

SAMPE 2025

Student Bridge Contest

Rules and Guidelines



The Governing Committee can be reached at:
studentbridge@sampe.org

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1. Contest Intentions. The contest is an opportunity for students to learn and develop skills in composite design and manufacturing. To participate, students must be enrolled in an accredited university, college, community college or high school. Students must be 16 years of age or older, in accordance with SAMPE conference regulations. Students under the age of 16 may participate as a team member but cannot attend the conference. The rules and guidelines in this document are to be considered an outline and are subject to final interpretation by the Governing Committee. Students are encouraged to contact the Governing Committee for clarification of the rules and regulations. Any team that is not compliant with the spirit of the rules and guidelines will be subject to disqualification.
 - 1.1. Teams. An individual team shall have no more than 5 members, consisting of one team leader and up to four additional members. Team members must be enrolled at the school they are representing unless the team meets the requirement of a complex team per section 1.1.1.1.
 - 1.1.1.1. Unique Team. A registered team must consist of a unique set of team members for each category. A team consisting of the same team members may compete in multiple categories but cannot register multiple bridges in the same category. Each student may only be on one team per category.
 - 1.1.1.1.1. Complex Teams. A team consisting of students from multiple schools can participate in the contest. The schools are required to be located geographically close to form a complex team and approval of the team is subject to the Governing Committee prior to registration.
 - 1.1.1.1.2. Failure to Comply. Teams that do not meet the unique team requirement the day of the contest will be disqualified.
 - 1.2. Design. Teams must submit unique designs for their registered categories. For schools submitting multiple bridges in a single category, the teams must show each design is unique. Uniqueness is subject to determination by the Governing Committee.
 - 1.2.1.1. Submitting Similar Designs. Teams may submit similar designs for a comparison evaluation by the Governing Committee. Similar bridge identification numbers must be listed in the preliminary design proposal. It is recommended that this be done prior to registering for the contest.
 - 1.2.1.2. Failure to Comply. Teams that do not meet the unique design requirement the day of the contest will be required by the Governing Committee to select a single bridge to be tested and the remaining bridges will be disqualified. Bridges will not be permitted to switch categories.
 - 1.3. Expectations. Students are encouraged to seek advice from school faculty, peers and industry professionals throughout the project. However, all

manufacturing must be done by student team members only. Students are encouraged to focus on manufacturability and design optimization.

2. Categories. There are 8 independent bridge categories comprised of different materials architectures and load requirements.
 - a. Category A: Carbon and/or Aramid Fiber I-Beam
 - i. Design Load: 7,200 lbf
 - ii. Minimum Required Load: 1,500 lbf
 - b. Category B: Carbon and/or Aramid Fiber Square Beam
 - i. Design Load: 7,200 lbf
 - ii. Minimum Required Load: 1,500 lbf
 - iii. No prepreg permitted
 - c. Category C: I-Beam or Square Beam **Recycled** Carbon Fiber (rCF)
 - i. Design Load: 7,200 lbf
 - ii. Minimum Required Load: 1,500 lbf
 - iii. Only SAMPE provided material permitted
 - d. Category D: Glass Fiber I-Beam
 - i. Design Load: 5,600 lbf
 - ii. Minimum Required Load: 1,000 lbf
 - e. Category E: Glass Fiber Square Beam
 - i. Design Load: 5,600 lbf
 - ii. Minimum Required Load: 1,500 lbf
 - iii. No prepreg permitted
 - f. Category F: Natural Fiber I-Beam or Square Beam
 - i. Design Load: 2,400 lbf
 - ii. Minimum Required Load: 500 lbf
 - g. Category G: Open Design
 - i. Design Load: 10,000 lbf
 - ii. Minimum Required Load: 1,500 lbf
 - h. Category H: Sandwich Beam
 - i. Design Load: 1,600 lbf
 - ii. Minimum Required Load: 500 lbf

3. Geometric Criteria. No exceptions will be taken to these requirements and failure to comply will result in disqualification.

3.1. Criteria for All Categories.

- 3.1.1. All bridges must be at least 24.0 inches in length. This length must be continuous. Additional pieces of material cannot be bonded on to the bridge ends to increase the length. Please consider the blade width when trimming the bridge.

3.1.2. The bridges are tested in a modified three-point bend with a 23 inch wide center span. Designs must not interfere with the loading by bracing against the supports.

3.2. Criteria for I-Beam Bridges. I-Beam bridges must have a single web with a thickness less than or equal to 0.6 inches. The caps must have a maximum thickness of 0.375 inches and they do not have to be equal in length, width and thickness. The radius of the web-to-cap fillet must be no greater than 0.5 inches. The cross section is permitted to vary along the length of the bridge and does not have to follow the centerline if the required dimensions are maintained. The maximum dimensions for I-Beams are shown in Figure 1.

