

**TRAC**  
**2010 – 2011**  
**Floating Bridge Competition Rules**  
**Grades 9 and 10 *Revised 11/22/2010 (page 6)***

**The TRANSPORTATION and Civil Engineering (TRAC) Program**

**THE PURPOSE OF TRAC:** The TRAC program is a new and inventive way of introducing students to the wide variety of career opportunities available in the field of engineering. The program teaches students how to apply math and science concepts to common engineering problems occurring within transportation systems. The TRAC program is designed to allow students to identify and evaluate the social and environmental impacts associated with the development of new transportation systems within their communities.

**COMPETITION FOR 9th AND 10th GRADES**

The Michigan Design and Build Bridge Challenge competition is designed to be an extended activity created from the TRAC PAC 2 Bridge Builder module. This event is designed to allow students the opportunity to write a proposal, develop and construct a bridge, test a bridge, learn to use Power Draft CAD Software by Bentley Systems, Inc. and create and present a PowerPoint presentation. Teams consisting of three students will be competing against other 9th and 10<sup>th</sup> grade TRAC student teams from throughout Michigan.

**Who Can Enter:**

- Only schools or organizations involved in the Michigan TRAC program can enter the competition.
- Students must be in 9th and/or 10th grades.
- Teams must be composed of three members – no less, no more. Team member changes will be allowed up until March 1, 2011. Team member changes after March 1, 2011 will be considered on an individual basis. Each student can be a member of only one team.

**Challenge Outline:**

Interested teams must fill out a Michigan Design and Build Bridge Challenge Registration Form. Registration Forms can be found at: [www.michigan.gov/mdot-trac](http://www.michigan.gov/mdot-trac) and must be postmarked on or before Nov. 24, 2010.

The Michigan Department of Transportation (MDOT) will send each team an information packet and bridge challenge kit within 14 days upon receipt of the completed registration form. Only materials included in the kit can be used in the construction of the bridge. Additional supplies will not be provided for the use in the building of test bridges. The kit will include the following items:

- Popsicle Sticks
- Lego Gears
- Balsa Wood
- Glue
- Glue De-bonder
- String
- Styrofoam blocks
- Straws
- Test tubes with tops
- Dowel Rods
- CD containing Power Draft CAD Software by Bentley Systems, Inc.

The Bentley Power Draft program will not run on a Mac computer. Each team must make arrangements to obtain a computer that will run the Bentley Power Draft Software.

- MDOT-created, Bentley Systems Software Power Draft Instructional DVD (approximately one hour in length). The print instructions contained on the MDOT instructional CD must be followed to ensure proper formatting in creating a print-out of the CAD drawing.
- Informational packet

Each team is required to submit one copy of their COMPLETE proposal to the MDOT TRAC Program Manager. Electronic copies will not be accepted. Do not send the bridge itself. The proposals must be postmarked on or before Feb. 4, 2011. All entries become the property of MDOT and will not be returned.

Proposals will be reviewed for completeness by the MDOT Bridge Challenge Committee. The proposal **MUST** include **ALL** of the items listed in the “Proposal Requirements” section of this document. Teams will be notified of the status of their proposals (complete or incomplete) by Feb. 11, 2011.

Teams submitting **complete** proposals will be invited to compete in the 3rd Annual Michigan Design and Build Bridge Challenge at the Lansing Center on March 24, 2011. The invitation to compete in the competition includes: mileage (0.362 cents per mile) to and from the competition, overnight accommodations (two rooms per team and advisor) the evening before the event, Bridge Challenge polo shirts (must be worn at the competition), and breakfast and lunch at the Bridge Challenge.

To compete in the Michigan Design and Build Bridge Challenge, each team must have a complete, constructed bridge and a PowerPoint presentation (7 to 10 minutes in length). Any deviations between the bridge design submitted in the proposal and the complete, constructed bridge must be detailed in the PowerPoint presentation. If a team attends the competition and does not have both a complete, constructed bridge and a PowerPoint presentation, or any member is not wearing the Bridge Challenge polo shirt (clearly visible), that team will not be reimbursed for contest expenses.

