

2016 Brookhaven National Laboratory Model Bridge Contest, Rules and Specifications

These rules have been developed by the BNL 2016 Model Bridge Contest Committee based on the official rules for the **2016 International Bridge Building Contest**. If you have a question that is not answered by this specification call 631-344-5461 between 9:00am and 3:00pm EST or email Susan Frank at: sfrank@bnl.gov for clarifications. For information on the International Bridge Contest, please visit the [International Bridge Building Contest Home Page](#) .

This is a contest for *individual high school students*, not teams. The object of this contest is to design, construct and test the **most efficient** bridge within the specifications. Model bridges are intended to be simplified versions of real-world bridges, which are designed to accept a load in any position and permit the load to travel across the entire bridge. In order to simplify the model bridge design process, the number of loading positions is reduced to three, and to allow the contest to proceed in a reasonable amount of time, only one loading position is actually tested. These simplifications do not negate the requirement that the bridge must be designed to accept a load at any of the three positions. Bridges determined by the judges to not meet this requirement will be disqualified and tested, if possible, as unofficial bridges.

1. Materials

- a. The bridge must be constructed only from 3/32-inch square cross-section basswood and any commonly available adhesive.
- b. The basswood may be notched, cut, sanded or laminated in any manner but must still be identifiable as basswood.
- c. No other materials may be used. The bridge may not be stained, painted or coated in any fashion with any foreign substance.

2. Construction

- a. The bridge mass shall be no greater than 25.00 grams.
- b. The bridge (see Figure 1) must span a gap (**S**) of 300 mm, be no longer (**L**) than 400 mm, be no taller (**H**) than 180 mm above the support surfaces and no wider (**W**) than 70 mm. No part of the bridge may extend below the top of the support surfaces. The loading plane (**P**) shall be horizontal and shall lie between 60 mm and 80 mm above the support surfaces. No portion of the bridge may extend below the top of the support surfaces.

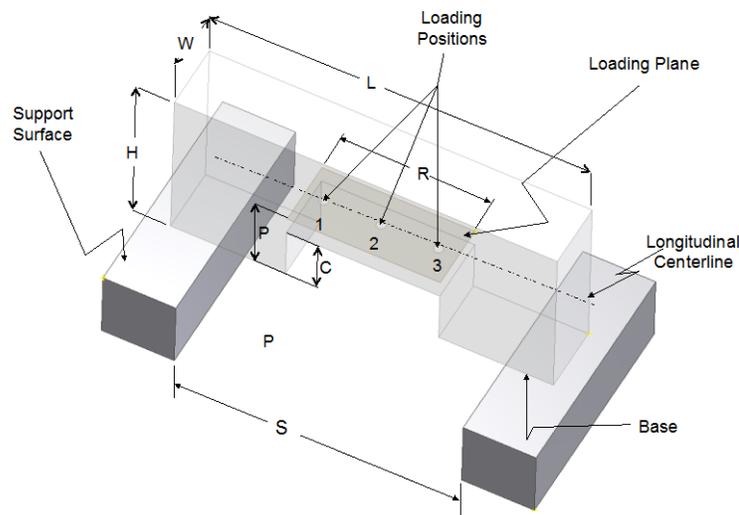


Figure 1: Bridge Schematic (not to scale)

- c. The bridge must be constructed such that the loading plane is horizontal and provides support for the loading plate and the loading rod at each of the three possible loading points. These three positions, at the mid-span of the bridge and 60 mm to either side of the center, will be clearly and consecutively labeled “1, 2, 3” from either end of the bridge by the participant, with load point #2 at mid span, before submission to the judges (see 3b, below). The structure of the horizontal loading plane must be a minimum length (**R**) of 160 mm and centered on the mid-span of the bridge. The bridge must allow the loading rod (see 3a) to be mounted from either above (for the BNL testing machine) and/or from below (for the international contest loading apparatus)
- d. The bridge must have a minimum clearance (**C**) of 60 mm in height above the support surfaces. This clearance also extends 80 mm (**D**) toward either end of the bridge from the center point of the bridge. It must be at least as long as the horizontal loading plane, and lie directly beneath it. No part of the bridge

structure may be in this clearance area, and a 60 mm high, by 160 mm long block oriented with its 160 mm dimension parallel to the span of the bridge must pass cleanly under the bridge when the bridge is placed on a flat table top.

