



# 3rd Annual Battle of the Bridges Saturday, February 13th, 2010



- Objective:** To build a model bridge onsite given a box of materials provided at the workshop within a time limit of 3 hours that is capable of supporting the greatest load per unit of mass.
- Who:** The contest is open to any student, grade or age. A team may consist two, three or four people. Teams will be categorized accordingly. All members of the team must sign up on the registration form. Registration is limited to the first 120 participants or 30 teams.
- |                            |                           |
|----------------------------|---------------------------|
| Dare Devils (Grades 1-3)   | Elementary (Grades 4-6)   |
| Middle School (Grades 7-8) | High School (Grades 9-12) |
| College                    | Family                    |
- Where:** Putnam Museum & IMAX Theatre  
1717 West 12<sup>th</sup> Street  
Davenport, IA 52804  
General Information: (563) 324-1933 or [www.putnam.org](http://www.putnam.org)
- When:** Saturday, February 13, 2010
- |                               |                                   |
|-------------------------------|-----------------------------------|
| Check-in: 11:15 am - 11:50 am | Introduction: 11:50 am - 12:00 pm |
| Bridge Building: 12 pm - 3 pm | Bridge Testing: 3pm - 5 pm        |
| Awards: 5 pm - 5:20 pm        |                                   |
- Cost:** \$10 per team. The cost includes a bridge kit provided to you at the workshop and a Certificate of Participation. The cost does not include entrance to the museum and/or theatre.
- Registration:** Registration deadline is Wednesday, February 10th, 2010. Registration is limited to the first 120 participants or 30 teams based on receipt of registration form and \$10 entry fee. If room is still available, walk-in registrations will be accepted..
- Register by phone: (563) 324-1933 ext. 242.
- Register by mail: Send registration form & check/money to the address listed below. Checks payable to "Putnam Museum & IMAX Theatre".
- Putnam Museum & IMAX Theatre  
Attn: Battle of the Bridges  
1717 West 12th St.  
Davenport, IA 52804
- Awards:** Awards are based on bridges with the highest structural efficiency ( $E = \text{maximum load} / \text{model mass}$ ). 1st, 2nd and 3rd place prizes in each category will be awarded along with a grand prize award to the team with the overall highest structural efficiency. In addition, each participant will receive a Certificate of Participation.
- Information:** If you have registration questions, please contact:  
Putnam Museum: Sally Patterson at (563) 324-1933 ext. 205  
All other questions, please contact:  
Bridge Chairman: Scott Bullock at (309) 269-0586 or [scott.a.bullock@us.army.mil](mailto:scott.a.bullock@us.army.mil)

## **BRIDGE CONTEST RULES, TESTING PROCEDURE AND GUIDELINES**

Bridges are designed and built by civil engineers, who are guided in their work by rules consisting of the rules of physics, building codes and a code of ethics. Building codes are based on public health and safety. Fairness is the basis of a code of ethics, which guides engineers to treat their clients and competitors fairly and respectfully. The rules of this competition reflect building codes and engineers' codes of ethics.

### **Contest Rules**

1. Teams will build bridges within a time limit of 3 hours, on site, using a box of materials provided at the workshop. Each team should have as its goal to build a bridge that is capable of supporting the greatest load per unit of mass of bridge material. Each team should perform its own work, both design and construction. The team may ask the contest judges for suggestions.
2. Bridge length: Must span a gap of 20" and not exceed 26".
3. Bridge height: maximum - none; minimum - none.
4. Bridge width: Inside bridge width must be at least 4 inches. Maximum bridge width is 6". The bridge must have floor system across the entire portion of the bridge that spans the 20" gap between supports.
5. Bridge structure may project up to 2" below the top of the supports.
6. A 1/2" hole must be placed in the center of the bridge deck. The hole will accommodate the loading apparatus - an eyebolt connected to a 6" long x 1.5" wide x 3/16" thick steel plate. The steel plate will be placed parallel to the longitudinal axis of the bridge at the time of load application.
7. The rules will be finalized no later than February 10th, 2010 for this competition.

### **Testing Procedure**

1. Bridge models will be loaded at the middle of the span. Care should be taken in the design to reinforce this area as well as the end supports with bracing.
2. The load, supplied and applied by the judges, shall hang from the bridge.
3. The load will be applied downward, from below, by means of a 6" long x 1.5" wide x 3/16" thick steel plate resting on the loading plane of the bridge. Two edges of the loading plate will be parallel to the longitudinal axis of the bridge at the time of load application.
4. The plate will have an eyebolt attached from below at its center. Masses will be supported on a vertical loading rod suspended from the eyebolt. Bridges must be designed to accommodate the loading apparatus.
5. The weight of the model will be recorded prior to testing.
6. The load shall be increased until the bridge fails. The largest achieved load will be recorded for each bridge.
7. The model will be judged based on the highest efficiency rating ( $E = \text{maximum load} / \text{model mass}$ ).
8. Testing will consist of the application of an increasing load until the bridge breaks. The peak load recorded up to this point will be considered the breaking load.
9. In the event of a tie or multiple bridges with the same efficiency rating, the lightest bridge wins. It is up to your team to decide on the optimum balance between mass and strength.
10. All construction and material requirements will be checked prior to testing by the judges. Bridges not meeting specifications will still be tested but will not be eligible for prizes.
11. Judges will be provided by the contest sponsors. All decisions of the judges are final.

**Note:** Each team will be given a bridge kit. Each kit will have a bridge stand measuring 18" long (inside length) and 21" long (outside length) x 5.5" wide (leg support width) and 7" wide (base support width). Questions regarding the bridge stand will be addressed on contest day. The bridge stand is only a guide. All other bridge kit "stuff" will be revealed on contest day. Each team will have the same "stuff" in their respective bridge kit.

## **Bridge Building Guidelines**

1. Prior to the Battle of the Bridges contest, we encourage you to explore on the internet other bridge contest, bridge building tips or at the very least consider some of the guidelines provided below. This will help you generate ideas prior to contest day.
2. Some excellent websites to begin generating ideas, learn more about bridges, bridge building and other bridge contest are listed below:  
<http://www.bridgesite.com/funand.htm>  
<http://bridgecontest.usma.edu/>
3. For additional bridge ideas look around at real bridges. Remember that for a real bridge, the important part is not the deck that the cars drive on, but the steel or concrete structure that supports the deck.
4. Your bridge needs to have a solid, stiff shape in all 3 dimensions. Engineers call this “maximizing the moment of inertia” of your structure. For example, take a Popsicle stick on its flat side and have it overhang from the edge of a table. Then, apply a bit of force with your fingers at the loose end and notice the deflection of the stick. Now, try the same thing; but, this time place the stick on its edge and try to bend the stick now. Notice how the stick is much stiffer and stronger when on its edge?
5. A bunch of sticks glued together flat, like a raft, has very little strength and will sag during testing under very little load.
6. The strongest structural shape is the triangle. A bridge which is made of a series of triangles will be very strong.
7. A bridge that is symmetrical is less likely to twist when loaded and hence will probably carry more load.
8. Bridges which are built too tall will have a high moment of inertia (which increases stiffness and strength – a good thing); however, they may become unstable under a load (a bad thing). This may cause your bridge to twist or topple to one side and...well, you can guess.

Be creative and have fun!! ! We look forward to seeing you build your amazing bridges!

The Quad City Engineering and Science Council would like to thank the following sponsors:

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