

# 2020 Colorado High School Bridge Building Contest Specifications

## 1. Materials

- a. The bridges must be constructed only from 3/32-inch square cross-section basswood, cables and any commonly available adhesive. The NSPE-CO website lists several suppliers of the basswood under the Competition Guidelines page.
- b. The basswood may be notched, shaped, cut, sanded or laminated in any manner but must still be identifiable as the original basswood.
- c. Cables may be any flexible non-metallic material such as string or fishing line. Metallic wire is not permitted.
- d. 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 50.00 grams**.
- b. Bridge outer dimensions (see Figure 1):
  - The bridge must span a gap of 300 mm.
  - The bridge shall be no longer than 400 mm.
  - The bridge shall have a maximum width of 100 mm.
  - The bridge shall be no taller than 200 mm above the upper support surface.
  - No portion of the bridge may be below the level of the lower support surface.
  - The bridge shall bear on the horizontal supports at differing heights as shown in Figure 1.
- c. Dimension limits above apply to the un-loaded condition. Deflections beyond these limits during loading will be permitted. See also deflection limits in Section 4.
- d. The bridge shall include a loading plane to which the testing load will be applied at the location along the span shown in Figure 1. The bridge's loading plane must be constructed to provide support for the loading plate (see Section 3 below) at the loading point. The loading plane may be at any vertical location on the bridge. If the intended loading plane is not at the top of the bridge, the bridge must provide an opening large enough for the 50 mm x 50 mm loading plate to pass through vertically. There are no required minimum dimensions of the loading plane.
- e. **The loading plane shall be horizontal.**

## 3. Loading

- a. The load will be applied downwards (from above) by means of a 50 mm square loading plate resting on the loading plane of the bridge. The plate will be attached to the rod from above to the center of the plate. The bottom plate surface will be horizontal and will not pivot during the loading.
- b. The load will be applied to the bridge at a position centered 150 mm from each end of the bridge (at mid-span).

#### 4. Testing

- a. The bridge will be placed on the support surfaces. The student may choose the orientation of their bridge, so as to place their intended loading plane location under the loading plate. If bridge entry is a mail-in and has no written instructions, the contest test personnel will place the bridge on the support surfaces using their best judgement.
- b. The loading plate will be located on the bridge and the load will be steadily applied from above the bridge onto the specified loading location.
- c. The load will be increased until failure occurs.
- d. Failure is defined as the inability of the bridge to carry additional load or a load plate deflection of 25 mm, whichever occurs first.
- e. The structural efficiency, E, of each bridge will be determined by the following formula:

$$E = \frac{\text{Load supported in grams}}{\text{Mass of bridge in grams}}$$

- f. Ranking of the bridges will be determined by the structural efficiency value.

#### 5. Qualification

- a. All construction and material requirements will be checked prior to testing by the judges. Bridges that fail to meet these specifications at the conclusion of the allowable time for checking will be disqualified. Bridges disqualified prior to the start of the contest may be tested as exhibition bridges at the discretion of the builder and the contest directors.
- b. If, during testing, a condition becomes apparent (i.e., use of ineligible materials, inability to support the loading plate, etc.) which 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. Disqualified bridges may be modified and rechecked by the judges prior to the conclusion of the allowable time for checking. If modifications lead to a bridge meeting the specifications, the bridge will then be considered an official bridge.
- d. If a student wishes to repair and/or modify a bridge after it has been tested, the bridge may be re-tested as an unofficial exhibition test, subject to the availability of time and the approval of judges and event staff.
- e. The decisions of the judges will be final. These rules may be revised as experience shows the need (please check the NSPE-CO Bridge Building web site at [http://nspe-co.org/events\\_bridge\\_building.php](http://nspe-co.org/events_bridge_building.php) periodically.)