

NEBRASKA MODEL BRIDGE CONTEST

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SPONSORS

THE ENGINEERS CLUB
OF GRAND ISLAND

BUREAU OF RECLAMATION

NEBRASKA SOCIETY OF
PROFESSIONAL ENGINEERS

MID-STATE CHAPTER, NE. S.P.E.

January 2, 2010

Dear Principal:

In order to interest Nebraska high school youth in engineering and related technical professions, the Engineers Club of Grand Island, the Nebraska Society of Professional Engineers (NeSPE), the Midstate Chapter of NeSPE, and the Nebraska-Kansas Area Office of the Bureau of Reclamation, sponsor the Nebraska Model Bridge Contest.

The 31st Annual Nebraska Model Bridge Contest will be held in the **Edgerton Explorit Center in Aurora, Nebraska on Saturday, February 20, 2010**. A maximum of three bridges are allowed to be entered from a high school. Every high school in the state is invited to participate. The model bridges are made as a school project and are of 3/32 inch square basswood which is available at many hobby stores. The students' bridges are tested by the judging committee to determine the structural efficiency, which is the maximum load the bridge, up to 50 kg (~110 lbs), will carry divided by the weight of the bridge. Prizes are awarded to the students entering the winning bridges and to the schools that have the best combined score of the three bridges. Last year \$1564 worth of certificates, trophies, and cash prizes were awarded. Also the University of Nebraska College of Engineering and Technology awarded a \$500.00 scholarship to the first place winner. Similar prizes will be awarded this year. **Additionally, this year we are again offering Special Awards to the first 20 schools that register and participate in the Contest. A Special Award of \$6.00 per bridge that is registered and entered will be given with a maximum of three bridges per school (\$18.00). The purpose of this award is to help defray the cost of the wood used to make the model bridges.**

The top two contestants of our Contest are eligible to enter the International Contest, which in 2010 will be held in Philadelphia, Pennsylvania, on April 24. Additional information about the 2010 International Bridge Contest can be obtained from their web page at:

<http://www.iit.edu/~hsbridge/>

Please inform the appropriate teachers in your high school of this contest. A copy of this year's Nebraska Model Bridge Contest specifications is enclosed. **Please give this copy to the teacher in your school who would be the sponsor and, if entering, have the teacher complete and return the included registration slip or respond by e-mail to Roger Andrews at rajandws@kdsi.net by February 10, 2010.** If you have any questions or need any assistance please contact me.

Sincerely,

Roger G. Andrews, P.E. Emeritus
General Chairman

Enclosure

SUPPORTING SPONSORS

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T-L IRRIGATION CO. - W DESIGN ASSOCIATES

**31st ANNUAL
NEBRASKA MODEL BRIDGE CONTEST
SPECIFICATIONS**

*The object of this contest is to see who can design, construct, and test the **most efficient** bridge within the following specifications.*

Model bridges are intended to be simplified versions of real world bridges, which are designed to accept a load in any position and permit the load to travel across the entire bridge. In order to allow the contest to proceed in a reasonable amount of time only one loading position is actually tested.

