

Bridge Building Competition
Department of Civil & Environmental Engineering
College of Engineering-University of Cincinnati
February 29, 2008

RULES

(Adapted from the Science Olympiad)

A. Registration

1. Teams may consist of one to three students. No student may be on more than one team.
2. All team members must be enrolled in high school.
3. Each team must be sponsored by a high school teacher. A teacher may supervise more than one team.
4. A team may submit only one bridge into the competition.
5. Due to space limitations, the maximum number of students that can participate in the on-campus event from a single high school is limited to 51. This means that only 51 students per school can attend the on-campus competition on test day. For example, if a school participates with all teams consisting of 3 students, they are limited to 17 bridge entries. On the other hand, a school with 2-member teams is limited to 25 entries, etc. However, additional bridges will be tested and data will be provided to the respective schools upon request, but not as part of the competition. Students associated with the bridges are not invited to attend the competition.
6. For each high school, teams can only be registered by the officially designated representative for that school. A teacher from each interested school should contact Dr. Rassati at gian.rassati@uc.edu to receive a password that will allow the teacher to register their school's teams. Unlike the previous years, students are no longer allowed to register themselves. Online registration will begin on Wednesday, January 16, 2008 and will close at 1:00PM Friday, February 15, 2008.
7. The bridges themselves will be submitted upon students' arrival to the testing site on test day. At least one member of a team must be present at the official testing of their bridge entry.

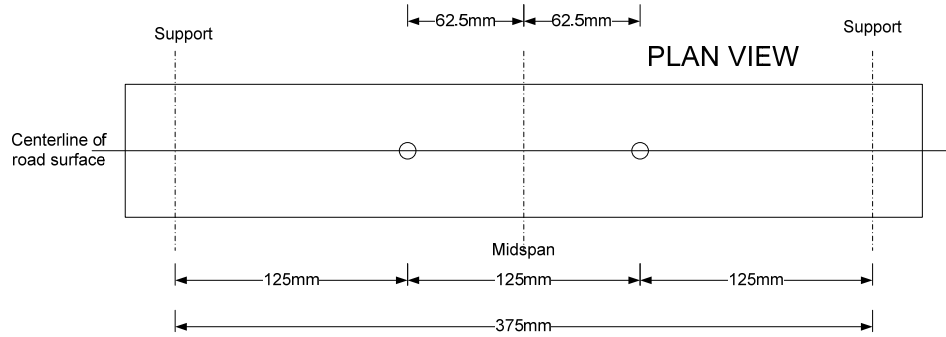
B. Materials

1. The bridge is to be a single structure constructed of wood bonded by glue. No other materials shall be used.
2. Particleboard, plywood, wood products, or commercially laminated wood may not be used.

3. The entire bridge, including the road surface, must be constructed of pieces of wood no larger than ¼” high and ¼” wide. Any dowels used cannot have a diameter larger than ¼”.
4. There is no limit on the length of individual wood pieces used in construction.
5. Any type of bonding material (glue) may be used.

C. Construction

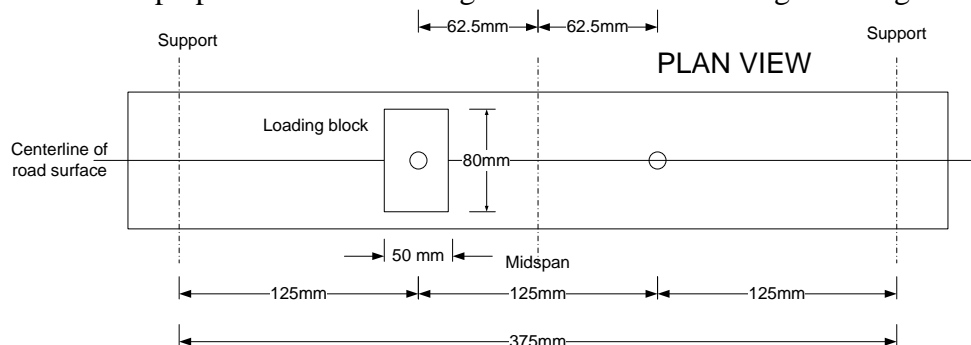
1. Any type of bridge that meets the specifications below may be constructed. Sound engineering practices such as truss construction, gussets, and mitered joints are encouraged.
2. All construction must be completed prior to the competition.
3. The bridge may not be coated with any material, e.g., paint, stain, glue.
4. Bridge dimensions
 - a. Span- At the competition, the bridge will be supported by two vertical supports, 375 mm apart. There is no maximum length of the bridge.
 - b. Width- The inside dimension of the road surface must be greater than 80 mm so that an 80 mm wide loading block will fit between the sides of the road surface and so a piece of paper will fit on each side of the block. There is no maximum width of the bridge.
 - c. No portion of the bridge may extend more than 13 mm below the top surface of the test supports.
5. Bridge mass limit is 0.68 kg.
6. The road surface is defined as a surface or surfaces that must allow the free passage of a rolling Matchbox™ or Hot Wheels™ model car along its entire length. The car must have an axle width of 30 ± 5 mm. The surface does not have to be solid.
 - a. Raised curbs, rails, or tracks are permitted and become an extension of the road surface on which the loading block may rest.
 - b. Length- The road surface must extend along the entire length of the bridge.
 - c. Height- The height of the road surface must not exceed 13 mm above the top surface of the test supports at any point.
7. Loading
 - a. The load point will be at the third-point of the span on the centerline of the road surface.
 - b. The bridge must accommodate an 80 mm long x 50 mm wide x 20 mm thick loading block (provided at the testing site). A hole large enough to accommodate a 3/8” diameter rod must be provided through the road surface at 62.5 mm in both directions from the mid-span of the bridge. The rod (provided at the testing site) is used to apply load to the bridge. See figure below.



