

## 2026 Bridge Challenge Guidelines Grades 11 and 12

**PLEASE THOROUGHLY READ ALL SECTIONS OF THIS DOCUMENT TO ENSURE ADHERENCE TO THE CHALLENGE GUIDELINES. RULES AND SPECIFICATIONS CHANGE EACH YEAR.**

### The Challenge:

This event is designed to allow students the opportunity to develop a **Half-Through Arch Bridge** that will be tested for strength-to-weight ratio. Student teams from grades 11 and 12 will be competing against other STEM Outreach Solutions student teams from across the country. Interested teams should fill out the online registration form and submit it prior to the deadline of **November 3, 2025**. Please note there is a **maximum limit of five challenge entries per school**. AASHTO will send STEM Outreach Solutions Bridge Challenge building materials to each team to begin their project. Only the building materials supplied by AASHTO can be used in the construction of the bridge. The building materials will be shipped by **November 10, 2025**, and will include **Balsa Wood and Glue**.

### Suggested software:

- Bentley PowerDraft Student Software (instructions can be found at the end of the document)
- ModelSmart 3D (provided in Bridge Module)

### Other materials needed not provided in the building materials shipped to registered teams:

- Supplies in AASHTO STEM Outreach Solutions Bridge Builder Module
- School Supplies (pencil, paper, scissors, rulers, computer)

After completing the project, each team is required to submit a digital proposal as a single file named as your state abbreviation, team name and saved as a PDF, Example: *MS Bridge Piers.pdf*, to Julia Smith, the AASHTO STEM Outreach Solutions Program Training Manager. **You must include pictures of the final built bridge and label as the challenge bridge.** The proposal must be received no later than **February 6, 2026**. Finalists will be notified by **March 2, 2026**. From those proposals entered, six teams from this grade division will be chosen to attend the national STEM Outreach Solutions Bridge Challenge finals at the AASHTO Spring Meeting, **April 13-15, 2026**, location to be confirmed. At the finals, teams will present a 10-minute PowerPoint presentation and structurally test their bridges against teams from other states to determine the winning bridge.

## Who Can Enter?

- Only schools in a state actively participating in the AASHTO STEM Outreach Solutions Technical Service Program can enter the challenge. Contact Julia Smith ([jsmith.aashtostem@outlook.com](mailto:jsmith.aashtostem@outlook.com)) for questions about STEM Outreach Solutions member states.
- Students must be in grades 11th or 12th.
- Teams shall be composed of three (3) members. NOTE: If a team is chosen to compete in the national challenge, three members must be present at the national challenge unless the national STEM Outreach Solutions Program Training Manager is notified of extenuating circumstances. Substitutions can be made as long as the new member has had an active role on the team.

## The Problem:

The goal of this challenge is to develop a **Half-Through Arch Bridge** that will carry as much weight as possible while weighing as little as possible (strength-to-weight ratio). Each team is to research the bridge type, design, and conduct experiments to test for strength-to-weight ratio, and then design a bridge resulting from those experiments. The teams are to construct a bridge **made only with the building materials received upon registration with AASHTO for the bridge challenge**. As a part of the design challenge, the team is required to develop a report portfolio describing the design and testing of the bridge and create design drawings using computer-aided design (CAD) software.

Each bridge will be checked for design according to the rules. The bridges will be weighed, and strength tested during the challenge to calculate strength-to-weight ratio. Bridges will be subjected to material tests after strength test is performed.

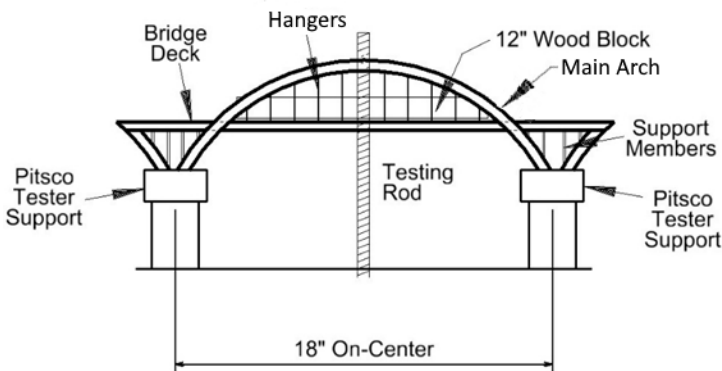
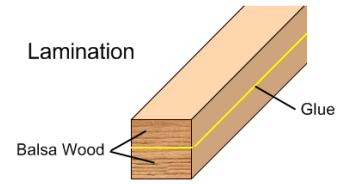
## Strength-to-weight Ratio:

