

2018 Bridge Competition Guidelines

Grades 9 and 10

COMPETITION FOR GRADES 9 and 10

The Competition:

This event is designed to allow students the opportunity to develop a **Cable-Stayed Bridge** that will be tested for strength-to-weight ratio. Student teams from grades 9 and 10 will be competing against other 9th and 10th grade student teams from around the Richmond Metro area. Interested teams should fill out the attached application and submit it prior to the deadline of **Friday, November 17, 2017**. [Please note there is a maximum limit of 3 competition entries per school.] VDOT will send an entry kit to each team to begin their project. Only materials included in the kit supplied by VDOT can be used in the construction of the bridge. The kit will be shipped to your school by **Friday, December 15, 2017** and will include **Balsa Wood and Wood Glue**.

Other materials needed not provided in kit:

- Calculator
- School Supplies

In order to provide arrangements, a commitment from the students is needed by **Friday, February 23, 2018**. **Competition will be held in Richmond on Saturday, March 17, 2018**. At the competition, 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?

- All schools.
- Students must be in grades 9th and 10th.
- Teams must be composed of three members, no less, no more.

The Problem:

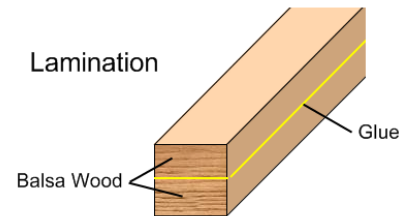
The goal of this competition is to develop a **Cable-Stayed Bridge** that will carry as much weight as possible while weighing as little as possible (strength-to-weight ratio). The teams are to construct a bridge **made only with the materials provided** in the VDOT Entry Kit.

Each bridge will be checked for design according to the rules. The bridges will be weighed and strength tested during the competition to calculate strength-to-weight ratio.

The Challenge:

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.

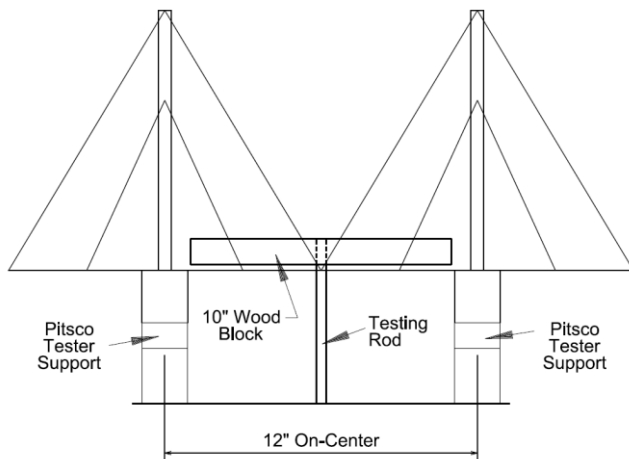
Example: Maximum load = 120.0 pounds
Bridge weight = 20.0 grams
Ratio = 2724.0
[(120 pounds x 454g/pound) / 20 g]



Specifications for Cable-Stayed Bridge:

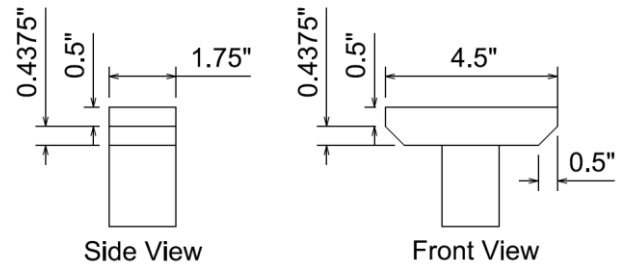
- The cable-stayed bridge shall be designed and built to perform like a cable-stayed bridge. Load must be transferred from the deck, through the strings, and to the towers. The bridge deck may sit on the tower base but shall not be attached to the base. Students will have to demonstrate this to the judges when testing.
- The materials provided in the kit 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 (0) weight held.
- The instrument used for testing will be the Pitsco Structures Testing Instrument as seen on the right.
- Lamination shall be permitted one layer thick as shown in the picture on the right.
- Connections can be butt joints, miter joints, or notched joints. Lap splices are permitted, but no greater than 1/4 of an inch.
- The bridge towers must be 12 inches apart on center and shall sit on the Pitsco Tester Supports.
- Maximum width of the bridge tower base will be 4.5 inches.
- A block of wood that is 10 inches long by 2 inches wide by 1 inch high must be able to be pushed across the bridge deck.
- Tester supports will be placed at 12 inches on center. Support dimensions are shown below.
- The bridge shall only touch the Pitsco Tester Supports. If the bridge touches any other part of the tester body, judges will record zero (0) weight held.
- The bridge deck must have a 3/4 inch hole in mid-span to allow a 5/8 inch testing rod to pass through and attach to a 10 inch block of wood for strength testing as seen in the picture to the right and the diagram below. The rod must be able to pass through the full height of the bridge deck.





