

Stick Together

LEVEL:	Grades 6 - 8
TYPE OF CONTEST:	Individual/Team
COMPOSITION OF TEAM:	1-2 students per team
NUMBER OF STUDENTS:	Preliminary – As determined by your local MESA Center Regional – 3 for 6 th Grade; 3 for 7 th /8 th Grade per Center
SPONSOR:	MESA Day Rules Committee

OVERVIEW: Students will use math and science to implement engineering concepts in the design and construction of a model bridge from your own plans that will carry a maximum load while using as few craftsticks as possible; stressing neatness, craftsmanship, and creativity. **Participation logistics, limits, and competition facilities may vary by host site. Advisors and students are responsible for verifying this information with their center director.**

MATERIALS:

- Only solid untreated (no manufactured notches or holes), natural wood craftsticks (e.g. popsicle sticks) with the following approximate dimensions may be used:
 - Length= 4 ½ inches (11.4cm)
 - Width = 3/8 inches (0.95cm)
 - Thickness = 1/16 inches (0.2cm)
- Maximum number of sticks allowed, including partial sticks, is 200. Each piece of stick, regardless of size, will be counted as one structural member.
- Only water soluble Elmer's-type white glue must be used.

GENERAL RULES:

- 1) Stick Together structures should be labeled with team members' names, school, and MESA Center. There will be a 10% penalty in the strength to weight score for improper labeling.
- 2) No kits are allowed
- 3) A maximum of 50% of a craftstick's total wide/flat surface may be glued. Both sides of each stick can be considered in the 50% calculation. e.g. 100% of side 1 and 0% of side 2; 75% of side 1 and 25% of side 2.
- 4) Glue (water soluble Elmer's type white glue) must only be used at joints, and must not be used on the surface of the roadway.

- 5) No coatings of any kind, including glue, paint, cement, epoxy; etc. may be applied to any surface of the bridge. The Bridge will be disqualified if it is coated with any substance.
- 6) The bridge MUST meet the following dimension restrictions:
 - a. Maximum horizontal length = **17 inches (43.2 cm)**
 - b. Maximum width = **5 inches (12.7 cm)**
 - c. Maximum height above the top of the roadway = **7 inches (17.78 cm)**
 - d. Maximum depth below the top of the roadway = **3.5 inches (8.89 cm)**
 - e. Minimum horizontal length = **15 inches (38.1 cm)**
 - f. Minimum width **at every point** = **4 inches (10.16 cm)**
 - g. Minimum width of open roadway across entire bridge length = **3.5 inches (8.89 cm)**
- 7) The bridge must be open at the top to allow insertion of testing apparatus.
- 8) The bridge must have a clear and unobstructed roadway at least 3 ½ inches wide, running the full length of the bridge, as if automobile traffic were going to cross it. The roadway shall be considered a roadway if a toy model car or truck freely rolls from one end to the other. The toy car/truck can be provided by the entrant. If a car is not provided by the entrant, a standard “Hot Wheels” or “Matchbox” car will be used.
- 9) The bridge may not have a roof, covering or any other object that will interfere with the 3½ x 3½ inch test plate that is placed directly on roadway at mid span to apply the force for load bearing capacity.
- 10) I-beams are illegal.
- 11) T-sections and longitudinal lamination may be used on the roadway only.
- 12) The bridge must rest on the tester support blocks in a stable manner, i.e. bridge substructure may NOT interfere with testing apparatus.
- 13) Project must be the original work of student(s). Judges may ask questions to confirm provenance.
- 14) Please remember that the purpose of this contest is to use creativity to build the best structure within the framework of the rules. The purpose is not to break the rules and see if you can get away with it.