An engineer's job is to not only design a safe bridge to carry required loads, but also to make sure that it is cost effective (least amount of materials used to achieve the desired load). To simulate this process, teams will use the following strength-to-weight ratio calculation to develop a bridge that carries a high load relative to the bridge weight. Strength to weight ratio is determined by dividing the maximum load carried by the weight of bridge.

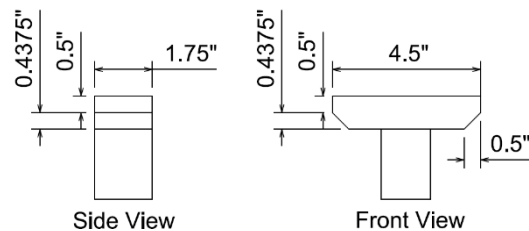
**Example:**      Maximum load = 120.0 pounds  
                      Bridge weight = 20.0 grams  
                      Ratio = 2724.0  
                      [(120 pounds x 454g/pound) / 20 g]

**Specifications for Half-Through Arch Bridge:**

- The building materials received upon registration with AASHTO are the ONLY materials to be used when building the bridge structure. Any modifications to the structural properties of the balsa wood or using different glue than provided will result in judges recording zero weight held.
- The instrument used for testing will be the Pitsco Structures Testing Instrument as seen on the right.
- Lamination is permitted one layer only. Lamination is gluing two members along their length as shown in the picture on the right. If two laminated members are beside each other, there must be a minimum 0.125 inch gap maintained between them.
- If spacers are used between members, the spacer minimum spacing is 2 inches.
- Connections can be butt joints, miter joints, or notched joints. Lap splices are permitted, but no greater than 0.25 inches.
- The main arch shall be shaped as the arc of parabola and must be one continuous piece of wood where the ends on center are 18 inches apart ( $\pm 0.25$  inches)
- The deck shall pass mid-height of the arch, shall be 24 inches in length ( $\pm 0.125$  inches) of the bridge and a minimum width of 2.5 inches.
- Maximum thickness of the bridge deck shall be 0.50 inches.
- The total length of the bridge shall be 24 inches ( $\pm 0.125$  inches), and the maximum width of the bridge shall be no greater than 4.25 inches.
- The bridge drawn below is not representative of the required design, but final designs must be representative of a Half-Through Arch Bridge.
- A block of wood that is 12 inches long by 2 inches wide by 1 inch high must be able to be placed on the bridge deck as shown in the diagram below.
- Tester supports will be placed at 18 inches on center. Support dimensions are shown below.
- The bridge shall only touch the top of the Pitsco Tester Supports as seen in the diagram below. If the bridge touches any other part of the tester body, judges will record zero weight held.
- The bridge must have at minimum a 0.75 inch gap at mid-span both longitudinally and transverse to allow a 0.625 inch testing rod to pass through and attach to a 12 inch block of wood for strength testing as seen in the picture to the right and the diagram below. **The testing rod must be able to pass through the full height of the bridge.**



**Tester Configuration Detail**  
 Not representative of required design  
 Use only for dimension reference



**Support Detail**

**PROPOSAL FORMAT:**

The information below gives an indication of what the judges are looking for in each section. **The proposal must contain all of the sections outlined below to be considered for the challenge.**

I. BRIDGE PROPOSAL (See Page 5 for Assessment)

- A. Proposal Format: The written proposal should be typed, double-spaced using a size 12 font of either Arial or Times New Roman on 8.5 x 11 paper with all pages numbered with 1" borders all around. Proposals cannot exceed 30 pages in length. Sections must be in order of the outline below.
- B. Timeliness: Proposals received after the deadline will not be accepted.
- C. Proposal Presentation: Portfolio **MUST** contain all the sections outlined below:

**I. Title Page.** Include name of challenge, team name, and team logo, name of school or organization, city and state, names of students, name of teacher or advisor.