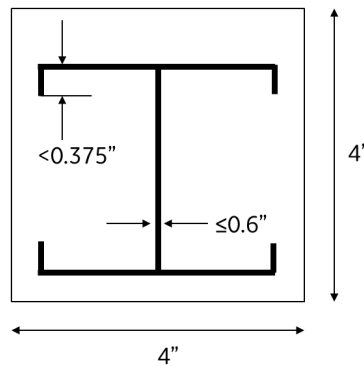


Figure 1. I-Beam Maximum Dimensions

3.3. Criteria for Square Beam Bridges. Square beam bridges are permitted to have a closed or open cross-section but are not permitted to have a solid cross-section along any length of the bridge. Square beams must have two or three independent webs; webs do not have to be perpendicular to the caps. The webs must maintain a minimum gap of 0.75 inches and the caps must maintain a minimum gap of 0.50 inches. Caps are permitted to extend past the web. The radius of the web-to-cap fillet must be no greater than 0.5 inches. The maximum dimensions for Square Beams are shown in Figures 2 and 3. The web and cap gap requirements are shown in Figure 4.

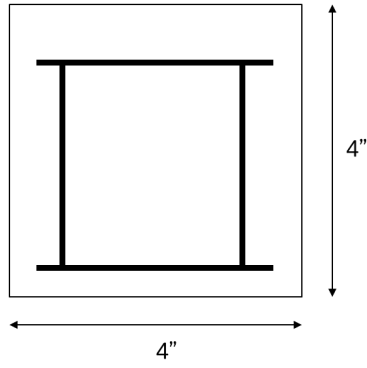


Figure 2. Closed Square Beam Maximum Dimensions

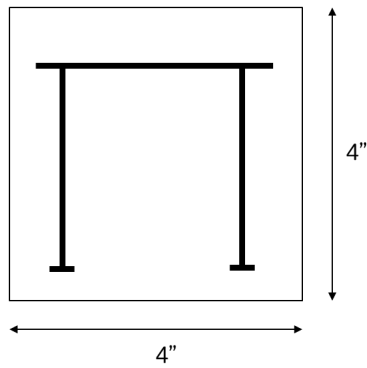


Figure 3. Open Square Beam Maximum Dimensions

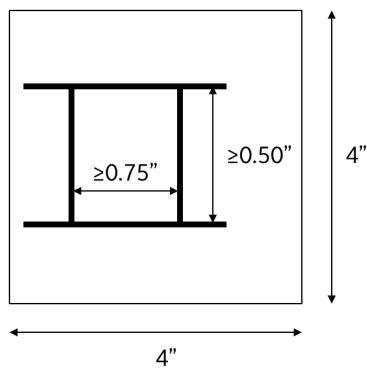


Figure 4. Square Beam Web and Cap Gap Maximum Dimensions

- 3.4. Criteria for Open Design Bridges. The base width of the bridge must not exceed 5 inches in width and the height must not exceed 14 inches.
- 3.5. Criteria for Sandwich Bridges. Sandwich bridges must maintain a constant cross-sectional area along the length. The cross-sectional width must be at least 3.0 inches. The facesheets must be at least 0.010 inches thick. The core must be at least 0.25 inches thick. The core type may vary within the cross-section and along the length. There must be no reinforcing webs, trusses or posts through the thickness or perpendicular to the facesheets. The maximum dimensions for a sandwich beam are shown in Figure 5.