**Definitions:**

Lamination - is a material that can be constructed by uniting two or more layers of material together. Coating with glue is considered lamination.

Region Coordinator – is a person designated to assist TRAC bridge challenge teams in a specific area of the state. Contact information for your region coordinator can be found on page 11 of this document.

Strength-to-weight ratio – a value which is determined by dividing the maximum load by the weight of the bridge.

**Example Calculation:**

Maximum load = 120.0 pounds

Bridge Weight = 20 grams

Ratio = 2,724.0

$[(120.0 \text{ pounds} \times 454 \text{ grams per pound}) / 20.0 \text{ grams}]$

\*Note: A list of frequently asked questions can be found at: [www.michigan.gov/mdot-trac](http://www.michigan.gov/mdot-trac).

**PREPARING FOR THE COMPETITION**

Form a team of three interested students including a team captain. Discuss the challenge and design specifications. Teams are limited to three students, no more, no less. Each student can be a member of only one team. Each team must have at least one teacher or other adult to help and advise the team. An adult may be an advisor to more than one team.

Study the rules. This document provides important information and should be reviewed in its entirety. Failure to adhere to the rules could lead to penalties or disqualification. If any information is not clear please call your region coordinator for clarification. Contact information for your region coordinator can be found on page 12 of this document.

Plan the timing of the project. Ensure that each team member knows the date for submission of the written proposal and recognizes that all major development work should be finished prior to the proposal submission.

Note to adults: MDOT would like to stress that the work on all phases of the project is to be done by the students. Guidance should be in the form of asking questions to promote creative thinking by the students to identify the scientific and engineering principles involved. Encourage students to consult library books and other resources to help with the project. Encourage students to test and improve their design. Adult assistance is to be limited to:

- Mentoring
- Basic guidance
- Teaching engineering, mathematical and scientific principles applicable to the project
- Guiding students in research
- Overseeing the stages of the project

### **THE MICHIGAN DESIGN AND BUILD BRIDGE CHALLENGE**

The goal of the competition is to develop a bridge that is capable of holding a 3-pound weight while floating. The weights used in the competition have the following dimensions:

Half-pound steel weights:	4 7/8" long x 1 1/2" wide x 1/4" thick
One pound steel weights:	9 3/4" long x 1 1/2" wide x 1/4" thick

The weights will be applied in any combination necessary to reach the goal of three pounds.

The roadway deck of the floating bridge must remain above the surface of the water while the 3-pound weight is applied to the bridge.

The bridge will be weighed, tested for buoyancy, and then tested for strength using the Pitsco di2000 tester. The floating portion of the bridge may be designed in a manner that it may be removed when the bridge is placed on the Pitsco di2000 tester.

Each team is to design and construct a bridge made only with the materials provided in the TRAC Design and Build Bridge Challenge Entry Kit.

During the contest, teams will be judged on their PowerPoint presentation, measurement specifications, and strength-to-weight ratio values. Fifty percent of a team's overall score will be based on the points earned on the PowerPoint presentation. The remaining 50 percent of the teams overall score will consist of the points earned during the testing of the bridge, verification of compliance with specification requirements, and the strength-to-weight ratio of the bridge.

**Specifications:**

The bridge must meet the specifications listed below or penalties, up to disqualification, will be applied for each requirement that is not met.

- The bridge must fit on the Pitsco di2000 Tester or the bridge will be disqualified.
- The testing block must fit onto the bridge without obstructions or the bridge will be disqualified.
- All team members must wear the Bridge Challenge polo shirt (clearly visible) or that team’s bridge will be disqualified.
- The materials provided inside the kit are the ONLY materials to be used to build the bridge. Additional supplies will not be provided for the use in the building of test bridges.
- Items in kits can not be interchanged with any other teams.
- The balsa wood used to construct each bridge must be only one layer thick. At the joints, more than one layer may be required. Joints may not exceed 1/2 inch in thickness. A multi-layered joint may not exceed 1/2 inch in length.



Not Acceptable



Acceptable



Not Acceptable



Acceptable

- Lamination is not permitted.
- A “car” that is 2-inches-wide and 1-inch-tall must be able to fit across the bridge. It is not necessary that the “car” rest or sit on any portion of the bridge (bridge decking is not required).
- The total length of the bridge must be 15 inches.

