Maryland Engineering Challenges
2025 Straw Bridge Challenge
Middle School Level – Grades 5 to 8

Supported By:
American Society of Mechanical Engineers, Baltimore Section

Engineer Contacts:
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Important Dates

Registration Due

- **January 24, 2025** **Prior to 4:00 PM**
- In order to be a participating team, each team must have their adult Coach register online at https://bit.ly/2025MECRegistration in advance of the due date

Written Report Due

- **Friday, January 31 , 2025** **Prior to 4:00 p.m.**
- Submit the team's Written Report as a PDF attachment in an email sent challenges@thebmi.org

Straw Bridge Competition and 3 Panel Poster Board Submission

- **Saturday, February 8, 2025** **Doors open at 9:00 AM**
- Competition will be at the Baltimore Museum of Industry, 1415 Key Highway, Baltimore
- Teams should bring their completed bridge and poster board to the competition ready to be tested
- Full details about the Challenge event will be emailed to Coaches after the registration deadline.

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

Kevin Capinpin: capinpin@usa.net
Other questions? Jessica Celmer challenges@thebmi.org

THE CHALLENGE

Design and construct a model road bridge made exclusively from paper straws and hotmelt glue. 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 10 pounds for up to 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 10 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 up to one minute.
- All bridges successfully completing the 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 https://bit.ly/BMIchallenges

Allowed materials:

- Drinking Straws: Empress Earth Jumbo Paper Straws, Item # EPS775JWU, 7.75" (available online or from challenge sponsors)
- Hotmelt Glue (low temp recommended)

EVALUATION STANDARDS

All Middle School competitions involve five main components: a written report, an oral report, a three panel poster board, 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 five parts:

Written Report and Drawings	30 Points

The preferred format of the report is typewritten 12 point double spaced format using WORD, then saved as a PDF. An introduction to preparing a professional report, the "Straw Bridge Written Report Guide" may be downloaded from https://bit.ly/BMIchallenges for further information

Oral Presentation	10 Points
Three Panel Poster Board	10 Points

Student teams are encouraged to use the three panel poster board as part of the oral presentation. Suggested content may include demonstration of team understanding of fundamental engineering principals of truss bridge design, description or illustration of design/build/test process used by team, description or illustration of team members contribution to the project, other content not specifically mentioned here.

Design and Fabrication	20 Points
Performance Demonstration	30 Points

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

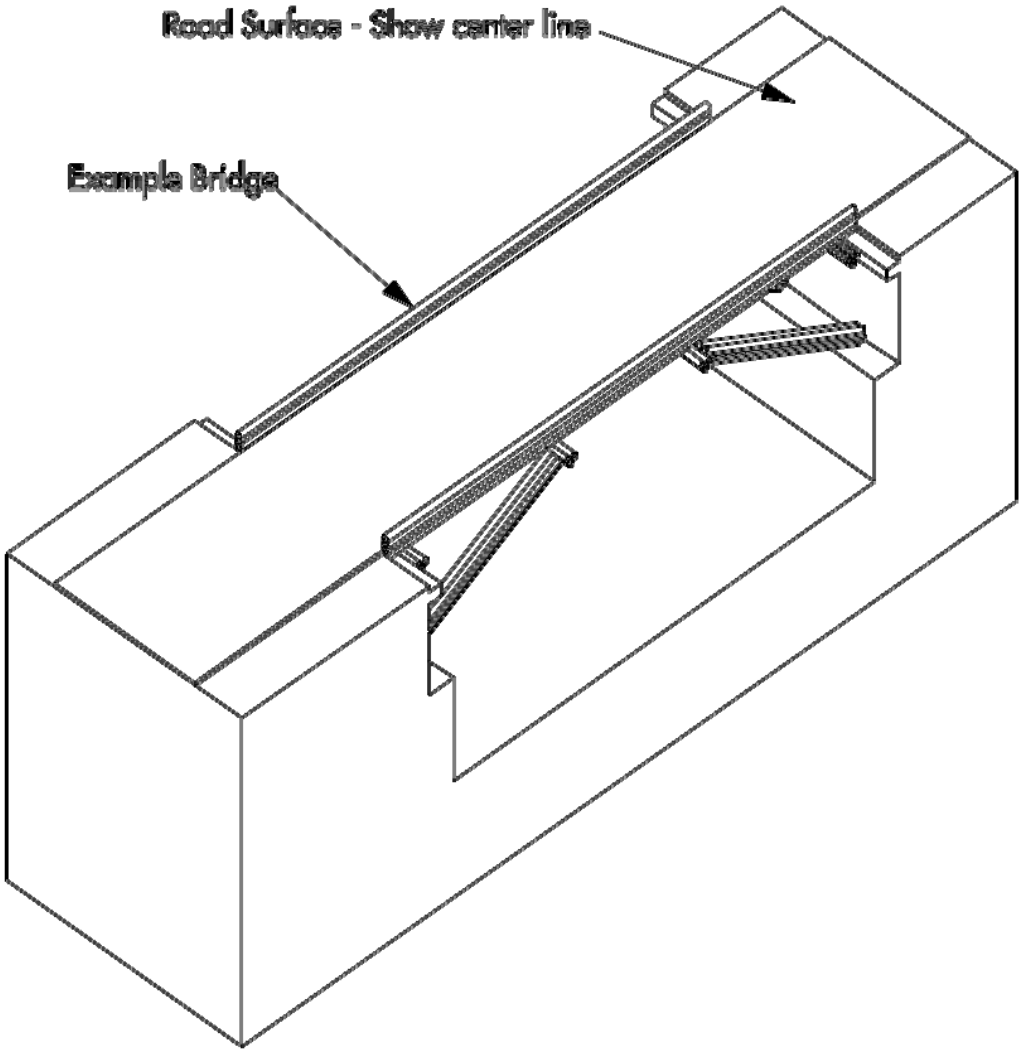
6th-8th Grade - S1.0 Skills and Processes - Topic A. Constructing Knowledge Design, analyze, or carry out simple investigations and formulate appropriate conclusions based on data obtained or provided.	**In preparing for the challenge, students will:** ● Develop the ability to clarify questions and direct 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
6th-8th Grade - S1.0 Skills and Processes - Topic B. Applying Evidence and Reasoning Review data from a simple experiment, summarize the data, and construct a logical argument about the cause-and-effect relationships in the experiment.	**In designing their projects, students will:** ● 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
6th-8th Grade - S1.0 Skills and Processes - Topic C. Communicating Scientific Information Develop explanations that explicitly link data from investigations conducted, selected readings and, when appropriate, contributions from historical discoveries.	**In composing the written and oral reports, students will:** ● 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
6th-8th Grade - S1.0 Skills and Processes - Topic D. Technology DESIGN CONSTRAINTS: Explain that complex systems require control mechanisms. MAKING MODELS: Analyze the value and the limitations of different types of models in explaining real things and processes.	**In building and testing their projects, students will:** ● 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

GOOD LUCK TO YOUR TEAM!

<u>Reference Drawings Follow</u>

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)