, they must not leave or receive outside assistance, materials, or communication until they are finished.
- 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 failure.
- e. Team members must attach their Boomilever to the Testing Wall using any one or more of the mounting holes and may insert the bolts from either side of the wall. Teams must assemble the Loading Block, eyebolt, chain and hook, 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 adjust the Loading Block to be within the permitted distance from the Testing Wall.
- g. Prior to the placement of the Loading Block and bucket assembly the Event Supervisor must measure the Boomilever's Clearance from the Contact Depth Line to the nearest 0.1 cm. Time used by the Event Supervisor for this measurement must not count toward the 10 minute event time.
- 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.
- 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 is supported by anything other than the Boomilever. Loading must stop immediately when a failure occurs or when time expires. The Event Supervisor must remove any sand and wood fragments added after failure.
- k. If a Boomilever is removed after testing there can be no further challenges for scoring or ranking.

6. **SCORING:**

- a. The Load Scored will be the load supported or 15.000 kg if the load supported is greater than 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 will be ranked in Tier 4.
- b. Boomilevers must be scored and ranked in the first 3 tiers by the highest Efficiency Score:  

$$\text{Efficiency Score} = \text{Load Scored (g)} / \text{Mass of Boomilever (g)}$$
- c. Boomilevers will 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) will only receive participation points.
- d. Ties are broken by this sequence: 1. Greatest Clearance from Contact Depth Line; 2. Lowest Boomilever Mass.



**SCORING EXAMPLES:**

Mass = 14.27 g, load scored = 13,235 g, score = 927.47

Mass = 16.92 g, load scored = 15,000 g, score = 886.52

Mass = 10.30 g, load scored = 15,000 g, contact depth = 20.4 cm; score = 1456.31 (Tier 3)

**Recommended Resources:** All reference and training resources including the **Boomilever DVD** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>