

Maryland Engineering Challenges

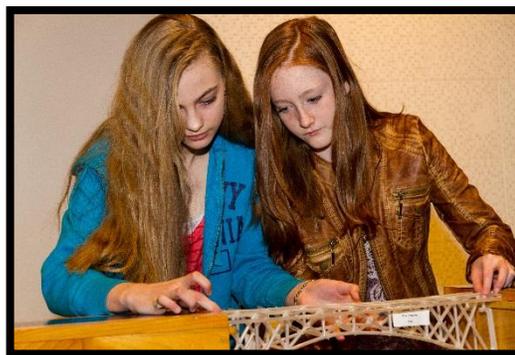
2020 Straw Bridge Challenge

Middle School Level – Grades 6 to 8

Supported By:
American Society of Mechanical Engineers, Baltimore Section

Engineer Contacts:

Kevin Capinpin — capinpin@usa.net
Bob Willbanks — rwillbanks.21221@gmail.com



Important Dates

Coaches' Information Session

⇒ **Wednesday, November 13, 2019** **4:00 p.m. to 7:00 p.m.**

This “drop-in” event is designed for adults interested in coaching a team to stop by and chat with engineers. Find out if a particular Challenge is a good fit for your students. The Information Session is not required and there is no cost. Registration is strongly encouraged. Contact Jessica at jcelmer@thebmi.org

Registration and Written Report Due

⇒ **Friday, January 10, 2020** **Prior to 4:00 p.m.**

In order to be a registered team, each team must have their adult Coach do the following:

- Register online: <https://forms.gle/Sq9ZFXhqLXjC9wj76>
- AND submit the team's Written Report as a HARD COPY to the Baltimore Museum of Industry
- AND pay a \$5 Coach's Fee, details at <https://48278.blackbaudhosting.com/48278/MEC-Coach-Fee>

Straw Bridge Competition

⇒ **Saturday, January 18, 2020** **Doors open at 10:00 a.m., registration at 11:00a.m.**

Full details about the Challenge will be emailed to Coaches after the registration deadline.

Questions about Challenge specifications or judging should be sent to the Engineer Contacts:

Kevin Capinpin — capinpin@usa.net
Bob Willbanks — rwillbanks.21221@gmail.com

Other questions?

Jessica Celmer jcelmer@thebmi.org

THE CHALLENGE

Design and construct a model road bridge made exclusively from paper straws, hotmelt

glue, and plastic tabs. The roadbed of the bridge must be at least 6 but no more than 7 inches wide. Additionally, the bridge must provide a vertical clearance of at least 3.5 inches. The bridge must span a 20-inch wide hazard with the only support being the 0.5 and 1 inch ledges available at 0.75 and 4.75 inches down from the level of the roadbed, as well as the vertical wall above the uppermost ledge and between the ledges. The total depth of the hazard is 9 inches. The bridge should be as light as possible while being able to support a load, represented as a model truck, weighing 6.5 pounds for one minute.

TEAM REQUIREMENTS

Recommended team size is 2 to 4 students. There is no limit to the number of teams a school may have. Teams of one are permitted.

PERFORMANCE DEMONSTRATION GUIDELINES

- Prior to load testing the bridge will be weighed, to within 1/10 of an ounce, on a postal scale.
- The bridge will be placed in the hazard and a challenge-provided cardboard “roadway” installed.
- The bridge will be load tested using an “Eighteen Wheeler” model truck that has been weighted to approximately 6.5 pounds.
- The truck will be towed onto the bridge by means of a string attached to the tractor.
- The truck must, unassisted, remain upright during the towing process.
- When the truck is stopped in the middle of the bridge the timer will be started.
- The truck will be left on the bridge for a period of one minute.
- All bridges successfully completing the one minute load test will receive a performance score based on overall weight, with the lightest bridge receiving the maximum 35 points.

DESIGN & CONSTRUCTION STANDARDS

- The bridge must conform to the specifications in this paper; however, credit and awards are also given for ingenuity and creativity.
- The bridge must hold a 6 inch wide cardboard “roadway” made from light cardboard. Challengers should not assume any strength will be provided to the bridge structure by the cardboard roadway. While instructors are encouraged to build their own hazards and roadbeds for testing, on the day of the competition the judges will provide the hazard and roadway. The roadway must not be attached to the bridge in any way.
- The bridge may have any height above the roadway and/or any descent below the

roadway. The bridge structure may not touch down between the designated support points within the hazard.

