



2022 Model Bridge Rules and Specifications

These rules and specifications have been developed by the 2022 BNL Bridge Building Contest committee based on the official rules for the 2022 International Bridge Building Contest. If you have a question that is not answered by this document, email us at bridgecontest@bnl.gov or call (631) 344-5461 between 9:00am and 3:00pm EST. 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 and test, if possible, as exhibition bridges.

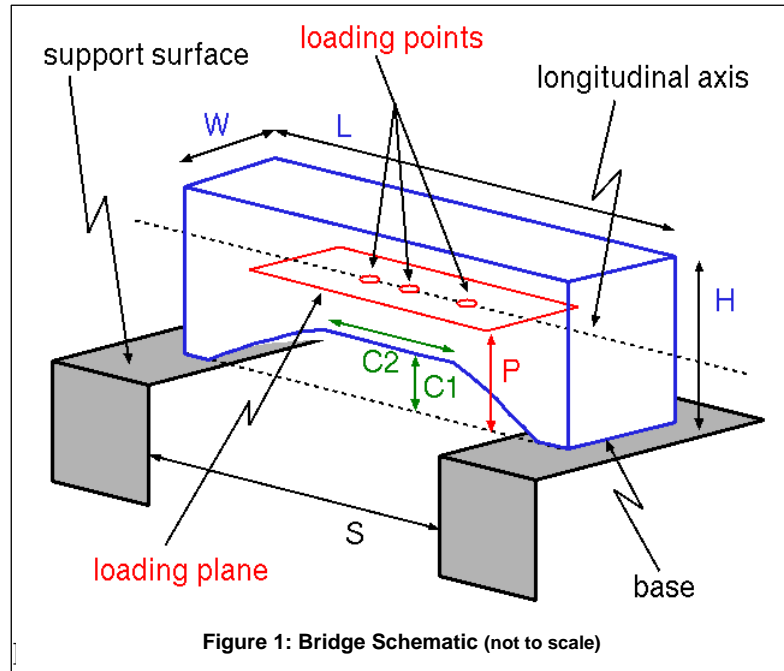
1. Materials

- 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.

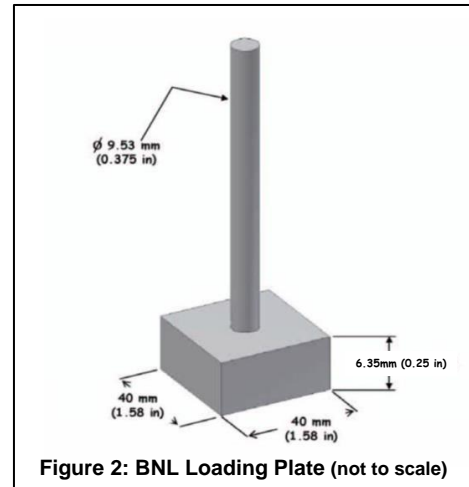
- b. The bridge (see Figure 1) must span a gap (**S**) of 300. mm, be no longer (**L**) than 400. mm, be no taller (**H**) than 150. mm above the support surfaces, and no wider (**W**) than 80. mm. The bridge structure may not project below the support surfaces (see Figure 1) and must provide a clearance (**C1**) of 20. mm at the center of the span and for 100. mm on either side of the center for a total of 200. mm wide (**C2**).



- c. The bridge must be constructed to provide a level, horizontal support for the load at each of the three possible loading locations (see 3c). Any portion of the structure above the loading plane must provide clearance for the loading plate and rod (see 3b) to be mounted from both above (for the BNL competition) and below (for the international competition) as described in section 6.
- d. The bridge must be constructed to allow a 48 mm diameter, 300. mm long pipe (1.5-inch schedule 40 PVC pipe) to be passed horizontally across the bridge with the pipe's lower surface on the loading plane (**P**) between 80. and 120. mm above the support surface. This pipe must touch all three loading locations simultaneously.
- e. The bridge structure shall be symmetrical about its longitudinal and transverse centerlines.

3. Loading

- a. On the day of the competition, the judges will decide which one of the three **loading points** will be used; it will be the same for all bridges. Competition loading will stop at 50. kg, loading will continue until bridge failure (see 4d).
- b. 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.



- c. The load will be applied with the center of the plate at one of three (3) possible **loading points** on the longitudinal axis of the bridge: The center, 30. mm to the left of center and 40. mm to the right of center. The 3 loading locations must lie in the same horizontal loading plane (**P**) between 80. and 120. mm above the support surface (see Figure 1).
- d. The loading 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. During the competition the loading plate will remain attached to the rod.

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.
- c. The load will be applied from above, as described in section 3 above. 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, as stated above.
- 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 from below by means of a 40. mm square plate (see Figure 3) with a thickness (t) of at least 6 mm but less than 13 mm. A 9.53 mm (3/8-inch) diameter eyebolt is attached from below to the center of the plate. The plate will be horizontal and will be mounted with two edges parallel to the longitudinal axis of the bridge.
- c. The winning bridges from the BNL competition will be recreated by the winning students to compete in the international competition.