Tester Detail

Not representative of required design
Use only for dimension reference



Support Detail

BRIDGE COMPETITION FINALS

Teams chosen to attend the 2018 VDOT Bridge Finals will present to a panel of judges comprised of various VDOT employees. Each team will be expected to make a PowerPoint presentation and be able to answer questions from the panel of judges about their entry. Judges will examine each entry to make sure it fits the specifications given in the rules. The criteria below outline the competition fundamentals:

- A. **ORAL PRESENTATION** (10% of the total score): Teams will present a 10 minute PowerPoint presentation (a deduction is assessed if over 10 minutes). A rubric on page 11 has been provided for the presentation as a guide.
- B. **PERFORMANCE** (90% of the total score): Achievement of performance goals and stability of construction. Bridges will be weighed and then tested on the Pitsco structural tester. Results will be used to calculate strength-to-weight ratio. Any bridge not meeting the specifications on page 3 will result in judges recording zero (0) weight held.

Awards:

Teams chosen to attend the VDOT Bridge Competition will compete for a:

First Place Team: Gold Medal

Second Place Team: Silver Medal

Third Place Team: Bronze Medal

PREPARING FOR COMPETITION

Form a team of interested students or friends. Discuss the challenges and design specifications. Teams are limited to only three (3) students. Each team must have at least one teacher or other adult to help and advise the group. However, 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 all the deadlines and to complete the bridge.

Notes to Adults: VDOT 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 creditable 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 COMPETITION TIMELINE AND DUE DATES

- 1) Applications due **Friday, November 17 2017.**
- 2) Packets will be shipped to schools by the VDOT office by **Friday, December 15, 2017.**
Packets will include:
 - Balsa Wood
 - Wood Glue
 - Information packet
- 3) Commitment to Participate **Friday, February 23, 2018**
- 4) Competition will be held in Richmond **Saturday, March 17, 2018.**

APPLICATION
2018 VDOT CABLE-STAYED BRIDGE COMPETITION
Grades 9 and 10

Email completed form to Tandi Williams, tandi.williams@vdot.virginia, by **Friday, November 17, 2017**.

We have read the challenge documents and the guide to entry, and we want to register.

Name of Adult Advisor _____

Team Name _____

Team Members Name & Grade Levels (Team members must be in 9th or 10th grade)

1. _____

2. _____

3. _____

School or Group _____

Address _____

Work Phone _____ Home Phone _____

Cell Phone _____ Fax Phone _____

E-mail address (required) _____

NOTE: Each leader working with different teams at the same school should send a separate application form for each team. Copy this form as necessary. If you do not have the team members' names by the due date, just state that on the application and send that information when it is available.

GUIDELINES
2018 VDOT BRIDGE COMPETITION
Oral PowerPoint Presentation: Bridge Competition

Team Name _____

NOTE: This is a rubric for to help for the preparation of the presentation. Oral presentation has a possible score of 100 points. Each category will be judged on a scale from 1 to 20 points.

CATEGORY	20	15	10	5	0	Sub-Score
Content	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
Mechanics	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
Organization	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
Presentation	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.	Delivery not smooth and audience attention lost.	Did not fulfill requirements	_____/20
Attractiveness	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 detract 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 Over 10 Minutes: (-20 points) _____ TOTAL SCORE _____						

2018 VDOT BRIDGE COMPETITION

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, please contact Tandi Williams/
 - a) Email: tandi.williams@vdot.virginia.gov
 - b) Work phone: 804-786-5706

1. Contact your VDOT engineers. They will answer many of your engineering questions.
 - a) Prasad Nallapaneni, P.E.: Prasad.nallapaneni@vdot.virginia.gov
 - b) Kwame Sakyi-Bekoe P.E.: Kwame.sakyi-bekoe@vdot.virginia.gov
 - c) Kyle Haber, P.E.: kyle.haber@vdot.virginia.gov
 - d) Matthew Yakim, P.E.: matthew.yakim@vdot.virginia.gov
 - e) Andy Zickler, P.E.: andy.zickler@vdot.virginia.gov

2. Check out other bridges in your area or around the world.

3. RESEARCH