

2019- 2020 USF-SELMON BALSA BRIDGE DESIGN COMPETITION RULES & GUIDELINES



UNIVERSITY OF
SOUTH FLORIDA
College of Engineering



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ABOUT THE USF-SE Balsa BRIDGE COMPETITION

Since 2010, the Tampa Hillsborough Expressway Authority (THEA) is partnering with the USF College of Engineering to sponsor the 33rd Annual Balsa Wood Bridge-Building Competition. This free fun-filled event is open to the public and promotes Science, Technology, Engineering, and Math (S.T.E.M.) education to middle school and high school students and provides students an opportunity to meet local engineers and engineering student organizations at USF. The Engineering Expo also features hands-on exhibits and shows that aim to encourage more students to pursue fields in science and mathematics. At the Balsa Wood Bridge-Building Competition, middle and high school students from Hillsborough, Pinellas, and neighboring Counties, showcase their engineering skills as their wood bridge creations are tested to find out which bridge can withstand the most weight and pressure. The student-run competition began in the 1980's, with the goal of connecting underrepresented middle and high school students to careers in engineering fields. It also provided a fun, extra-curricular educational enrichment opportunity to promote the S.T.E.M. philosophies. The competition's theme of Design It, Build It, Break It! allows teams of three students to design and build model bridges from Balsa wood and then test their load capacities. Teachers and their student teams are encouraged to watch an instructional video on the Workshop webpage which provides an opportunity to prepare for the competition and develop lesson plans that incorporate engineering and design with math and science through bridge building process.

Through its partnership with USF, THEA seeks to support community events that provide mentorship, encourage the STEM mindset, and raise the educational opportunities for Tampa Bay area students. The Wood Bridge-Building Competition is a branch of THEA's Selmon S.T.E.M. Scholarship (S3) Program. Lee Roy Selmon, a member of NFL Hall of Fame, and former Athletic Director at USF and the Expressway's namesake and THEA partnered to create the S3 Program, which provides opportunities and exposure to students about careers in Science, Technology, Engineering, and Mathematics. The program features outreach to Bay area high schools, the USF College of Engineering's Wood Bridge-Building Competition, monetary scholarships, and paid internships at the THEA.

[Source: THEA]

BENEFITS TO THE COMPETITION

BUILDING TEAMWORK SKILLS

Engineers usually work in teams, but most classroom assignments are structured as individual activities. Essential teamwork skills do not always come naturally, but they can be cultivated. Bridge building affords a rare opportunity to learn and practice the engineering team approach to problem solving. Students that work in teams, as engineers do, usually produce better results.

AWARDS AND RECOGNITION



Selmon S.T.E.M. Scholarship Program (S3)

This fund supports engineering students on the Tampa campus who are graduates of Hillsborough, Pinellas or Pasco County high schools. These scholarships are based on merit and financial need. Strong consideration is given to students who demonstrate, through leadership or volunteer activities, the challenge of a diverse and changing society. The scholarship seeks to increase the educational opportunities and exposure to transportation careers for students.

There are opportunities through the S3 Program in four categories for disadvantaged students pursuing engineering degrees:

- Freshman Book Scholarship
\$1,500 Book Scholarship (\$750 per Semester)
- Sophomore Book Scholarship
\$1,500 Book Scholarship (\$750 per Semester)
- Junior Internship w/ Book Scholarship
\$1,500 Book Scholarship (\$750 per Semester)
Two (2) Semester Internship with THEA (20 hours per week)
- Senior Internship w/ Book Scholarship
\$1,500 Book Scholarship (\$750 per Semester)
Two (2) Semester Internship with THEA (40 hours per week)

[Source: THEA]

PAST TOP TWO FINISHERS

(* Efficiency Winner)

Middle School	High School
2019	2019
1) Cambridge Christian - Meister Dub_71*	1) Newsome High - Not Last Place
2) Terrace Middle School - Bridge to Nowhere	2) Newsome High - Mountain
2018	2018
1) Cambridge Christian Middle - Supreme Bridges*	1) Newsome High - Benchwarmers United
2) Terrace Community Middle - Themyscira	2) Middleton High - Over the top Tiger Bridgesters
2017	2017
1) Cambridge Christian Middle - Team #1*	1) Middleton High - Tiger Bridgeters
2) Cambridge Christian Middle - Team #3	2) Pasco High - Arch Enemies
2016	2016
1) Terrace Community Middle - Bifost*	1) Lennard High - Lennard 2
2) Cambridge Christian Middle - Team #2	2) Lennard High - Lady Longhorns*
2015	2015
1) Gulf Coast Academy - CGA1	1) Gaither High - Close Enough*
2) Randall Middle - Rage Quit	2) Lennard High - Lady Longhorns
2014	2014
1) Terrace Middle - MME*	1) Gibbs High - 404 Bridge not Found*
2) Randall Middle - Archy Jr.	2) Lennard High - SVETY
2013	2013
1) Stewart Middle - Venta	1) Leonard High - Human Beings*
2) Rampello Middle - Rampello Pirate	2) Gibbs High - 404 Bridge Not Found

Section 1 - GENERAL INFORMATION

General information on the competition as well as registration information for the Balsa Bridge Competition is located on the Balsa Bridge Competition website (usfbalsabridge.weebly.com). Questions regarding Competition qualifying procedures, etc. should be directed to the Balsa Bridge Competition Website's Contact Us page.