**II. Table of Contents.**

**III. Summary (abstract).** Clearly and concisely stated. (At least ½ page, no more than two pages)

**IV. Introduction.** Indicate the team name, team members as well as the background of each member.

**V. Body.** The main part of the report. This may be divided into several sections (such as Design, Development, etc.). In general, this part should:

- a) Explain the scientific principles behind your design.
- b) Describe the challenges you encountered in designing your bridge.
- c) Include Data Tables, Graphic Representation of Tests, and supporting Calculations page.
- d) Include scaled CAD drawings of preliminary and final bridge designs.
- e) Include at least five pictures of team work during bridge design and construction, along with a picture of the constructed bridge (prototype or final).
- f) Explain how you tested your design, and the improvements this led you to make.
- g) Describe the challenges that you encountered in building your bridge and how you solved these problems. Include safety precautions, building methods, etc.

**VI. Conclusions (and Recommendations).** How successful is your project? What did you learn by taking part?

**VII. Acknowledgments.** List the names of the adults who assisted you in the project with a brief description of what they did. 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."

**VIII. Bibliography.** List all references used, including Internet, books and magazines.

**IX. Appendices.** They must include:

- A. Scheduling and Accomplishments.** Show on a timeline, or similar method, how you scheduled your project. Include *brief* records of meetings.
- B. Daily Journal.** Progress reports of day-to-day work on the project, including date, performance, and comments from each team member.

**PROPOSAL ASSESSMENT**

**ALL PROPOSALS SHOULD FOLLOW THE FORMAT BELOW TO BE CONSIDERED FOR THE STEM OUTREACH SOLUTIONS BRIDGE CHALLENGE**

Proposal Format	Possible Points	Points Awarded
Typed	(1 point)	
Double Spaced	(1 point)	
12 Point Font (Arial or Times New Roman)	(1 point)	
All pages on 8.5 x 11 paper	(1 point)	
Information is in the proper order	(2 points)	
All pages are numbered	(1 point)	
Style and presentation	(1 point)	
Mechanics	(1 point)	
Visuals	(1 point)	

Score \_\_\_\_\_ / 10 Possible Points

Proposal Presentation

Title page	(1 point)
Table of Contents	(1 point)
Summary (no more than 2 pages)	(2 points)
Total length of Proposal no more than 30 pages	(3 points)
Introduction	(1 point)
Body	
○ Sections of portfolio identified	(3 points)
○ Scientific principles of the design	(5 points)
○ Design challenges	(5 points)
○ Tables, Graphs, Calculations	(10 points)
○ Detailed scaled CAD drawings	(5 points)
○ Photos during and after construction	(5 points)
○ Testing and improvements	(5 points)
Conclusion	
○ Recommendations	(5 points)
○ Success of the project	(5 points)
○ What was learned by taking part	(5 points)
Acknowledgements	
○ Adults involved	(1 point)
○ Description of what the adults did	(1 point)
○ Certification and signatures	(1 point)
Bibliography	(1 point)
Appendices	
○ Schedule on a timeline or similar	(5 points)
○ Daily Journals (must be legible)	(20 points)

Score \_\_\_\_\_ / 90 Possible Points

**TOTAL SCORE: \_\_\_\_\_ / 100 Points**

## BRIDGE CHALLENGE FINALS

Teams will be chosen to attend the 2026 STEM Outreach Solutions Bridge Challenge finals by a panel of judges that score the portfolios. Finalist teams will present at the AASHTO Spring Meeting to a panel of judges comprised of various AASHTO members and sponsors. Each team will be expected to make a PowerPoint presentation and be able to answer questions from the panel of judges about their entry. Supporting materials may be presented to the judges. All technical drawings must be created using CAD Software. Judges will examine each entry to make sure it fits the specifications given in the rules. **The bridge brought to challenge must be similar with no major changes to the bridge in pictures labeled the challenge bridge submitted in the portfolio.** The criteria below outlines the challenge fundamentals:

- A. SPECIFICATIONS: Prior to testing, the bridge will be checked by the judges for adherence to the specifications on page three of this document. Specification violations will be discussed with the team prior to testing. Any bridge not meeting the specifications on page three will result in judges recording zero weight held.
- B. ORAL PRESENTATION (50% of the total score): Teams will present a 10-minute PowerPoint presentation (a deduction is assessed for every minute under or over 10 minutes). A rubric on page 11 has been provided for the presentation as a guide.
- C. PERFORMANCE (50% of the total score): Bridges will be weighed and then tested on the Pitsco structural tester. Results will be used to calculate strength-to-weight ratio.