- A detailed “Straw Bridge Design Guide,” giving further information and tips, should be downloaded from www.thebmi.org

Allowed materials:

- Drinking Straws: Empress Earth Jumbo Paper Straws, Item # EPS775JWU, 7.75” (available online or from challenge sponsors)
- Hotmelt Glue (low temp recommended)
- Plastic tabs, at the joints only (typically cut from plastic soda bottle or milk jug material)

EVALUATION STANDARDS

All Middle School competitions involve four main components: a written report, an oral report, evaluation of the design and construction of the entry, and the entry’s performance under competition conditions. An outline of what is required for each of these, and guidance on preparing for the competition, is given in the “Middle School Guide to Entry”, which should be read in connection with this document.

The challenge scoring consists of four parts:

Written Report and Drawings	30 Points
<i>The preferred format of the report is typewritten 12 point double spaced format using a standard word processor program, although points are not deducted for a hand written report. An introduction to preparing a professional report, the “Straw Bridge Written Report Guide” may be downloaded from www.thebmi.org for further information</i>	
Oral Presentation	10 Points
Design and Fabrication	25 Points
Performance Demonstration Points	35

CURRICULUM TIES-- Maryland Engineering Challenges and the Next Generation Science Standards

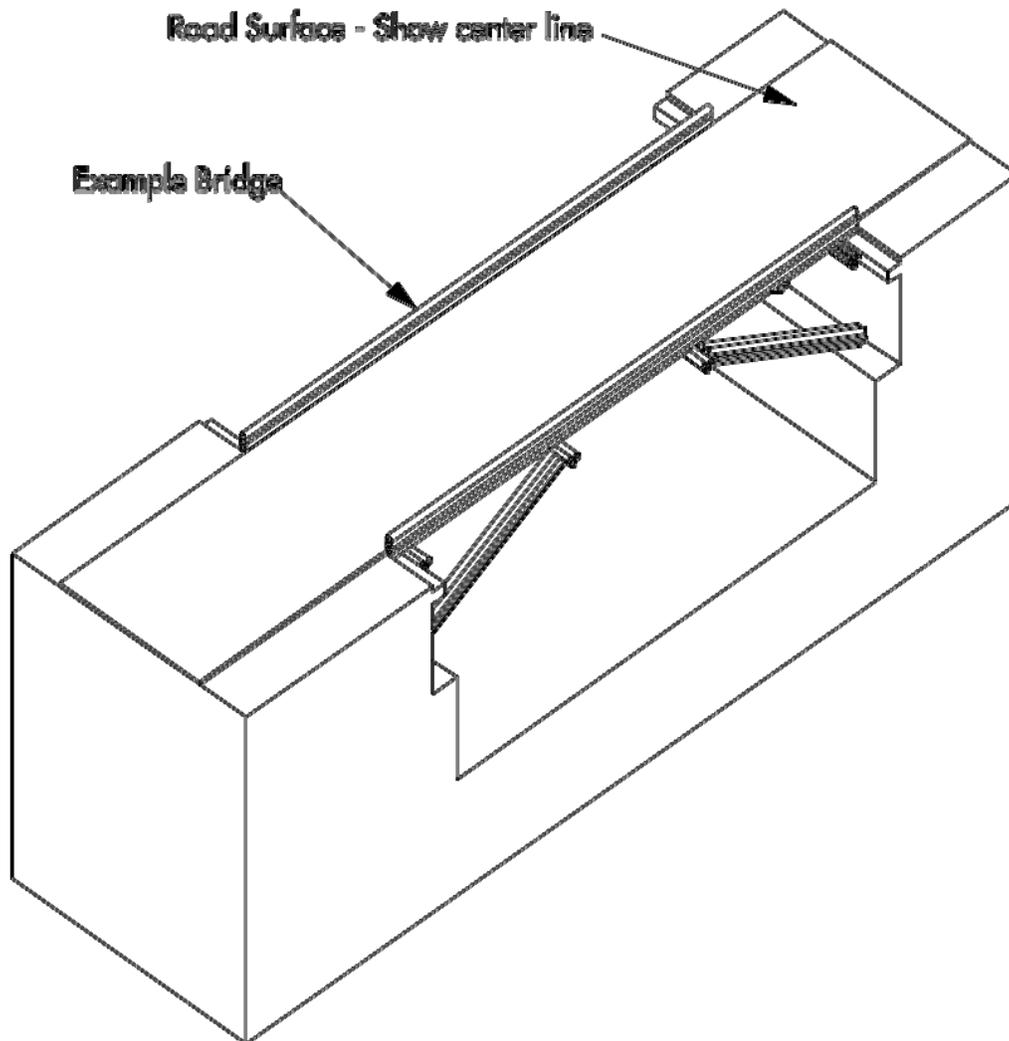
<p>6th-8th Grade - S1.0 Skills and Processes - Topic A. Constructing Knowledge</p> <p>Design, analyze, or carry out simple investigations and formulate appropriate conclusions based on data obtained or provided.</p>	<p>In preparing for the challenge, students will:</p> <ul style="list-style-type: none"> • Develop the ability to clarify questions and direct them toward objects and phenomena that can be described, explained, or predicted by scientific investigations. Objective b • Locate information in reference books, back issues of newspapers, magazines and compact disks, and computer databases. Objective d. • Explain why accurate recordkeeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society. Objective i
<p>6th-8th Grade - S1.0 Skills and Processes - Topic B. Applying Evidence and Reasoning</p> <p>Review data from a simple experiment, summarize the data, and construct a logical argument about the cause-and-effect relationships in the experiment.</p>	<p>In designing their projects, students will:</p> <ul style="list-style-type: none"> • Verify the idea that there is no fixed set of steps all scientists follow. Objective a • Explain that what people expect to observe often affects what they actually do observe. Objective b • Describe the reasoning that lead to the interpretation of data and conclusions drawn. Objective d
<p>6th-8th Grade - S1.0 Skills and Processes - Topic C. Communicating Scientific Information</p> <p>Develop explanations that explicitly link data from investigations conducted, selected readings and, when appropriate, contributions from historical discoveries.</p>	<p>In composing the written and oral reports, students will:</p> <ul style="list-style-type: none"> • Organize and present data in tables and graphs and identify relationships they reveal. Objective a • Explain how different models can be used to represent the same thing. What kind of a model to use and how complex it should be depend on its purpose. Objective e
<p>6th-8th Grade - S1.0 Skills and Processes - Topic D. Technology</p>	<p>In building and testing their projects, students will:</p>