1. **CAUTION.** Students and Teachers are cautioned to carefully read this year's specifications. There are again some **MAJOR** changes from previous years so closely read the specifications.
2. **DATE AND LOCATION OF CONTEST.** **The Contest will be held at the Edgerton Explorit Center in Aurora, Nebraska on Saturday, February 20, 2010. Note: Because National Engineers Week is February 14-20 this year our Contest will be on the next to last Saturday in February, which is the 20th.** Registration is from 8:30 a.m. until 10:15 a.m. and with the Contest starting at 10:30.
3. **PRE-REGISTRATION.** Registrations will be taken until the close of registration just prior to the start of the Contest but to facilitate the conduct of the Contest it is requested that schools pre-register. The Pre-Registration slip and instructions are included in a later section of these specifications.
4. **SPECIAL AWARDS.** **There will be special Awards to schools that Register and Participate in this year's Contest.** A Special Award of \$6.00 per bridge that is registered and participates in the Contest with a maximum of 3 bridges per school (\$18.00) will be awarded to **the first 20 schools that Register and Participate in the Contest. The purpose of this award is to help defray the cost of the wood used to make the model bridges.**
5. **ELIGIBILITY FOR CONTEST.** Any high school student may enter a model bridge. Not more than three models may be entered from each school. Those schools with three entries will have the best chance to win the school category. Only one bridge per student will be allowed for competition. More than one name may be entered on a bridge but one student should be named the Team Captain.
6. **REQUIREMENT OF TEACHER.** A teacher in each school shall support the contest by:
 - a. Registering the school – Return pre-registration slip or respond by e-mail to Roger Andrews at rajandws@kdsi.net by Wednesday, February 10, 2010.
 - b. Encouraging students to construct model bridges.
 - c. Assisting them to comply with the size limits. All construction requirements, weight, and dimensions will be checked prior to testing.
 - d. Holding school competition to determine best entries.
 - e. Entering the three most efficient models for the contest.
7. **MATERIALS OF CONSTRUCTION.** **The models shall be constructed entirely of 3/32-inch square basswood bonded by any commonly available glue.** Contestant may fabricate his/her own basswood laminates. Thread or other wrapping of joints is not permitted: neither are spines or dowels made from materials other than basswood. Tension members also shall be constructed of basswood only. All materials must be conveniently available in retail stores.

Note: No other materials other than basswood bonded by glue will be allowed. Materials of construction will be inspected by the judging committee after testing. Bridges found not in conformance with specifications will be disqualified. Do not paint or stain the bridge. Basswood can be bought from Hobby Town, Conestoga Mall, 3404 W. 13th St., Grand Island, NE 68803. Telephone number (308) 382-3451; Fax: (308) 382-6933.
8. **CONSTRUCTION (See Figure 1).**

- a. The bridge mass shall be no greater than 30.00 grams.
 - b. The bridge (see **Figure 1**) must span a gap (**S**) of 300. mm, be no longer (**L**) than 400. mm, have a width (**W**) between 40. mm and 70. mm, and be no taller (**H**) than 180. mm above the support surface, and have a width (**W**) between 40. mm and 70. mm. It must have a horizontal loading plane that is a maximum height (**P**) of 80. mm above the support surface. The bridge structure may not project below the support surface.
 - c. The bridge must be constructed to provide horizontal support for the loading plate and rod (**from both the top and bottom**) at each of the three possible loading positions. These three positions, at mid-span of the bridge and 60. mm to either side of the center, will be clearly and consecutively labeled “**1,2,3**” from either end of the bridge by the participant before submission to the judges (see 9 b). The horizontal loading plane must be a minimum length (**R**) of 160. mm and centered on the mid-span of the bridge. The bridge structure must allow the loading rod (see 9a) to be **mounted from both below and from above**.
 - d. The bridge must have a minimum clearance (**C**) of 60. mm in height above the support surface. This clearance also extends 80. mm toward either end of the bridge from the center point of the bridge. It coincides with the horizontal loading plane, and lies directly beneath it. No part of the bridge structure may be built around this clearance area, and a 60. mm high by 160. mm wide block must pass cleanly under the bridge.
9. LOADING.
- a. The load will be applied by means of a 40. mm square plate that is 20. mm in thickness. A 9.53 mm (3/8) inch diameter loading rod is attached from above (**and below to simulate the International Contest**) to the center of the plate (see **Figure 2**). The plate will be horizontal, it will not pivot on the loading rod, and the sides of the plate will be parallel to the longitudinal axis of the bridge.
 - b. The three loading positions will be located on the horizontal loading plane. The center loading position (numbered “**2**”) will be located at the center of the bridge. The other two loading positions (numbered “**1**” and “**3**”) will be located 60. mm toward either end of the bridge from the center
 - c. On the day of competition the judges will randomly draw the number of the loading position to be used; it will be the same for all bridges tested
 - d. The bridge must be capable of carrying an initial and significant load. Collapsing to the support surface is considered failure of the bridge. If the bridge has leg(s) which fail, the bridge will have failed regardless of deflection. **During testing a maximum deflection allowed is 15. mm.**
10. TESTING.
- a. On the day of the contest, the judges operating the testing machine will center the bridge on the loading surface. They will have previously located the loading plate and the 3/8 inch bolt to the selected loading position. A mechanical sighting device will mark the bottom of the loading block (or top of the loading plane). This is defined as the “zero” reference (starting point) for measuring bridge deflection. The judges will then begin applying the load by means of the testing machine. The maximum load supported by any bridge will be 50 kg. Any amount over this quantity, will not count in the calculation of the bridge’s efficiency
 - b. Bridge failure is defined as the inability of the bridge to carry additional load, or a **deflection of 15. mm**, whichever occurs first.
 - c. **Competition loading will stop at 50. kg (~ 110 lbs). However, loading will continue until bridge failure.**
 - d. The bridge with the highest structural efficiency, **E**, will be declared the winner.