### Awards:

Teams chosen to attend the AASHTO STEM Outreach Bridge Challenge finals will compete for these award levels:

- First Place Team:** \$400 gift card per team member (\$1200 total)  
**Second Place Team:** \$300 gift card per team member (\$900 total)  
**Third Place Team:** \$200 gift card per team member (\$600 total)

Teacher/advisor of each First Place Team at the STEM Outreach Bridge Challenge finals will receive a gift card, not to exceed \$250 per teacher/advisor.

## PREPARING FOR THE CHALLENGE

**Form a team of interested students or friends.** Discuss the challenges and design specifications. Teams shall consist of three students. Each team must have at least one teacher or other adult to help and advise, though a single adult may be advisor to more than one team.

**Study the rules.** The individual challenge documents and the grading criteria will give important information, which must be followed if your team is to achieve the best results. Failure to adhere to the rules could lead to penalties, or even disqualification. If any of the information is not clear, please call for additional help.

**Plan the timing of the project.** Ensure that everyone in the team knows the date for submission of the written report and recognizes that this means that all major development work should be finished before this date.

**Keep records of meetings and working drawings carefully** and give members of the team responsibility for different sections of the final report.

**Notes to Adults:** AASHTO would like to stress that **the work on all phases of the project is to be done by the students.** Adult assistance is to be limited to:

- Mentoring
- Basic guidance of the students
- Teaching engineering, mathematical and scientific principles applicable to the project
- Guiding students in research
- Assisting in the production of the report and preparation of the drawings
- Overseeing the manufacturing stages of the project

Guidance should be in the form of asking questions, (leading questions if necessary) to promote creative thinking by the students to identify the scientific and engineering principles involved. **Encourage students to consult credible web sites and other resources** to help with the project. **Encourage students to test and improve their designs.** A good way to begin is for each student to design and/or construct a rough prototype. Test it and make improvements.

## BRIDGE CHALLENGE SCHEDULE

- 1) Registration is due **November 3, 2025**.
- 2) Building materials will be shipped to teams by **November 10, 2025**.  
Building materials will include:
  - Balsa Wood
  - Wood Glue
- 3) Proposals, saved as your state abbreviation, team name, and saved as a PDF, are due **February 6, 2026** (do not include the Bridge). Example: MS Bridge Piers.pdf
- 4) Notification of finalists by **March 2, 2026**.
- 5) Finals will be held at the **AASHTO Spring Meeting, April 13-15, 2026, location to be confirmed**.

## REGISTRATION

### 2026 STEM OUTREACH SOLUTIONS BRIDGE CHALLENGE

Grades 11 and 12

All registration forms are due by **November 3, 2025**.

By submitting this form, you agree that you have read the challenge documents and the guide to entry, and you wish to register for the 2026 STEM Outreach Solutions Bridge Challenge for 11th & 12th Grade.

NOTE: Each advisor working with different teams at the same school should submit a separate application for registration for each team. Each school can have five registration submissions per grade level. In the event there are more than five registration submissions per grade level from one school, the first five registrations will be accepted.

Click on the link to fill out the registration form: [11th & 12th Grade Registration](https://forms.gle/4W9SzkpoZfBgZWLN7) or copy and paste this link in the web browser address bar: <https://forms.gle/4W9SzkpoZfBgZWLN7>

**PROPOSAL ENTRY FORM  
2026 STEM OUTREACH SOLUTIONS BRIDGE CHALLENGE  
Grades 11 and 12**

**Return to Julia Smith by February 6, 2026**

*Entry form for report proposal (saved as state abbreviation, team name and in a PDF format\*) for:*

Name of Adult Advisor \_\_\_\_\_

Team Name \_\_\_\_\_

Team Members Name & Grade Levels (Team members must be in 11th or 12th grade)

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

School or Group \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Work Phone \_\_\_\_\_ Home Phone \_\_\_\_\_

