

1. **DESCRIPTION:** Teams will design and build a Boomilever meeting requirements specified in these rules to achieve the highest structural efficiency.

A TEAM OF UP TO: 2 **IMPOUND:** NO **EYE PROTECTION:** B **EVENT TIME:** 6 minutes

2. **EVENT PARAMETERS:**

- a. Each team is allowed to enter only one Boomilever, built prior to the competition.
- b. All participants must properly wear eye protection at all times. Participants without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows. Participants without proper eye protection will not be allowed to compete and be placed in Tier 3.
- c. Participants may NOT bring any equipment such as levels or squares.
- d. The Event Supervisor will provide the Test Apparatus (see Section 5) and tools/materials for measurement.

3. **CONSTRUCTION PARAMETERS:**

- a. The Boomilever must be a single structure with no separate or detachable pieces, constructed of wood, and bonded by adhesive. No other materials are permitted.
 - i. Wood is defined as the hard, fibrous substance making up the greater part of the stems, branches, trunks, and roots of trees beneath the bark. Wood does NOT include: bark, particleboard, wood composites, bamboo or grasses, paper, commercially laminated wood (i.e. plywood), or members formed of sawdust and adhesive. Wood may never be painted, color enhanced, or have tape/preprinted/paper labels affixed. Ink barcodes or markings from the construction process may be left on the wood.
 - ii. There are no limits on the cross-sectional sizes of individual pieces of wood. Wood may be laminated by the team without restriction.
 - iii. Adhesive is a substance used to join two or more materials together and may be used only for this purpose. Any commercially available adhesive may be used (e.g., glue, cement, cyanoacrylate, epoxy, hot melt, polyurethane, and super glues). Adhesive tapes are not allowed.
- b. The Boomilever must be designed to attach to the Testing Wall (5.a.) using the Mounting Hook.
- c. The Boomilever must be **designed to** support the Loading Assembly (5.b.) so that the loading point (**the centerline of the chain**) is between 40 cm and 45 cm from the Testing Wall.
- d. Before and throughout loading, no portion of the Boomilever may touch the Testing Wall **between the Contact Width Lines (5.a.v.) or below the Contact Depth Line (5.a.iv.)**.
- e. Participants 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. **THE COMPETITION:**

Part I: Check-In

- a. The team **must** present their Boomilever for inspection & measurement.
- b. The team **must** place their Boomilever on the scale so the Event Supervisor can determine the mass, in grams to the nearest 0.01 g or best precision available.
- c. The team must submit their Estimated **Load Supported** (4.Part II.h.) to be used as a tiebreaker.
- d. No alterations, substitutions, or repairs may be made to the Boomilever after the check-in process has started.
- e. **Prior to Part II: Testing**, the Event Supervisor will verify that the combined mass of the Loading Assembly and sand is at least 15,100 g, but no more than 15,200 g.

Part II: Testing

- a. Once participants enter the event area to compete, they must not leave or receive outside assistance, materials, or communication until they are finished competing.
- b. Participants will have 6 minutes to setup and test their Boomilever to maximum load or failure.
- c. The participants must place the Boomilever on the Testing Wall and assemble the Loading Assembly as required to load the Boomilever. If necessary, participants may disassemble & reassemble the Loading Assembly **but must not adjust the Mounting Hook**. The bucket must be mounted to allow enough clearance above the floor for the bucket to tilt or the Boomilever to deflect.
- d. The participants will be allowed to adjust the Boomilever until they start loading sand. Once loading of sand has begun, the Boomilever must not be further adjusted.
- e. Prior to loading, the Event Supervisor will verify that the Boomilever is placed properly:
 - i. Only attached to the Testing Wall by the Mounting Hook.