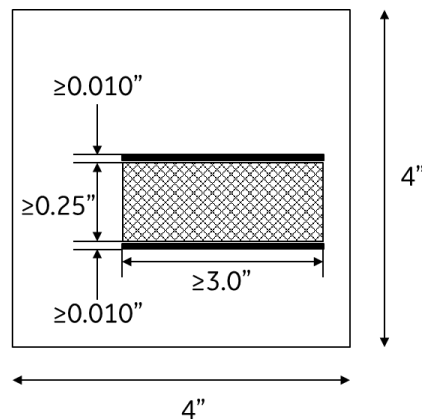


Figure 5. Sandwich Beam Maximum Dimensions

4. Materials and Fabrication. Materials used for the manufacturing of the bridges are at the final discretion of the Governing Committee.
- 4.1. Raw Materials. The fiber type permitted for each category is defined in the category name in Section 2. The designated fiber type is intended to be the highest strength fiber for the category, but other fiber types are permitted. For example, natural fibers are permitted in glass fiber categories, natural and glass fibers are permitted in carbon/aramid fiber categories. All modulus carbon fibers (standard, immediate and high) are permitted. All matrices (vinyl ester, polyester, epoxy, etc.) are permitted. Prepreg is not permitted in Categories B and E; for these categories, a prepregging machine shall not be used to produce material. For Category C, only recycled carbon fiber (rCF) provided in kits from SAMPE are permitted.
- 4.2. Natural Fiber. Permitted natural fibers must be naturally occurring in fiber form. Basalt and similar fibers are not permitted because they are naturally occurring minerals, not fibers. Animal hair and/or fiber is not permitted.
- 4.3. Core Materials.
- 4.3.1. All Categories Except F and H. Approved core materials include but are not limited to aluminum honeycomb, glass/phenolic honeycomb, foam, solid

wood and wood laminates. Wood laminates can be purchased or self-laminated. Other materials must be submitted to the Governing Committee for approval.

4.3.2. Category F. Core materials must be naturally occurring, such as solid wood or wood laminates. Wood laminates can be purchased or self-laminated but cannot contain non-naturally occurring reinforcements, fillers or additives between wood layers.

4.3.3. Category H. All core material allowed in 4.3.1 are permitted except for wood laminates (purchased or self-laminated) which are not permitted. In addition, core is permitted to be 3D printed from either acrylonitrile butadiene styrene (ABS) or polylactic acid (PLA) filament. The filament cannot be fiber reinforced or contain additives. A request must be submitted to the Governing Committee for teams wanting to extrude filament.

4.4. Prohibited Materials. Hazardous materials and metal (excluding honeycomb) are prohibited in all categories.

4.5. Manufacturing. Acceptable methods of bridge manufacturing include wet layup, compression molding and resin transfer molding (RTM). Processing in an oven, autoclave and press are permitted. Filament winding is not permitted in any category.

5. Testing. Testing parameters may be subject to change the day of the competition by the Governing Committee based on Conference Schedule. If parameters are changed, they will be changed at the start of a new category.

5.1. Setup. Teams are permitted to load and unload their own bridge; two team members maximum are permitted to do so. A time limit of 1 minute is allowed for loading the bridge and a countdown timer will be displayed on the viewing screen in the Bridge Contest Area.

5.2. Parameters. The load rate will be a minimum of 1 inch per minute. To ensure all bridges are tested, testing will end once the design load for the category is exceeded by 100 lbf.

5.3. Equipment. The fixture consists of a base and loading block, shown in Figure 6. Dimensions for the lower contact points are further dimensioned in Figure 7. The corresponding load case is depicted in Figure 7. The fixture will be installed and oriented prior to the competition; adjustments are permitted during the competition.