JUDGING:

- 1) The bridge is examined and measured by the judges to check whether it conforms to contest rules and specifications.
- 2) Any bridge that does not meet the requirements will be disqualified.
- 3) The bridge is weighed and its weight recorded.
- 4) The bridges are judged for neatness, craftsmanship, and creativity by a team selected by the Host Center prior to testing.
- 5) The bridge will be supported by two wide blocks (each >1 inch) 14 inches apart (see Testing Setup & Apparatus)
- 6) A 3½ x 3½ inch test plate is lowered onto the bridge at mid span so that it rests on the roadway.
- 7) The test plate is loaded until a point of maximum load is reached as determined by judges. The maximum load recorded by the load testing machine will be used as the load capacity of the bridge, regardless of when failure begins.
- 8) Individuals' bridges are not limited in the number of categories they may win.
- 9) Disqualified bridges are not eligible for awards in any category; however, they may be tested, time permitting.

10) Strength-to-Weight Ratio: Determined by dividing maximum load at failure by weight of bridge. Bridge with greatest load bearing capacity compared to its weight wins.

Example: Maximum load = 220.0 pounds
 Bridge weight = 50.0 grams
 Ratio = $1997.8 * [220 \text{ pounds} \times 454\text{g/pound}]/50\text{g}$

11) Creativity & Engineering Design: Finest workmanship, including neatness and innovation of design.

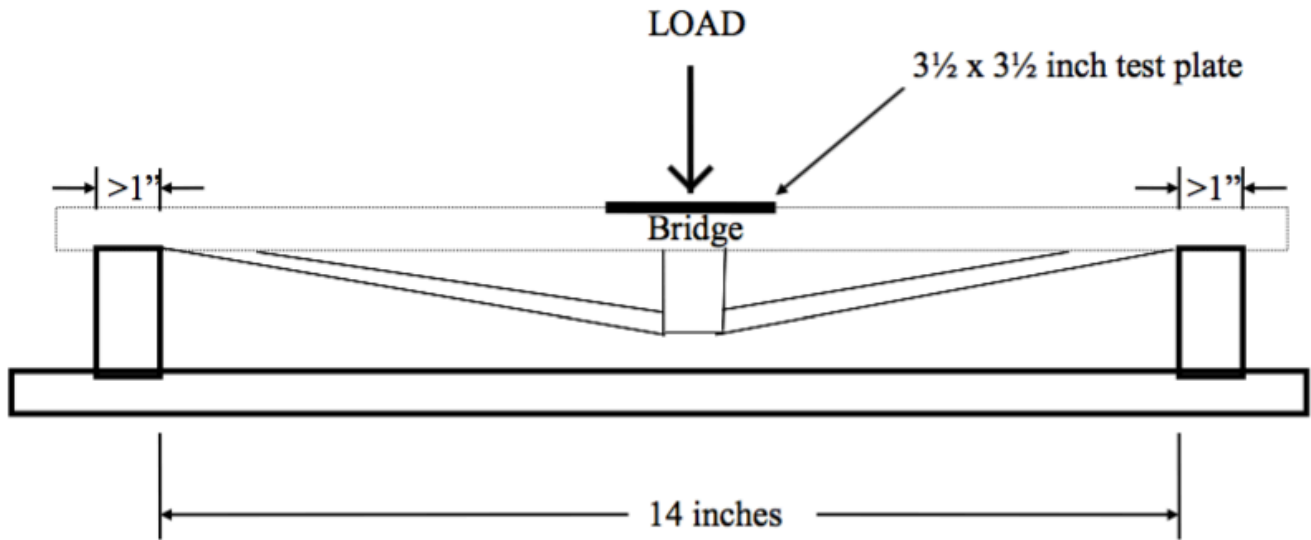
AWARDS:

- Awards will be given per grade level: 6th grade and 7th/8th grade.
- Medals will be awarded for 1st, 2nd, and 3rd place based on the best Strength-to-Weight Ratio
- Ribbons will be awarded for Creativity and Engineering Design.
- Only teams placing in the Strength-to-Weight category will advance to Regional MESA Day.

