

Stick Together

LEVEL:	Grades 6-7
TYPE OF CONTEST:	Team
COMPOSITION OF TEAMS:	1-2 students per team
NUMBER OF TEAMS:	3 teams per Center (Strength to weight winners only advance)
SPONSOR:	Larry Lim, USC
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

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 (11.4 cm)
 - Width = ¾ inches (0.95 cm)
 - Thickness = 1/16 inches (0.2 cm)
- 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.

Rules for Bridge Size:

- | | |
|------------------------------|---------------------|
| 1. Maximum horizontal length | 17 inches (43.2 cm) |
| 2. Maximum width | 5 inches (12.7 cm) |

3. Maximum height above top of roadway	7 inches (15.78 cm)
4. Maximum depth below top of roadway	3.5 inches (8.89 cm)
5. Minimum horizontal length	15 inches (38.1 cm)
6. Minimum width at every point	4 inches (10.16 cm)
7. Minimum width of open roadway (running entire length of bridge)	3.5 inches (8.89 cm)

RULES FOR CONSTRUCTION:

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 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 be open at the top to allow insertion of testing apparatus.
7. 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.
8. The bridge may not have a roof, covering or any other object that will interfere with the 3 ½ x 3 ½ inch test plate that is placed directly on roadway at midspan to apply the force for load bearing capacity.
9. I-Beams are illegal.
10. T-Sections and longitudinal lamination may be used on the roadway only.
11. The bridge must rest on the tester support blocks in a stable manner, i.e. bridge substructure may NOT interfere with testing apparatus.

SPECIFICATION CHECK:

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.

JUDGING:

1. The bridges are judged for neatness, craftsmanship, and creativity by a team selected by the Host Center prior to testing.
2. The bridge will be supported by two wide blocks (each >1 inch) 14 inches apart (see attachment #1).
3. A 3 ½ x 3 ½ inch test plate is lowered onto the bridge at midspan so that it rests on the roadway.
4. 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.
5. Individuals' bridges are not limited in the number of categories they may win.
6. Disqualified bridges are not eligible for awards in any category; however, they may be tested, time permitting.

AWARDS:

Awards are given in each of the following two categories: *

1. 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 = $1997.8 * [(220 \text{ pounds} \times 454 \text{ g/pound})/50\text{g}]$

2. Creativity: Finest workmanship, including neatness and innovation of design.

*Although awards will be presented in two categories, bridges qualifying for MESA Regional finals will be determined by strength to Weight Ratio only.

Safety: Appropriate safety measures will be used in testing.

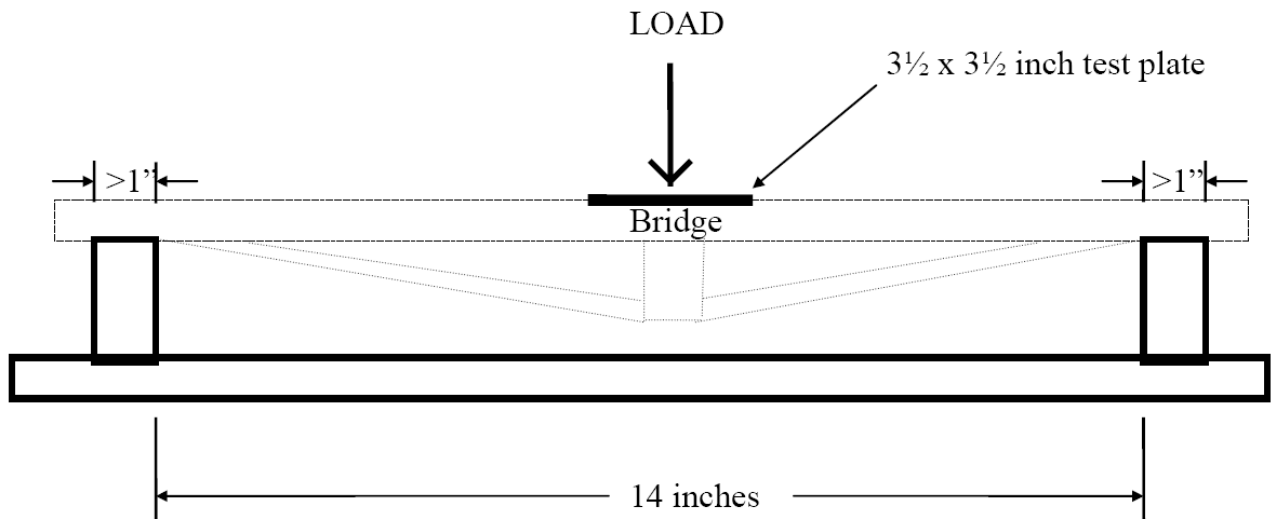
Attachments:

1. Testing set-up and Apparatus
2. Stick Together Bridge Specification Checklist

*subtract 10% if structure is improperly labeled:
 e.g. $1997.8 - (1997.8 \times 0.10) = 1997.8 - 199.78 = 1798.2$

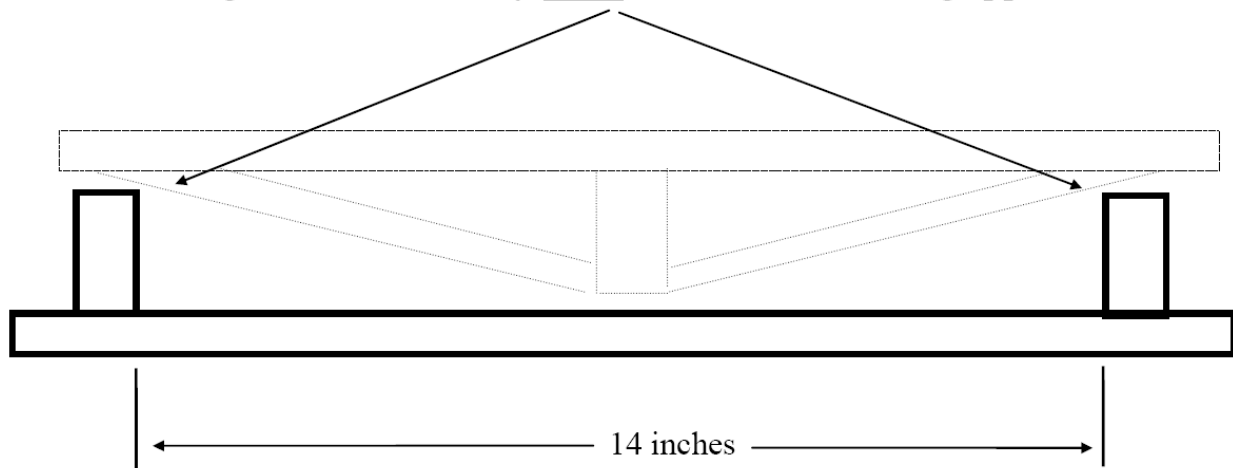
STICK TOGETHER

ATTACHMENT #1: TESTING SET-UP and APPARATUS



STICK TOGETHER

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



Stick Together Specification Checklist

This checklist is provided for you to “pre-inspect” your bridge to ensure that it meets the rules specification. Please check-off each item after you have compared your bridge’s dimensions with the rules.

- 2008-2009 rules used
- Bridge is properly labeled with team members names, school, and MESA Center
- Material is solid, natural wood craftsticks (popsicle sticks)
- Glue is water soluble Elmers white glue
- Maximum length ≤ 17 inches (43.2 cm)
- Maximum width ≤ 5 inches (12.7 cm)
- Maximum height above top of roadway ≤ 7 inches (15.78 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 ½ 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

MESA DAY CONTEST RULES 2009– 2009

Master Set

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