

Rules and Format of Competition

I. Awards

- A. 1st, 2nd, and 3rd place awards will be given in following three categories:
- 1) Structural: Certificates will be given to the bridges with the highest sustained applied load to bridge weight ratio.
 - 2) Craftsmanship: Certificates will be given to bridges with highest ratings in this category. Factors that will be considered are construction, aesthetics, and design categories each scored on a scale of 1 to 10. Construction will consider how well the bridge was built (joints, glue, etc.), aesthetics will consider the general appearance of the structure, and design will consider conformance with specifications and practicality of design.
 - 3) Overall Performance: Plaques will be given to the bridges with the highest overall performance ratings. Performance rating will be calculated by the following:

$$\text{Overall Performance} = 1.75 \times (\text{Structural Score \%}) + 1.0 \times (\text{Craftsmanship Score \%})$$

*As a percentage of the maximum possible score.

II. Material Specifications

- A. **Overall Bridge Dimensions:**
- 1) The span between the bridge supports will be 36 inches. Therefore, the model bridges will need to be 37 inches to rest on the supports and may NOT be longer than 39 inches. The bridge will be simply supported, meaning the supports exist only at the 0 inches and 36 inches points and are not continuous on either end of those points. The length of the supports will be less than or equal to ½ inches total length at those points. See Figure 1 below for diagram.
 - 2) The bridge can be anywhere between 5 inches and 7 inches wide. (Width is considered to be the length between the outermost edges of the bridge.)
 - 3) The maximum allowable height of the bridge is 9 inches. (Height is the vertical distance from the lowest point to the highest point on the bridge.)
- B. **Bridge Mass**
- The overall mass of the bridge shall **NOT** exceed 100 grams. This will be strictly enforced and any bridge over 100 grams will be disqualified from competition.
- C. **Materials**
- 1) Wood: The bridge members will be composed of balsa wood, with no member having dimensions greater than ¼ inch by ¼ inch, and 36 inches in length. Exceptions are made at the joints (See below for details). Note: A member is defined as a single piece of balsa wood.
 - 2) Glue: Standard Elmer's, or equivalent, wood glue used for carpentry and residential use.
 - 3) No other material (e.g. paint, varnish, glue, hairspray, string, etc.) may be used as a member or applied to the bridge to strengthen a member or the bridge.
- D. **Laminating:** Layering members on top of one another (laminating) is not allowed.
- E. **Joints:** The following are acceptable for joints:
- 1) Overlapping of members no greater than ½ inch will be allowed.
 - 2) Gusset Plates with maximum dimensions of ¾ inch x ¾ inch x 1/16 inch are allowed.
 - 3) Diagrams of allowable joints can be found Appendix A.

III. Loading of Bridges

- A. Failure will be defined as the point at which the structure can no longer support a load.
- B. The load will be applied at the one-third points of the span. These points are 12 inches from either support.
- C. Loading will occur on the bridge deck.
- D. The space 3 inches above and 3 inches below the middle section of the bridge must remain clear and free of members to accommodate the loading device. See Figure 1 below.
- E. Bars spanning the width of the deck at the 1/3 points will apply the loads. For this reason, a space no smaller than $\frac{1}{2}$ inches $\times \frac{1}{2}$ inches must be left open at deck level at those points through which to slide these bars. See Figure 1 below.

