



2024 Model Bridge Rules and Specifications

These rules and specifications have been developed by the 2024 BNL Bridge Building Contest committee based on the official rules for the 2024 International Bridge Building Contest. If you have a question that is not answered by this document, email us at bridgecontest@bnl.gov.

For more information about this contest, visit www.bnl.gov/bridgebuilding. For information about the International Bridge Building Contest, visit <http://bridgecontest.phys.iit.edu>.

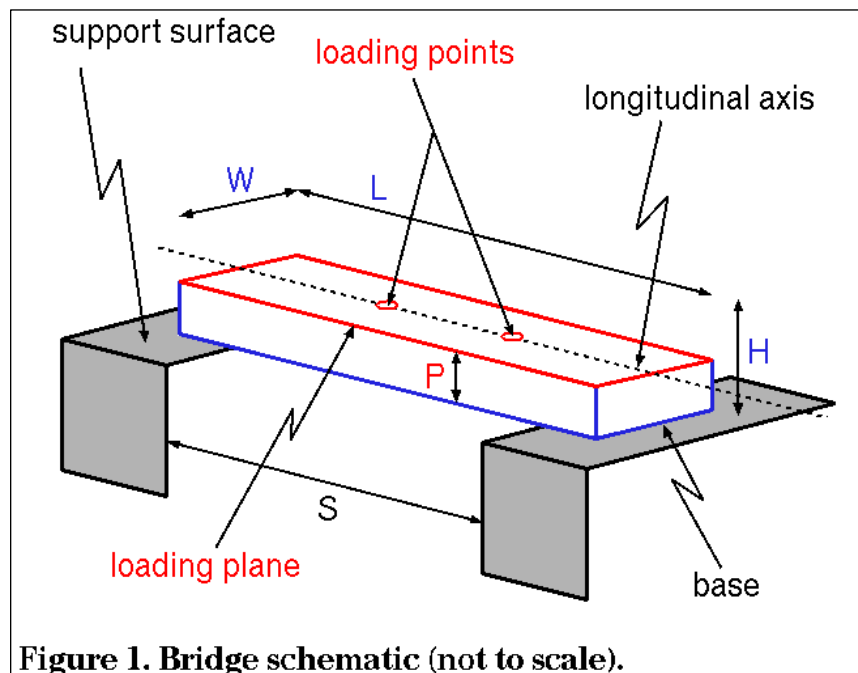
This is a contest for *individual high school students*, not teams. The object of this contest is to design, construct, and test the most efficient bridge built in accordance with the specifications. Model bridges are intended to be simplified versions of real-world bridges, which are designed to accept 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, and to allow the contest to proceed in a reasonable amount of time, only one loading position is tested. These simplifications do not negate the requirement that the bridge must be designed to accept a load at any of the specified positions. Bridges determined by the judges to not meet this requirement will be disqualified for competition. If possible, disqualified bridges may be tested as exhibition 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 matter 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

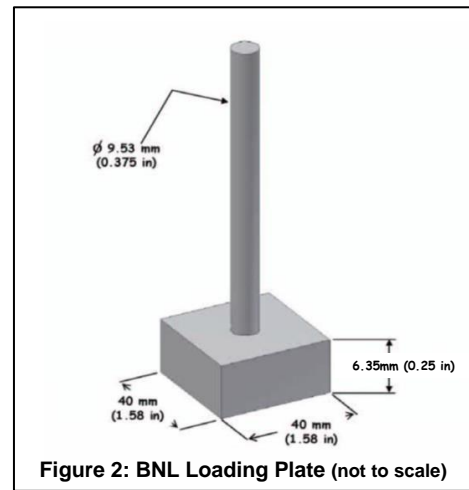
- a. The bridge mass shall be no greater than 25.00 grams.
- b. The bridge (see Figure 1) must span a gap (**S**) of 300. mm, be no longer (**L**) than 400. mm, be no taller (**H**) than 150. mm above the support surfaces, and no wider (**W**) than 80. mm. The bridge structure must not project below the support surfaces.
- c. The loading plane (**P**) shall be horizontal and shall lie on the physical top of the bridge between 100. mm and 150. mm above the support surfaces.



- d. The bridge must be constructed to provide a horizontal support surface so that the loading plate (see section 3 below), *without rod attached*, can be pushed smoothly along the loading plane from one loading point to the other: 30. mm and 50. mm on either side of the center of the 300. mm span along the longitudinal axis of the bridge.
- e. The bridge structure shall be symmetrical about its longitudinal and transverse centerlines.

3. Loading

- a. The load will be applied downward, from above, by means of a 40. mm (+/- 1 mm) square plate with a thickness of 6.35 mm (1/4 inch). The plate will have a 9.53 mm (3/8 inch) diameter rod threaded into its center (see Figure 2) loaded from the top using an Instron testing machine.
- b. The load will be applied on the longitudinal axis of the bridge with the center of the plate at one of two (2) possible loading points: 30. mm and 50. mm on either side of the center of the 300. mm span. The loading locations must all lie in the same horizontal loading plane (**P**) (see Figure 1).



- c. On the day of the competition, the judges will randomly decide which of the two loading points will be used; it will be the same for all bridges.

4. Testing

- a. On the day of the competition, the bridge will be centered on the support surfaces.
- b. The loading plate will be lowered from above on the bridge at the selected loading location with two edges of the plate parallel to the longitudinal axis of the bridge. The loading plate will be horizontal; it will not pivot on the loading rod. During the competition the loading plate will remain attached to the rod.
- c. The load will be applied from above, as described in section 3. Competition loading will stop at 50. kg. However, loading will continue until bridge failure occurs (see 4d).
- d. Bridge failure is defined as the inability of the structure to carry additional load or a bridge 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.
- e. 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 by the judges. Bridges that fail to meet these specifications will be disqualified. Bridges disqualified prior to the start of the contest may be tested as exhibition bridges. The results will be reported to the contestants.
- 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 (see 5a).
- c. The builder's name and bridge number must be legibly written on the side of the bridge toward the bottom.
- d. These rules may be revised as experience shows the need. It is your responsibility to check for rule updates periodically at <https://www.bnl.gov/bridgebuilding/>.
- e. All decisions of the judges are final.

6. International Competition Loading Information

- a. All bridges submitted to the BNL competition must be designed to accommodate the load in both the BNL Instron testing machine and the international loading apparatus.
- b. At the international competition, the load will be applied downward, from below, by means of a 40. mm square plate (see Figure 3). The plate will have a thickness (t) of at least 6 mm but less than 13 mm and will have an up to 9.53 mm (3/8-inch) diameter threaded rod attached from below at its center with a standard hex nut. The plate will be horizontal with two sides parallel to the longitudinal axis of the bridge.
- c. The top two bridges from the BNL competition will be recreated by the winning students to compete in the international competition.