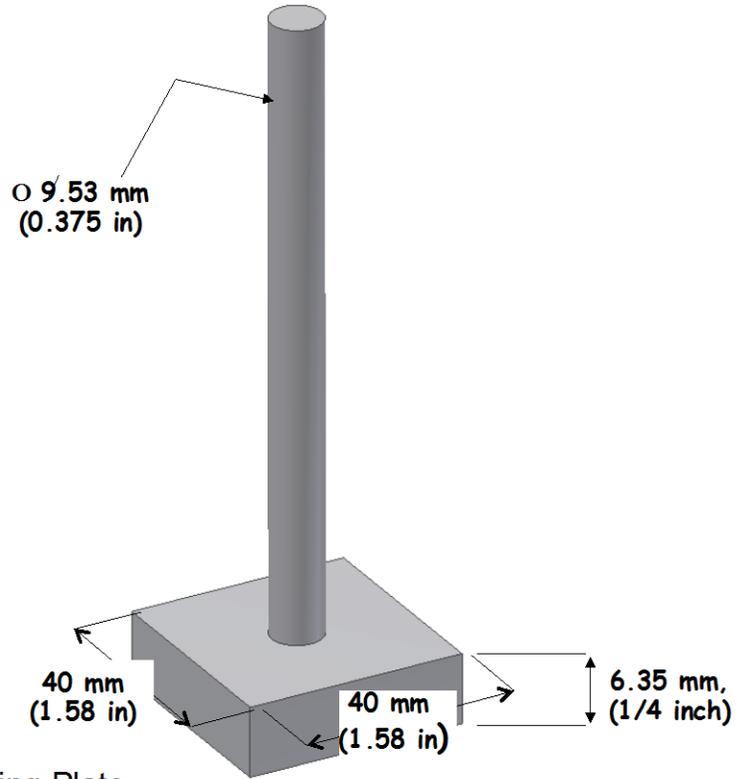


Figure 2a: BNL Loading Plate
(Not To Scale)

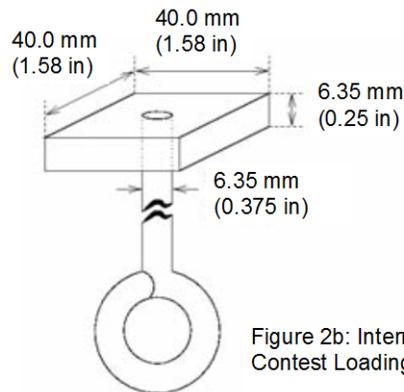


Figure 2b: International
Contest Loading Apparatus

3. Loading

- a. The load will be applied downward by means of a 40. mm (+/- 1 mm) square plate that is 6.35 mm (1/4 inch) in thickness. The plate will have a 9.53. mm (3/8 inch) diameter loading rod threaded into its center (see Figures 2a and 2b) loaded from the top (for the BNL contest using an INSTRON testing machine; loading will be from the bottom for the international contest using calibrated weights). The plate will be horizontal; it will not pivot on the loading rod, and during testing the sides of the plate will be placed parallel to and centered laterally on the longitudinal axis of the bridge.
- b. The three load positions will be located on the horizontal loading plane. Location and numbering will be as described in 2c, above.
- c. On the day of the competition, the judges will randomly draw the number of the loading position to be used; It will be the same for all bridges tested.

4. Testing

- a. On the day of the contest, judges will decide which loading location is to be used. It will be the same for all bridges.
- b. The bridge will be centered on the support surfaces.
- c. The loading plate will be located on the bridge at the specified loading location, as determined by the judges on the day of the contest.
- d. The load will be applied from above as described in section 3.
- e. Competition loading will stop at 50 kg. However, loading will continue until bridge failure.
- f. Bridge failure is defined as the inability of the bridge to carry additional load, or a load deflection of 25 mm under the loading location, whichever occurs first. If a bridge has leg(s) which fail, the bridge will have failed regardless of deflection.
- g. The bridge with the highest structural efficiency, E , will be declared the winner. Bridges failing above 50 kg will be considered to have held 50 kg for efficiency calculation.

$$E = \text{Load supported in grams (50,000 g maximum)} / \text{Mass of bridge in grams}$$

5. Qualification

- a. All construction and material requirements will be checked prior to testing. Bridges failing to meet these requirements will be disqualified. If physically

possible, disqualified bridges may be tested as exhibition bridges at the discretion of the contest directors.

- b. If, during testing, a condition becomes apparent (i.e., use of ineligible materials, inability to support the loading plate, bridge optimized for a single loading point, etc.) which is a violation of the rules or prevents testing as described above in Section 4, that bridge shall be disqualified. If the disqualified bridge can accommodate loading, it may still be tested as an exhibition bridge as stated above.
 - c. Registration number and builder's name should be written on the side of the bridge toward the bottom.
 - d. For questions on the preceding rules call 631-344-5461 between 9:00am and 4:00pm EST or email Susan Frank at: sfrank@bnl.gov.
 - e. All decisions of the judges are final.
 - f. These rules may be revised as experience shows the need. **It is your responsibility to check** for rule updates, periodically check the BNL web site: <http://www.bnl.gov/education/contests/bridge>
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