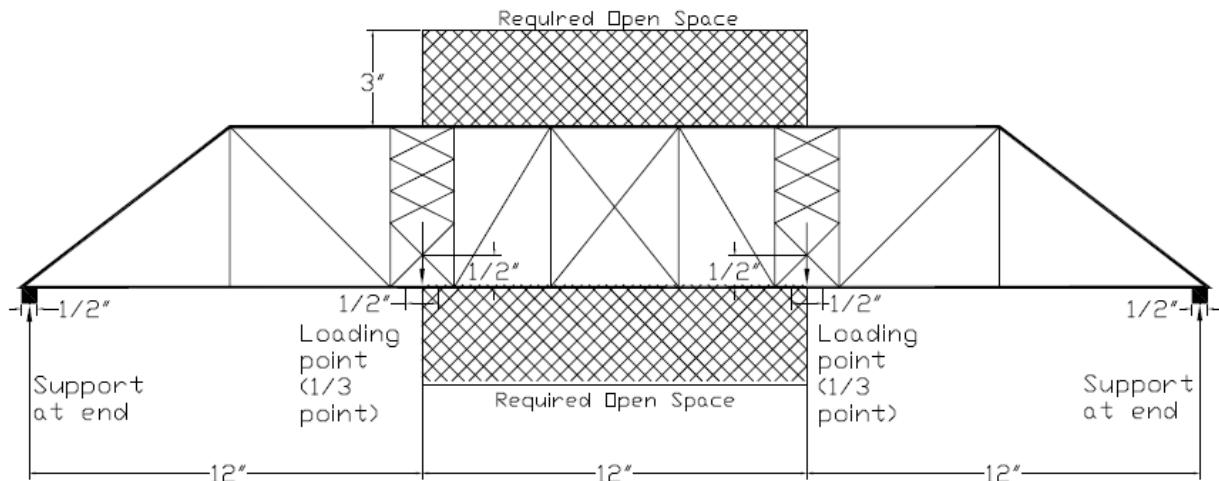


Figure 1: Diagram of support locations and approximate size, loading positions, space between loading points, and 3 inches above and 3 inches below the bridge that must be an open area.

IV. Eligibility and Rules

- A. Each team can be composed of no more than 3 students.
- B. All teams must be registered by March 21, 2014.
- C. Each bridge must be ready to be weighed in by 9:00 a.m. on Saturday, April 5, 2014.
- D. Bridges will be loaded in random order beginning shortly after 9:00 a.m.
- E. Craftsmanship will be judged by students, and faculty of the civil engineering department. The judges will have final say on any conflicts which may arise during competition.
- F. Presentation of awards will take place shortly after the loading of the last bridge.
- G. Bridges that do not conform to all specifications will automatically be disqualified.
- H. Specifications include material, weight, height, construction (i.e. laminating), width, loading requirements(items E & F of Part III), and length.

V. Hints

- A. Joints are critical parts of any bridge design. Poor joint construction can greatly reduce the load carrying capacity of your bridge.
- B. For a truss design some members will be in tension (pulled), and some will be in compression (squeezed). Decide which members are going to be in tension, and which are going to be in compression. Design these members accordingly.
- C. Don't be afraid to ask someone knowledgeable in bridge design for some tips. Be sure however, that the design is completely a student design.
- D. This is a team project. Be sure to get input from all members of the design team.
- E. Reinforce the deck beams at the loading points so as to prevent premature failure of the bridge.
- F. Do not build your bridges much longer than 36 inches because the bridges will be sitting on simple supports and not on tables. If your bridge is too long the joints will not be resting over the supports and the bridge will probably break rather quickly. See Figure 2 for a diagram of a simply supported bridge.
- G. Most I-beams or truss failures result from twisting of the member or the truss, so provide adequate bracing to prevent twisting of members.

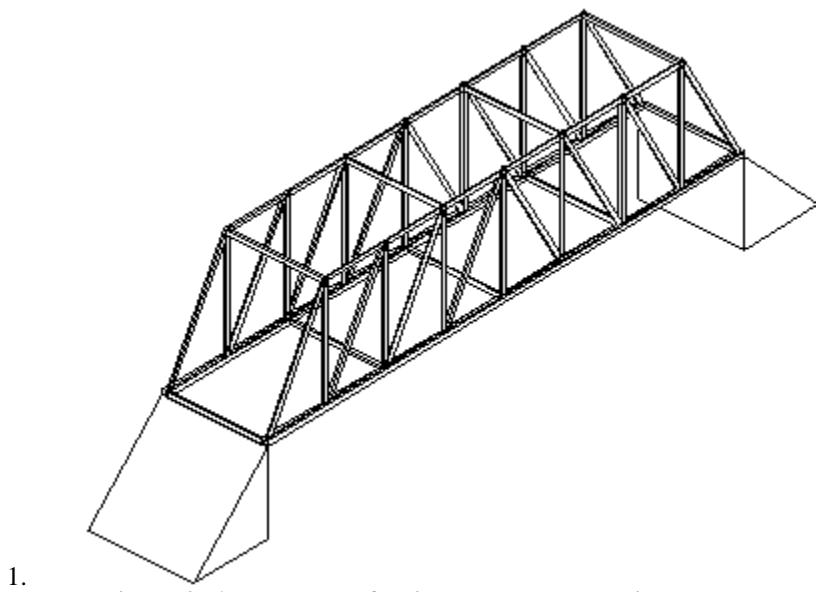


Figure 2: An example of a simply supported bridge.

Please read the rules carefully and follow the required specifications so we can avoid any future problems or misunderstandings. Feel free at anytime to email me at ashearr@ksu.edu to ask me about the rules.

Good luck on the construction of your bridges and I look forward to seeing you in April!

Sincerely,
Andy Shearrer
ASCE Balsa Bridge Coordinator
Graduate Student, Civil Engineering
Kansas State University

Appendix A

Diagrams of Acceptable Joints for Balsa Bridge Competition

The following types of joints will be allowed in the balsa bridge competition. No other joint configuration will be allowed.