- The center of the bridge must have a minimum of a 5/8-inch diameter opening to make it possible for the rod of the Pitsco di2000 Tester to fit. The rod of the Pitsco di2000 Tester extends up to 10 inches beyond the top of the bridge deck.
- The vertical supports of the Pitsco di2000 Tester will be placed 14 inches apart on center. The tester will not be moved to accommodate bridges that do not fit the 14 inch measurement.
- No part of the bridge can touch the Pitsco di2000 tester other than at the testing block or where the bridge sits on the testing pads.
- ~~The floating span must be a minimum of 12 inches and a maximum of 15 inches.~~
- The floating bridge must support a 3-pound weight. The weight will be placed on the roadway deck.

A diagram of the Pitsco di2000 tester can be found on the following page. Additional information on the Pitsco di2000 Tester can be found at: [www.pitsco.com](http://www.pitsco.com).



## **PROPOSAL REQUIREMENTS**

### **Format Requirements:**

- I.** Typed
- II.** Double-spaced
- III.** 12-point font (Arial or Times New Roman)
- IV.** All pages on 8.5 by 11-inch paper
- V.** Information must be in the same order as shown below
- VI.** All pages numbered

### **Proposal Components:**

- I.** Title Page. Include name of challenge, team name and logo, name of school or organization, name of team captain and team members, and name of teacher or advisor.
- II.** Table of Contents.
- III.** Summary. Clearly and concisely stated (No more than two pages).
- IV.** Introduction.
  - a.** Indicate the team name.
  - b.** Describe the background and specific skills of each team member.
  - c.** Describe how each team member helped to make the project a success.
  - d.** Describe what special skills were learned or demonstrated.
  - e.** Provide information about your school.
  - f.** Provide information about your community.
- V.** Body. The main part of the report. The body may be divided into several sections (such as development, design, construction, etc.). At a minimum, the body should include:
  - g.** Explain the reasons behind the design of your bridge.
  - h.** Explain the scientific principles supporting the design of your bridge.
  - i.** Include data tables and graphic representation of tests.
  - j.** Include supporting calculations.
  - k.** Include 8.5 x 11-inch scaled drawing of the bridge using Power Draft CAD software by Bentley Systems, Inc. Do not crop or use the print screen option when printing the drawing. The print instructions contained on the MDOT instructional CD must be followed to ensure proper formatting in creating the print-out of the CAD drawing. Drawings must be created by Power Draft software to be accepted. Please do not submit additional drawings created using software packages other than Power Draft.

- l.** Explain how you tested your design, and the improvements you made as a result of the testing.
- m.** Describe the problems you encountered in designing and building your bridge and how you solved these problems.
- n.** Describe any personal safety considerations that were given and/or used when you built your bridge.
- o.** List and describe any special tools or machines that were used to design and/or build your bridge.

**VI.** Conclusions and Recommendations.

- p.** How successful is your project?
- q.** What did you learn by taking part in the bridge challenge?
- r.** Describe any recommendations you have to improve your bridge or the bridge challenge competition.

**VII.** Scheduling and Accomplishments.

- s.** Show a timeline, or similar method, showing how you scheduled tasks necessary to complete the project.
- t.** Describe how you managed the schedule.
- u.** Include records of meetings and meeting minutes (include comments from each team member).
- v.** Describe how you managed the meetings.

**VIII.** Acknowledgements.

- w.** List the names of the adults who advised you in the project.
- x.** Provide a brief description of what the adults did to assist in the project.
- y.** Include a certification, signed by all student team members and adults assisting stating that: “We hereby certify that the majority of the ideas, design, and work was originated and performed by the students, with limited assistance by adults, as described above.”

**IX.** Bibliography.

- z.** List all references used, including internet, books and magazines.

**X.** Appendices.

- aa.** Working Drawings. Include working drawings not contained in the design section.
- bb.** Additional Supporting Information.

## **JUDGING**

Judges: Executive-level civil engineers will be judging the challenge.