- ii. The loading point (3.c.) is between 40 cm and 45 cm from the Testing Wall as measured horizontally to the centerline of the chain (5.a.iv.).
 - iii. No portion of the Boomilever touches the Testing Wall **between the Contact Width Lines (5.a.v.) or below the Contact Depth Line.**
 - f. Participants will 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 participants is NOT allowed. The bucket may only be stabilized by using the tips of the provided Bucket Stabilizing Sticks (5.d.).
 - g. **Loading stops immediately when the Boomilever touches the Testing Wall between the Contact Width Lines (5.a.v.) or below the Contact Depth Line (5.a.iv.), failure occurs, or time expires. Failure is defined as the inability of the Boomilever to carry any additional load, or if any part of the load is supported by anything other than the Boomilever. Incidental contact of the chain/ eyebolt with the Boomilever is not failure.**
 - h. **Once loading stops, any parts of the Boomilever in the bucket will be removed. The Load Supported (mass of the Loading Assembly and the sand in the bucket) will be recorded to the nearest gram or best precision available. The minimum Load Supported is the mass of the Loading Assembly. The maximum Load Supported is 15,000 g.**
 - i. **At the Event Supervisor's discretion, more than one Test Apparatus may be used.** Teams may be given a choice of which apparatus they will use.
 - j. The Event Supervisor will review with the team the data recorded on their scoresheet.
 - k. Teams who wish to file an appeal must leave their Boomilever with the Event Supervisor.
5. **TEST APPARATUS:**
- a. The Testing Wall must be as follows:
 - i. Vertical, solid, and rigid surface **at least** 40.0 cm wide x 30.0 cm high. Constructed of $\frac{3}{4}$ " grade plywood or other suitable material, with a smooth, hard, low friction surface that does not bend when loaded.
 - ii. The Mounting Hook must be a 4" steel J-bolt made of $\frac{1}{4}$ " nominal round stock, have a $\frac{5}{8}$ " nominal inside hook diameter with a threaded $\frac{1}{4}$ " mounting end [e.g., National Hardware barcode stock number N232-892 (UPC 038613228917), $\frac{1}{4}$ " by 4" or exact equivalent shall be used].
 - iii. The Mounting Hook must be attached to the Testing Wall by the Event 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 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. The Hook must be approximately 5.0 cm below the top of the Testing Wall and halfway between the sides. The horizontal and vertical centerlines of the hole must be marked on the face of the Testing Wall.
 - iv. A horizontal Contact Depth Line must be clearly visible on the Testing Wall. It must be drawn **20 cm for Division B or 15 cm for Division C** below the center of the hole for the Mounting Hook.
 - v. **Two vertical Contact Width Lines must be clearly visible on the Testing Wall. They will be drawn 4.0 cm to the right and left side of the center of the hole for the Mounting Hook.**
 - b. The Loading Assembly will consist of:
 - i. A square Loading Block measuring 5 cm x 5 cm x approximately 2 cm high with a hole no larger than 8 mm drilled in the center of the 5 cm x 5 cm faces for a $\frac{1}{4}$ " threaded eyebolt
 - ii. $\frac{1}{4}$ " threaded eyebolt (1" nominal eye outside diameter), **minimum 2 $\frac{1}{4}$ " length to a maximum 4 $\frac{1}{2}$ " length**, and a $\frac{1}{4}$ " wing nut
 - iii. A chain and S-hook that are suspended from the eyebolt on the Loading Block
 - iv. An approximately five-gallon plastic bucket with handle and hook to be suspended from the chain
 - v. **The total combined mass of the Loading Assembly may not exceed 1.5 kg**
 - c. **Sand:** sand or other clean, dry free-flowing material.
 - d. Two (2) Bucket Stabilizing Sticks each made from a piece of $\frac{1}{2}$ " dowel approximately 18 inches long with a spring-type door stop screwed into one end. Refer to example on www.soinc.org.

6. **SCORING:**

- a. High score wins. $\text{Score} = \text{Load Score (g)} / \text{Mass of Boomilever (g)}$.
- b. **The Load Score = Load Supported (4.Part II.h) + Bonus.**
- c. **Boomilevers that have a Load Supported of 15,000 g will earn a Bonus of 5,000 g.**
- d. Boomilevers will be placed in **three** tiers as follows:
 - i. **Tier 1: Holding any load and meeting all construction parameters and competition requirements**
 - ii. **Tier 2: Holding any load with any violations of the construction parameters and/or competition requirements**
 - iii. **Tier 3: Unable to be loaded for any reason (e.g., cannot accommodate or hold Loading Assembly, failure to wear eye protection) and will be ranked by lowest mass**
- e. Ties are broken as follows:
 - i. **Estimated Load Supported closest to, without exceeding, the actual Load Supported**
 - ii. **Lowest Boomilever mass**
- f. Example score calculations:
 - i. **Boomilever 1: mass = 10.12 g, Load Supported = 12,134 g; Score = 1,199**
 - ii. **Boomilever 2: mass = 12.32 g, Load Supported = 15,000 g + Bonus = 5,000 g = 20,000 g; Score = 1,623**

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Boomilever Video Download and Problem Solving/Technology CD; other resources are on the event page at soinc.org.

This event is sponsored by ArcelorMittal