<p>DESIGN CONSTRAINTS: Explain that complex systems require control mechanisms.</p> <p>MAKING MODELS: Analyze the value and the limitations of different types of models in explaining real things and processes.</p>	<ul style="list-style-type: none">• Realize that design usually requires taking constraints into account. Objective c• Identify reasons that systems fail- they have faulty or poorly matched parts, are used in ways that exceed what was intended by the design, or were poorly designed to begin with. Objective d• Explain that the kind of model to use and how complex it should be depends on its purpose and that it is possible to have different models used to represent the same thing. Objective b• Explain that models may sometimes mislead by suggesting characteristics that are not really shared with what is being modeled. Objective c
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GOOD LUCK TO YOUR TEAM!

Reference Drawings Follow

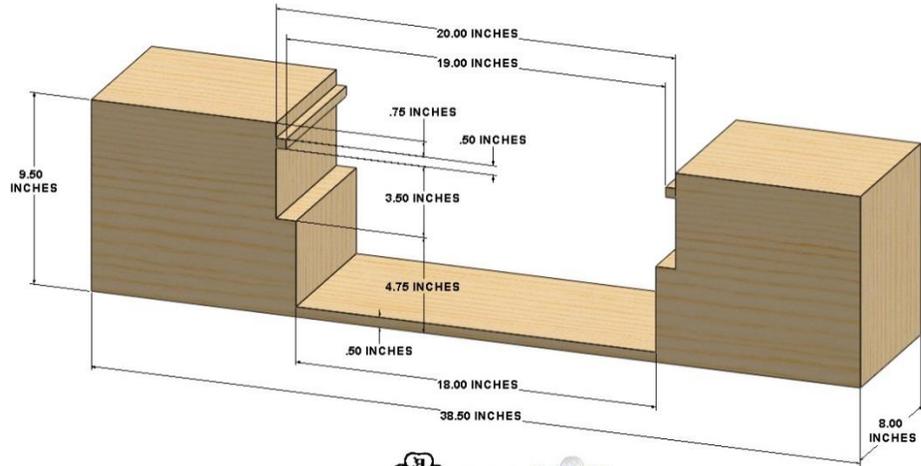
FIGURE 1



Orthogonal Sketch of Simple Bridge
Shown Over Hazard
Road bed must be at least 6" wide

FIGURE 2

Line Drawing showing the pertinent dimensions of the straw bridge hazard. (prepared by Steve Pederson, Contract Engineering Services)



 ASME 
STRAWBRIDGE HAZARD