Cell Phone \_\_\_\_\_ Fax Phone \_\_\_\_\_

E-mail address (required) \_\_\_\_\_

*Return completed form through email to:  
Julia Smith.*

*Email: [jsmith.aashtostem@outlook.com](mailto:jsmith.aashtostem@outlook.com)*

*\*Example report proposal name: **MS Bridge Piers.pdf***

**2026 STEM OUTREACH SOLUTIONS BRIDGE CHALLENGE**  
**ORAL POWERPOINT PRESENTATION**

Team Name \_\_\_\_\_

NOTE: This rubric is designed to help with the preparation of the presentation. The oral presentation has a possible score of 100 points. Each category will be scored on a scale from 1 to 20 points.

CATEGORY	20 ●	15 ●	10 ●	5 ●	0 ●	Sub-Score
<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 1-2 factual errors.	Content is minimal OR there are several factual errors	Did not fulfill requirements	_____/20
<b>Mechanics</b>	No misspellings or grammatical errors.	Three or fewer misspellings and/or mechanical errors	Four misspellings and/or grammatical errors.	More than 4 errors in spelling or grammar.	Did not fulfill requirements	_____/20
<b>Organization</b>	Content is well organized using headings or bulleted lists to group related material.	Uses headings or bulleted lists to organize, but the overall organization of topics appears flawed.	Content is logically organized for the most part.	There was no clear or logical organizational structure, just lots of facts.	Did not fulfill requirements	_____/20
<b>Presentation</b>	Interesting, well-rehearsed, few to no glances at presentation and/or notecards, with smooth delivery that holds audience attention.	Relatively interesting, rehearsed, glancing frequently to presentation and/or notecards, with a fairly smooth delivery that usually holds audience attention.	Delivery not smooth, read from presentation and/or notecards but able to hold audience attention most of the time.	Delivery not smooth, read from presentation and/or notecards and audience attention lost.	Did not fulfill requirements	_____/20
<b>Attractiveness</b>	Makes excellent use of font, color, graphics, effects, etc. to enhance the presentation.	Makes good use of font, color, graphics, effects, etc. to enhance to presentation.	Makes use of font, color, graphics, effects, etc. but occasionally these distract from the presentation content.	Use of font, color, graphics, effects etc. but these often distract from the presentation content.	Did not fulfill requirements	_____/20
Total Sub-Score _____/100 Each Minute Under/Over 10 Minutes: (-10) _____ <b>TOTAL SCORE</b> _____						

## 2026 STEM OUTREACH SOLUTIONS BRIDGE CHALLENGE SUGGESTIONS AND HELPFUL HINTS

1. Students should be prepared for questions at the end of the presentation. These questions may be concentrated in the following topics. However, note that the judges are free to ask any question about any topic. Therefore, each team should be prepared.
  - a) Choice of design
  - b) Civil engineering careers related to bridges
  - c) Safety
  - d) Impacts of bridges
  - e) Lessons learned
2. Stay organized and keep track of time limits.
3. If you have a question, ASK. Students and parents communicate to teacher/advisor and teacher/advisor communicate with Julia Smith at [jsmith.aashtostem@outlook.com](mailto:jsmith.aashtostem@outlook.com).
4. Contact your DOT engineers. They will answer many of your questions.
5. Check out other bridges in your area or around the world
6. **Include detailed information in the team portfolio. Remember, your portfolio is what determines if your team is selected to come to national challenge.**
7. RESEARCH

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- No school email? *Upload proof like a student ID.*
- Verify your email and set your password.

## Step 2: Log In & Access Software

- Go to **Bentley Education** and log in.
- Navigate to the **Software** section.
- On the left, scroll down and click **Students & Educators**.
- Browse or search for the software you need.

## Step 3: Download & Install

- Click **Install** next to your chosen software.
- Follow instructions to download and install.
- **Bentley's Connection Client** will install the first time to manage your access.

## Bonus Resources

- Visit <https://learn.bentley.com> for **free courses and tutorials**.
- **Earn certificates** to showcase your skills and build your portfolio.

## Stay Connected

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Questions? Contact: [Waseem.Ayaz@Bentley.com](mailto:Waseem.Ayaz@Bentley.com)