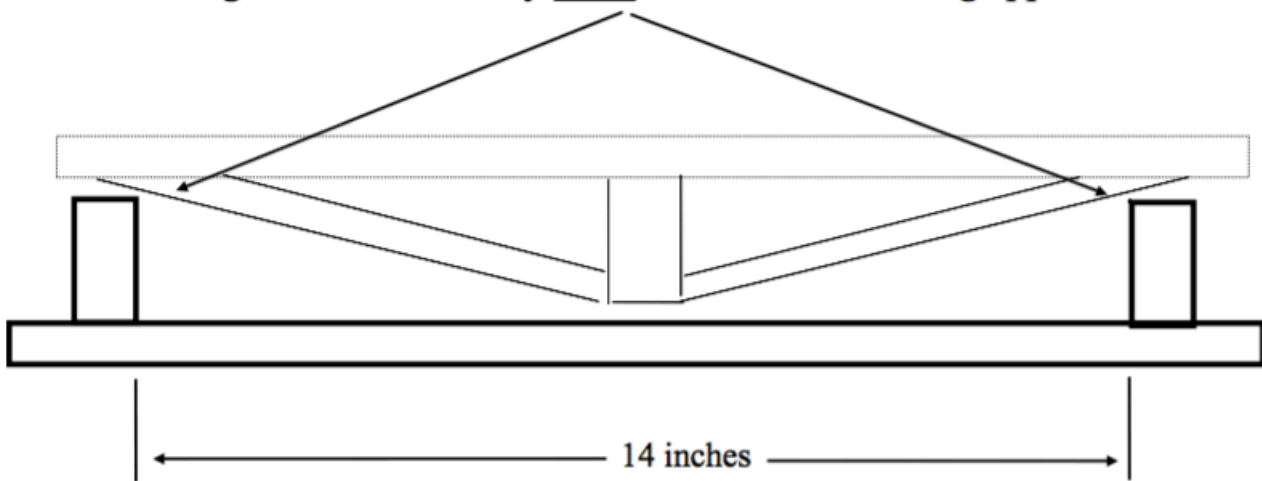
ATTACHMENTS/APPENDIX:

- Testing Setup & Apparatus
- I-beam & T-Section Samples
- Specification Checklist

TESTING SETUP & APPARATUS



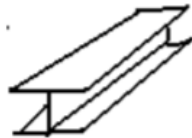
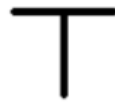
Bridge **MUST** rest on tester support blocks;
Bridge substructure may **NOT** interfere with testing apparatus



I-Beam & T-Section Samples

I-beam

T-section

**Specification Checklist**

**Note: As the name above implies, this list is intended simply as a guide for meeting the required competition specs. It should not be treated as an official judging document.*

- Bridge is properly labeled with team members names, school, and MESA Center
- Material is solid, natural wood craftsticks (popsicle sticks)
- Glue is water soluble Elmer's-type white glue
- Maximum length ≤ 17 inches (43.2 cm)
- Maximum width ≤ 5 inches (12.7 cm)
- Maximum height above top of roadway ≤ 7 inches (17.78 cm)
- Maximum depth below top of roadway ≤ 3.5 inches (8.89 cm)
- Minimum length ≥ 15 inches (38.1 cm)
- Minimum width ≥ 4 inches (10.16 cm)
- Minimum width of roadway ≥ 3.5 inches (8.89 cm)
- Roadway runs entire length of bridge
- Maximum number of members (sticks and/or partial sticks) ≤ 200
- Glue only at the joints
- Each stick glued $\leq 50\%$
- No I-beams
- T-sections on roadway only
- Sticks are not painted or treated
- Bridge open at the top (no roof or covering)
- Bridge has open $3\frac{1}{2}$ inch area for placement of the test plate on roadway
- Bridge has supports suitable for placement on testing fixture
- Bridge substructure does not interfere with testing fixture