$$E = \text{Load supported in grams (50,000g maximum)} / \text{Mass of the bridge in grams}$$

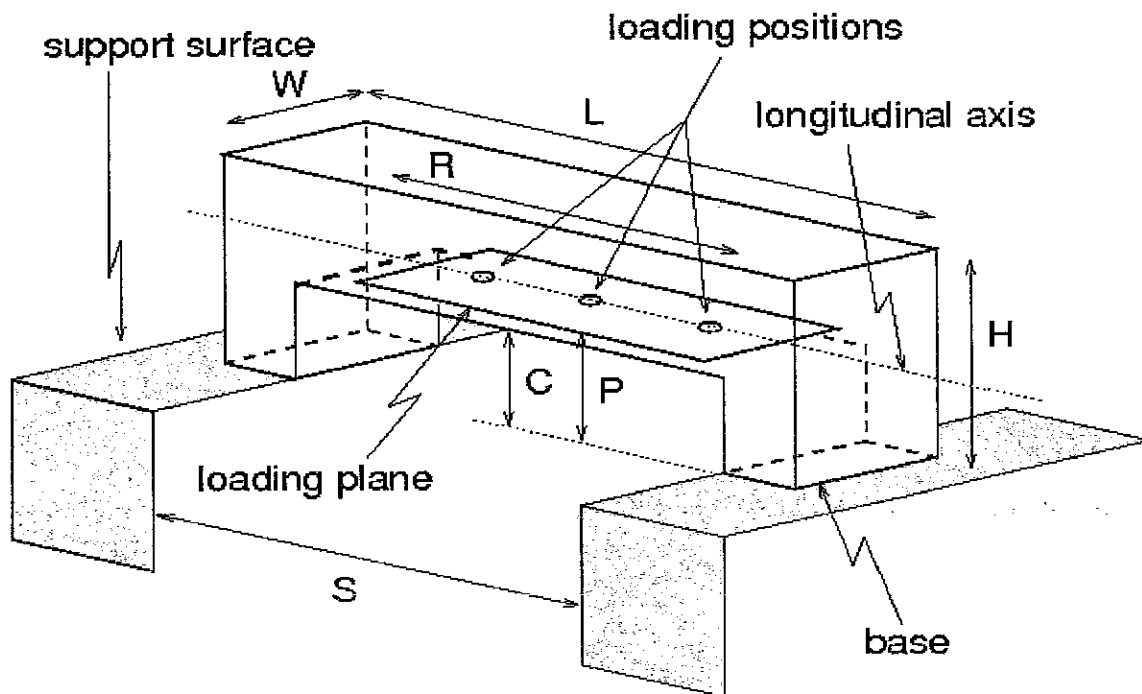


Figure 1. Schematic of Bridge (not to scale)