- c. The selection of which of the two third-points to be loaded will be at the discretion of the judges, who will select the configuration that appears to provide the least strength/stiffness.
- d. The bottom surface of the loading block will be no more than 13 mm above the test supports when placed on the load point.

D. Testing

1. Bridges will be submitted upon the students' arrival and impounded on their submittal. After the testing, the bridge will be returned to the students.
2. Bridges will be assessed prior to the testing to determine if they meet the above specifications.
3. Test #1.
 - a. The bridge will be inclined by placing a 50 mm high block under one end of the bridge.
 - b. The model car will be placed on the elevated end of the road surface and allowed to roll down its length **and** exit the bridge. If the car gets stuck, the students may restart from that point. Two restarts will be allowed.
 - c. The event supervisors will supply the model car, however the students may bring their own.
4. Test #2
 - a. The bridge will be centered on the testing apparatus containing the 375 mm opening between the supports.
 - b. The 80 mm x 50 mm x 20 mm loading block will be applied to the bridge. The 80 mm dimension of the loading block will be oriented perpendicular to the longitudinal axis of the bridge. See figure below.



- c. A rod 3/8” in diameter will be attached to the loading block, which will be used to apply force to the loading block at one of the third-point locations
- d. The deflection of the bridge used to determine stiffness score will be measured at midspan.
- e. The test will be stopped when the applied force reaches a maximum value and begins to decrease **or** the maximum vertical midspan deflection reaches 15 mm.

E. Evaluation of Test Results

- 1. There is no score for the rolling test. Failure of this test disqualifies the bridge.

- 2. $Strength\ Factor = \frac{Maximum\ Applied\ Load}{Model\ Weight}$

The largest Strength Factor will be assigned a Strength Score of 1; the second highest 2, and so on.

- 3. $Stiffness\ Factor = \frac{Maximum\ Applied\ Load / Maximum\ Midspan\ Deflection}{Model\ Weight}$

The largest Stiffness Factor will be assigned a Stiffness Score of 1; the second highest 2, and so on.

F. Awards

- 1. Awards will be given in each of three categories:
 - a. Best Strength Score
 - b. Best Stiffness Score
 - c. Best Overall Score
 - (i.) The Overall Score is determined by summing the Strength Score and the Stiffness Score. The lowest, second lowest, and third lowest Overall Scores will be declared the first, second, and third place finishers, respectively, in this category.
 - (ii.) Example: The Strength Score of a bridge is 8, and the Stiffness Score is 3. The Overall Score would be 11 for this bridge.
- 2. For each of three award categories, the first place team will receive \$75, the second place team will receive \$50, and the third place team will receive \$25. In case of a tie, the award for that place finish will be divided equally among those qualifying teams.
- 3. Unfortunately, this year we are not in a financial position to offer any academic tuition scholarships for the College of Engineering

G. Judging

- 1. The Head of the Civil and Environmental Engineering Department of the University of Cincinnati will appoint judges.

2. The judges will make the final determination on compliance with the rules and penalties for rules violations.
3. The decision of the judges will be final, and appeals will not be considered.
4. Advance registration is required in order to be considered for the awards. The actual bridges will be submitted on the day of testing.

H. Competition Schedule

1. The Bridge Building Competition will occur on the Clifton Campus of the University of Cincinnati, from 8:00 AM to 2:00 PM on Friday, February 29, 2008.
2. Details concerning the schedule of activities (testing site, engineering department and campus tours, lunch, etc.) and the specific locations, along with appropriate maps, will be sent to the designated high school faculty member following receipt of the Advanced Registration of the team(s) they are sponsoring. This information will also be posted on the competition website beginning Wednesday, January 16, 2008.
3. A memento will be provided to each student attending the competition.