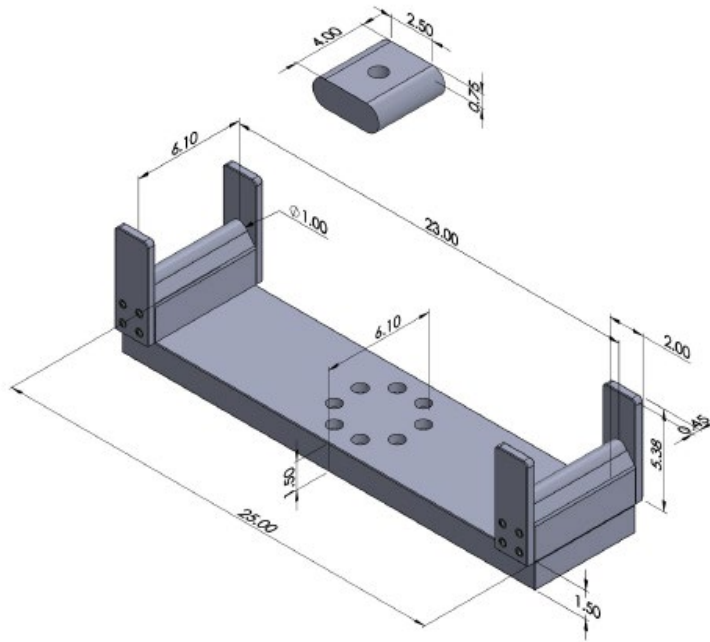


Figure 6. Loading Fixture with Bridge

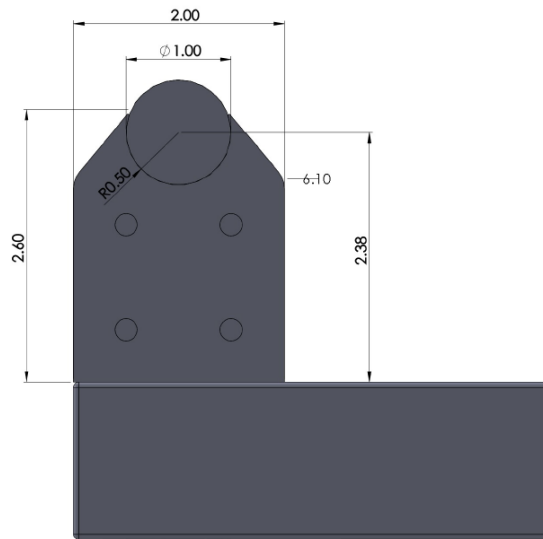


Figure 7. Lower Contact Point

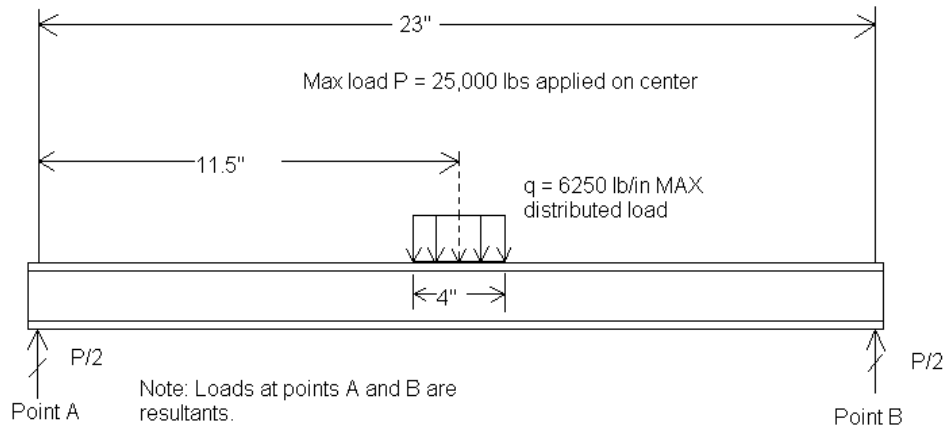


Figure 8. Load Case Free Body Diagram

5.3.1.Base. The span from center to center is 23 inches. The height from top to bottom is 2.88 inches. The support diameter is 1 inch.

5.3.2.Loading Block. Block dimensions are 4 inches by 4.1 inches by 1.5 inches (L x W x H), as shown in Figure 9.

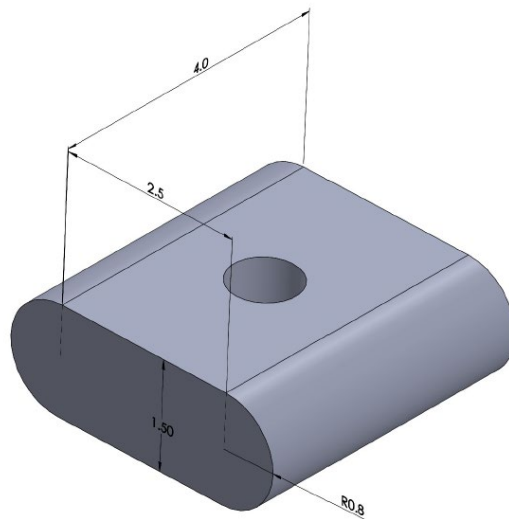


Figure 9. Loading Block Dimensions

6. Registration. To participate in the competition, teams must register online on the Contest Website by **May 12, 2025**. Late registration at the conference will NOT be available. Registered teams will receive a Bridge Registration Number via email. If you are unable to locate your number, please contact the Governing Committee.

6.1. Proposal. All teams must submit a design proposal for each registered bridge for review and approval by the Governing Committee no later than **May 16, 2025**. Proposals must include the following elements:

- a. Cover Page. A cover page template can be found in Appendix A. The cover page must include the following:
 - i. Bridge Registration Number
 - ii. Category
 - iii. School Name
 - iv. Team member names with one team member identified as the team leader. An email address must be provided for the team leader as a point of contact for the Governing Committee.
 - v. Faculty advisors name and contact information, including email address, mailing address, and phone number.
 - vi. Complete list of Bridge Registration Numbers for the school.
- b. Written Description of Bridge. Please keep the description to one page. The description must include, but is not limited to, details about the design, materials used, manufacturing process and analysis (if completed) to assess the structural capability.
- c. Drawing. Drawings with dimensions and different views including a cross-sectional view are recommended. Drawings are not required to be done in a CAD based software.
- d. Approval. The Governing Committee will reply to teams either approving the submitted proposal or providing feedback. If feedback is provided, teams may need to clarify details or make changes and resubmit the proposal for approval.