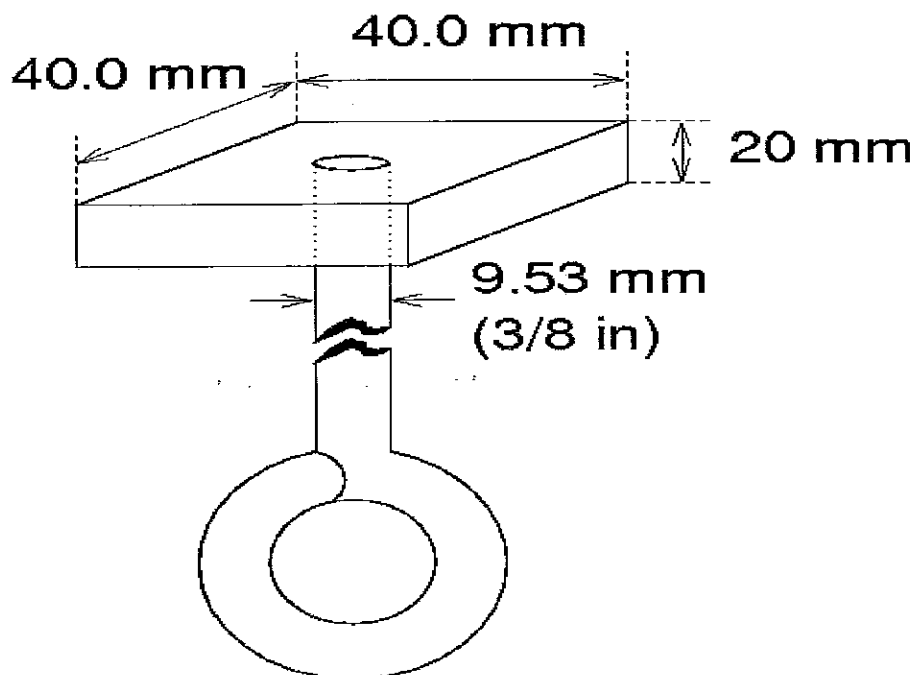


Figure 2. Loading Plate Detail (Note: International contest will load from the bottom but the Nebraska Contest will load from the top. Access for the 3/8 inch rod must be provided from both the top and bottom)