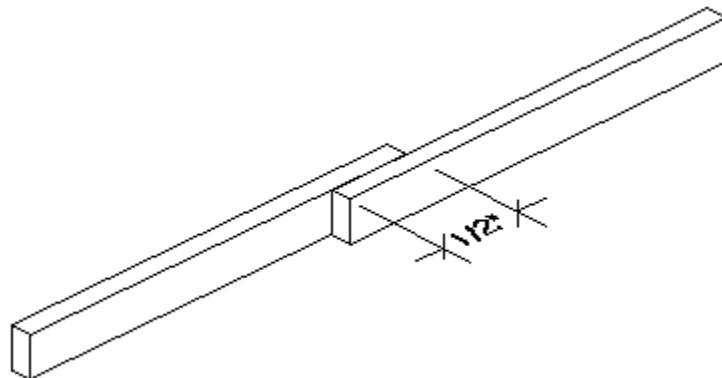


Figure 1: Simple Overlapping Joint

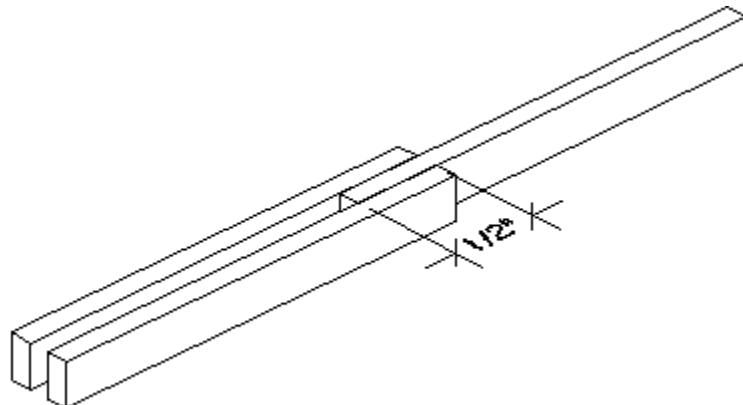


Figure 2: Double Overlapping Joint

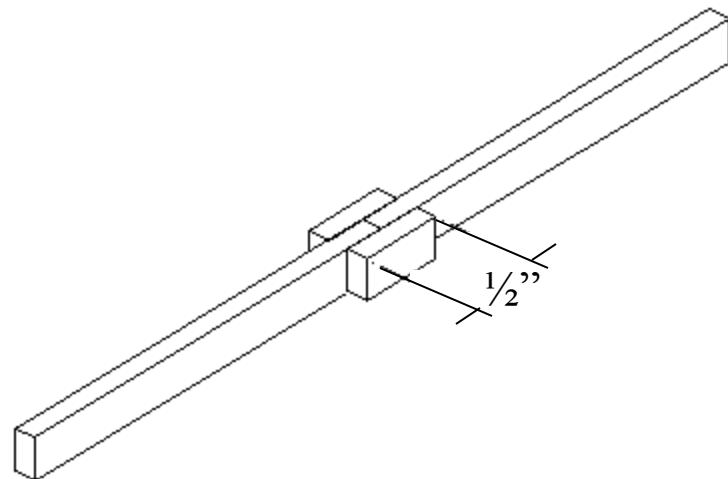


Figure 3: Butt Joint

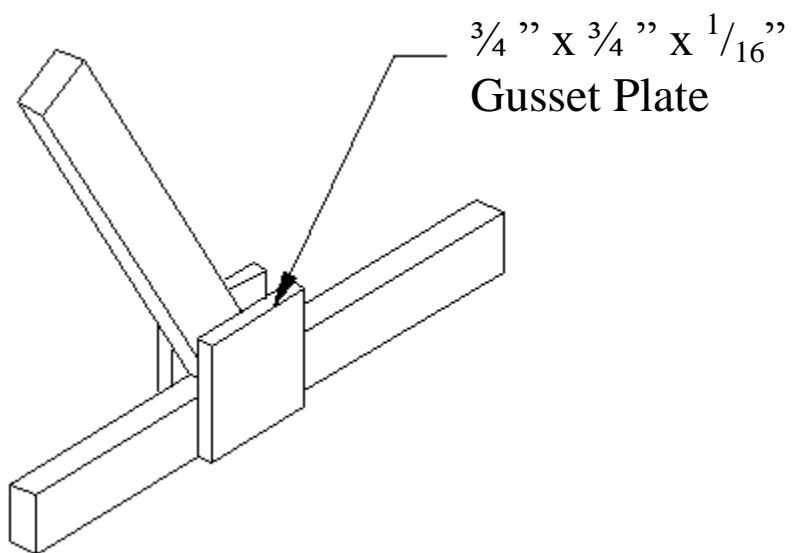


Figure 4: Joint with Gusset Plate