6.2 Posters. All teams must submit a paper poster for each registered bridge. The poster must highlight details about the design, materials used, manufacturing process and analysis (if completed) to assess the structural capability.

- 6.2.1 Paper Posters. Posters must be 22”H x 28”W in a landscape (horizontal) format. A poster template can be found in Appendix B. The poster must include:
 - 6.2.1.1 Bridge Registration Number in the upper left-hand corner.
 - 6.2.1.2 School Name at the top center.
 - 6.2.1.3 Bridge Category in the upper right-hand corner.
- 6.2.2 Poster Submittal. Teams are responsible for printing their own posters. Posters must be hung up in the Bridge Contest Area no later than 30 min before the start of testing. No alterations to posters are allowed once the posters are hung up.
- 6.2.3 Prize Eligibility. The Governing Committee will verify posters are hung before the start of testing and contain all of the required

information as specified in 6.2.1. If the poster has not been submitted or does not contain the required information, the Bridge Entry will not be eligible for prizes. Posters deemed ineligible will be identified with a red sticker; posters deemed eligible will be identified with a green sticker. Posters without a sticker are also deemed ineligible. No alterations to posters are allowed after Governing Committee verification.

6.2.4 Bridge entries deemed ineligible per Section 6.2.3 may still be tested but will not be eligible for prizes.

6.3 Material Kits. Material kits will be supplied for Category C, rCF, only. Teams must register by **March 15, 2025** to receive a material kit.

6.3.1 Shipping. Due to hazardous material shipping regulations, material kits cannot be shipped outside of the continental United States.

7 Evaluation Criteria. Bridges and posters are evaluated for 1st, 2nd and 3rd place monetary awards. The monetary awards are \$500 for 1st place, \$300 for 2nd place and \$200 for 3rd place. Based on awards for each bridge and poster category, an overall winner for the contest will be awarded to the school with the best overall performance. The overall winner will receive a trophy.

7.1 Bridge Evaluation. The maximum applied load up to the category design load is recorded. If bridges in a category do not meet the design load, rewards are determined by highest applied load that is equal to or greater than the category minimum load. Bridges that do not meet the category minimum load requirement are not eligible for rewards. If bridges in a category meet the design load, rewards will be determined by minimum bridge weight. The evaluation criterion is not a strength to weight ratio.

7.1.1 Tie Breaker. In the event of a tie, all tied teams will be awarded the same place award. The teams will receive the same monetary award and points towards the overall contest point total.

7.2 Poster Evaluation. Paper posters are evaluated by industry professionals. The following criteria are evaluated from 1 to 5 points, for a maximum score of 25 points.

7.2.1 Paper Poster Criteria:

7.2.1.1 Depth of technical content

7.2.1.2 Effective use of images

7.2.1.3 Readability (font, text formatting, conciseness)

7.2.1.4 Presentation and layout (flow of information)

7.2.1.5 Relevance to bridge entry

7.2.2 Tie Breaker. In the event of a tie, all tied teams will be awarded the same place award. The teams will receive the same monetary award and points towards the overall contest point total.

7.3 Overall Contest Winner. The overall contest winner is determined by a summation of points earned by a school for placing in a bridge category and/or poster category. Three points are awarded for 1st place. Two points are awarded for 2nd place. And one point is awarded for 3rd place.

7.3.1 Tie Breaker. In the event of a tie, the winner will be determined by the school with the most 1st place awards. If a tie still exists, the winner will be determined by the school with the most 2nd place awards. If a tie still exists, the winner will be determined by the school with the most 3rd place awards. If a tie still exists, for each bridge category a mean load will be calculated. For each entry a percent deviation from the category mean will be calculated. The school with the highest average percent deviation from the mean wins; the average is to include all entries from the school, not just winning entries.

- 8 Contest Details. Information regarding times and location for the contest will be emailed to registered teams and/or posted on the contest webpage prior to the conference. Check-in for the contest is the day before the contest, Tuesday, **May 20, 2025**. Late check-in will not be permitted unless extenuating circumstances have been coordinated in writing with the Governing Committee. The contest will be held on Wednesday, **May 21, 2025**.

Appendix A. Proposal Cover Page Template

SAMPE Bridge Contest Design Proposal

Bridge Registration Number:

Bridge Category:

School Name:

Team Leader:

 Email Address:

Team Members:

Faculty Advisor:

 Email Address:

 Mailing Address:

 Phone Number:

Other Bridge Registration Numbers:

Appendix B. Poster Template