Awards: Teams invited to the Michigan Statewide Design and Build Bridge Challenge will be competing for the following prizes:

First-place Team:	\$600
Second-place Team:	\$375
Third-place Team:	\$225
Fourth-place Team	\$150

## **SCHEDULE**

- Registration forms must be postmarked on or before Nov. 24, 2010.
- Kits will be shipped within 14 day upon receipt of the completed registration form.
- Proposals must be postmarked on or before Feb. 4, 2011 (do not include the bridge).
- Notification of complete proposals by Feb. 11, 2011.
- Teams invited to compete in the challenge will receive polo shirts that **MUST** be worn during the competition. Teams will be disqualified for not wearing their shirts. The shirts will be distributed at the registration desk on March 23 and 24, 2011.
- Design and Build Bridge Challenge, March 24, 2011, at the Lansing Center in Lansing. The teams will be staying overnight at the Radisson Hotel in Lansing on March 23, 2011.

Any questions, please contact:

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**Michigan Bridge Challenge  
Oral PowerPoint Presentation Scoring Rubric**

<b>CATEGORY</b>	<b>25</b>	<b>20</b>	<b>15</b>	<b>5</b>
<b>Content</b>	Covers topic in-depth with details and examples. Subject knowledge is excellent.	Includes essential knowledge about the topic. Subject knowledge appears to be good.	Includes essential information about the topic but there are one to two factual errors.	-
<b>Appearance</b>	Content is well organized using headings or bulleted lists to group related material. Makes excellent use of font, color, graphics, effects, etc. to enhance the presentation. No misspellings or grammatical errors.	Uses headings or bulleted lists to organize, but the overall organization of topics appears flawed. Uses font, color, graphics, effects, etc. to enhance the presentation. Three or fewer misspellings and/or mechanical errors.	No clear or logical organizational structure, just a lot of facts. Use of font, color, graphics, effects, etc. but these often distract from the presentation content. Four misspellings and/or grammatical errors.	-
<b>Oral Presentation</b>	Interesting, well-rehearsed with smooth delivery that holds audience attention.	Relatively interesting, rehearsed with a fairly smooth delivery that usually holds audience attention.	Delivery not smooth, but able to hold audience attention most of the time.	-
<b>Timeliness</b>	Seven to 10 minutes.	Up to one minute under/over.	Up to two minutes under/over.	Up to three minutes under/over.

NOTE: This is a rubric to help with the preparation of the presentation. Oral presentation will count towards 50 percent of the total team score for the competition. This rubric also will be used by the judges to score the presentations. The remaining 50 percent of the team score will be determined by the outcome of the specification measurements and the strength-to-weight ratio calculations.

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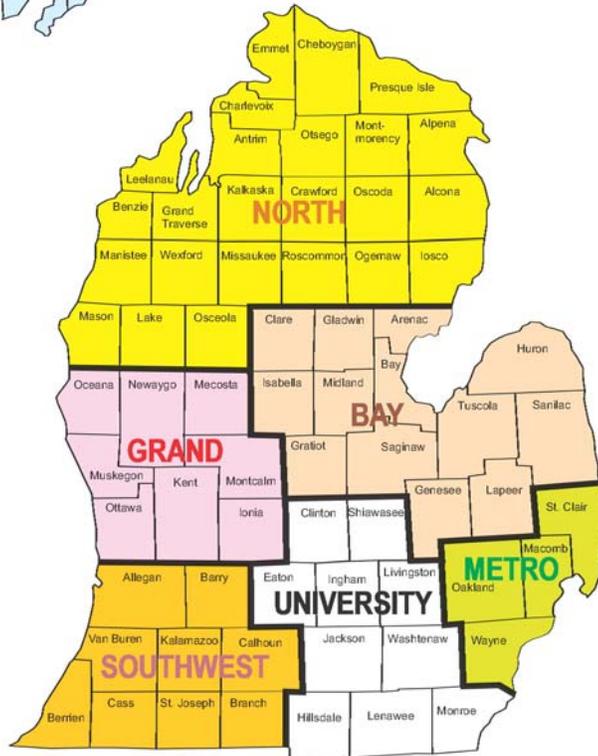
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