11. BASIS FOR COMPETITION. Contestants will be ranked by a model efficiency number which will be the maximum load applied to the loading plate (up to 50,000g), divided by the weight of the model. Winners will be those with the highest efficiency numbers from a single test to bridge failure. All data from the test equipment will be tabulated and summarized. Contestants may be disqualified for improper conduct on their or their parents' or teachers' part.
12. QUALIFICATION.
 - a. All construction and material requirements will be checked prior to and after testing. Bridges failing to meet these requirements at the conclusion of time allowed for checking will be disqualified. Bridges disqualified prior to the start of the contest may be tested as exhibition bridges at the discretion of the builder and contest directors.
 - b. If, during testing, a condition becomes apparent (i.e. use of ineligible materials, inability to support the loading plate, bridge optimized for a single loading point, etc.) which is a violation of the rules or prevents testing as described above in Section 10, that bridge will be disqualified. If the disqualified bridge can accommodate loading, it may still be tested as an exhibition bridge
 - c. Decisions of the judges are final: these rules may be revised as experience shows the need. **All participants registered by Wednesday, February 10, 2010 will be notified by e-mail of all changes by formal addendum.** Participants will be responsible for all changes.
13. PRIZES. Individual prizes will be awarded to the contestants entering models with the highest model efficiency numbers. A special Judges' Award of Merit will be given to an individual contestant. The Award of Merit will, in the opinion of the judges, be based on neatness of construction, good craftsmanship, and the general eye-pleasing appearance of the bridge. In addition, a Most Unique Design Award in memory of Bob Reichert, will be given to the individual who the judges determine entered the most unique designed bridge. In addition to the individual prizes an award will be given to the school with the highest sum of the model efficiencies for the maximum of the three bridges that each school is allowed to enter. The top two winners with the highest model efficiency numbers will be entered in the International Contest, which will be held on **Saturday, April 24, 2010, in Philadelphia, Pennsylvania, USA.** Students may participate in the Nebraska Contest in person, by proxy, or by mail entry. As noted in Section 4, a Special Award of \$6.00 per bridge that is registered and participates in the Contest with a maximum of 3 bridges per school (\$18.00) will be awarded to **the first 20 schools that Register and Participate in the Contest.**
14. LOCATION OF CONTEST. The Contest will be held at the **Edgerton Explorit Center** located at 208 16th Street, (Highway 14), Aurora, Nebraska. The Center is located two miles north of I-80, exit 332, on Highway 14, next to the Plainsman Museum. The Contest will be held on Saturday, February 20, 2010 starting at 10:30 a.m. Registration will be from 8:30 to 10:15 a.m.
15. SPONSORS OF CONTEST. The Contest is co-sponsored by the Engineers Club of Grand Island, the Nebraska-Kansas Area Office of the Bureau of Reclamation, the Midstate Chapter of the Nebraska Society of Professional Engineers, and the Nebraska Society of Professional Engineers. Mid-State Engineering and Testing, Kearney and Columbus and Geotechnical Services, Inc., Grand Island and Lincoln, Nebraska, are providing the testing equipment.
16. RESPONSE GUIDE.
 - a. Complete and return the registration slip or respond by e-mail to Roger Andrews at rajandws@kdsi.net by February 10, 2010, thereby registering your school as a participant. Entries will be accepted up to and including the morning of the Contest but only the first 20 schools that register **and participate** in the contest will be eligible for the Special Award of \$6 per bridge, maximum of \$18 per school.
 - b. Inform students of the Contest specifications.
 - Materials and dimensions.
 - Calculation of Efficiency Number.

- c. Have students start building models.
- d. Hold contest at your school by:
 - Weighing model.
 - Loading models to maximum.
 - Calculating efficiency number.
 - Selecting the three models with the highest efficiency number.
 - Rebuild bridge models for the Contest on February 20, 2010.
- e. Bring the models to the Contest on February 20, 2010, or mail not more than three models to **arrive no later than Thursday, February 18**, to assure the models arrive in time for the Contest.

Mailing address:

Nebraska Model Bridge Contest
 2524 W. John Street
 Grand Island, NE 68803-5821

Note: If you mail your entries we recommend that they be in the mail by February 12. However, it is highly recommended students and teachers attend Contest if possible.

- f. Apply a tag to each model showing:
 - Student's name and School name.
- g. Model judging and testing will begin at 10:30 a.m. on Saturday, February 20, 2010, at the Edgerton Explorit Center, 208 16th Street, Aurora, Nebraska. Awards will be presented after completion of the testing. Only entered models will be tested during the Contest. A few unentered models may be tested at the completion of official testing, if time permits. Hand-carried models will be accepted between the hours of 8:30 a.m. and 10:15 a.m., the day of the Contest.

Note: Please complete and return the registration slip or register by e-mail by February 10, 2010, if you plan to enter the Contest. Mail or e-mail to:

Nebraska Model Bridge Contest
 2524 W. John Street
 Grand Island, NE 68803-5821
 e-mail: rajandws@kdsi.net; Telephone: (308) 384-5771

ADDITIONAL INFORMATION about the International Bridge Building Contest can be obtained from their Web Page at <http://www.iit.edu/~hsbridge/>.

PRE-REGISTRATION SLIP

Yes, we would like to enter the 31st Annual Nebraska Model Bridge Contest

Name of School: _____

Teachers name: _____

e-mail address: _____

Student(s) Names(s): 1) _____

2) _____

3) _____