Section 2 - RULE CHANGES AND PRECEDENCE

The Rules and Regulations of the Balsa Bridge Competition are updated each year. **Teams are encouraged to read this entire document carefully and disregard rules and website postings from previous years.**

Teams should not consider items such as, but not limited to, rulings and interpretations made by judges in previous competitions for this year's competition.

Section 3 - REGISTRATION

Schools may register up to a maximum of four (4) teams. Each team may consist of a minimum of three (3) members and a maximum of four (4) members. Registered participants are the only individuals eligible to present and load the team's bridge. Changes of registered participants will be allowed up until 14 days before the competition.

3.1 Eligibility Requirements - Registered participants at the Balsa Bridge Competition shall meet all of the following requirements:

- 1) Be a current student in middle or high school
- 2) Have contributed to the design and construction of the presented Bridge during the current academic year.

3.2 Validation

- 1) When registering for team, be sure to use the validation code of **Bridge2020**.
- 2) This is to ensure that the rules have been read in its entirety. Information that has been change or updated since the preceding year has been highlighted in gray.
- 3) **Please note that the code is case sensitive.**

Section 4 - BRIDGE REQUIREMENT

4.1 Materials

- 1) Basic materials will be provided to teams that register at least fourteen (14) days prior to Competition and will have to be picked up at least seven (7) days prior to competition. Any additional material will be the responsibility of the teams and their associated school.

Materials will **NOT** be delivered to the teams or their schools, instead will have to be picked up at the Engineering College of the University of South Florida Tampa Campus. More information on location and dates can be found on the Balsa Bridge Competition website.

- 2) Kits will consist of:
 1. Twenty (20) .25" x .25" x 3' Balsa wood,
 2. Six (6) .25" x .125" x 3' Balsa wood,
 3. Ten (10) .25" x .0625" x 3' Balsa wood and
 4. One (1) .25-ounce Zap-a Gap glue.
- 3) Material(s) achieved will have to follow the following specification
 1. Balsa wood:
 - Max cross-section size is ¼" x ¼"

- Must be made of the material of balsa wood
2. Glue:
 - Any liquid glue

4.2 Display Requirements

- 1) The bridge display and load test shall adhere to the following requirements. Failure to follow these guidelines will result in immediate disqualification and will not be tested during competition.

Requirements are as follows:

- a. The bridge must be "free standing."
- b. Total mass of the Bridge, including glue, may not exceed 110 grams.
- c. Maximum dimensions of the bridge shall not exceed 550 mm in length, 100 mm in width and 300 mm in height.
- d. The bridge piers must be at a minimum 400 mm apart from each other measuring from the inside and must raise the bridge a minimum of 20 mm.
- e. The minimum height of the "roadway surface" is 100 mm above the bottom of the bridge feet.
- f. The bridge must provide a "roadway surface" that is approximately level. The roadway surface must have a minimum width of 46 mm and extend the entire length of the completed bridge.
- g. No fastening method other than mechanical interlock of the balsa pieces or commercial glue is allowed.
- h. The bridge design must allow the standard testing block to be placed on the roadway surface with the testing rod(s) extending beyond the sides of the bridge. (See Bridge Testing)
Alternatively, a $\frac{3}{4}$ inch hole may be provided for a metal rod to extend up through the deck for the testing block to be affixed.
- i. The bridge may **NOT** be painted or coated in any way including coating of members with glue.
- j. In order to prevent damages to the bridge should be fabricated of high enough craftsmanship to withstand normal handling by the judges. The contest supervisors are not responsible for any damage to bridges.

Section 5 - BRIDGE TESTING

The load capacity test will be conducted with a Pitsco Structure Testing Instrument as follows:

5.1 The bridge will be placed on the testing stand consisting of two (2) flat, level surfaces which will be level with respect to each other and separated by approximately 350 mm.

1. **Option I:** A 17 x 4 cm testing block will be placed on the roadway surface at the center of the span with a 12.5 mm diameter rod extending up through the Bridge. The load shall be applied to the Bridge using the rod placed in a hole in the test block symmetrical about the center of the span.
2. **Option II:** A 17 x 4 cm testing block will be placed on the roadway surface at the center of the span with a 12.5 mm diameter rod extending beyond the sides of the Bridge. The load shall be applied to the Bridge from two (2) rods placed in slots in the test block symmetrical about the center of the span.

3. Whether Option I or II is used will be determined by the design of the bridge. If either option works, Option II, two (2) rods, will be used.

5.2 A testing device will slowly apply pressure downward until one of the following occurs:

1. **Catastrophic destruction takes place when:**

- a. The vertical force applied drops to zero (0).
- b. The downward deflection of the bridge exceeds 35 mm. The load that the Bridge sustained when the deflection reached 35 mm will be considered to be the failure load.

Section 6 DRAWING GUIDELINES

Along with the bridge, a scaled drawing will need to accompany the submitted bridge. The drawing needs to have the below information. Not having all the information will NOT disqualify the team. However, it WILL cause a deduction from the amount of achievable points during scoring.

6.1 A scale needs to be present on Drawing. Scales are written a:b, where ‘a’ is the size on the Drawing in comparison to the size ‘b’ of the actual object. e.g. 1:2-inch scale means on inch on the Drawing is two (2) inches on the Bridge.

6.2 The following information need to be placed on the lower right-hand side of the Drawing

Team Name		
School Name		Teacher(s) name
Member Names		
Scale	Date	Grade Levels

6.3 Size dimensions need to be labeled on Drawing.

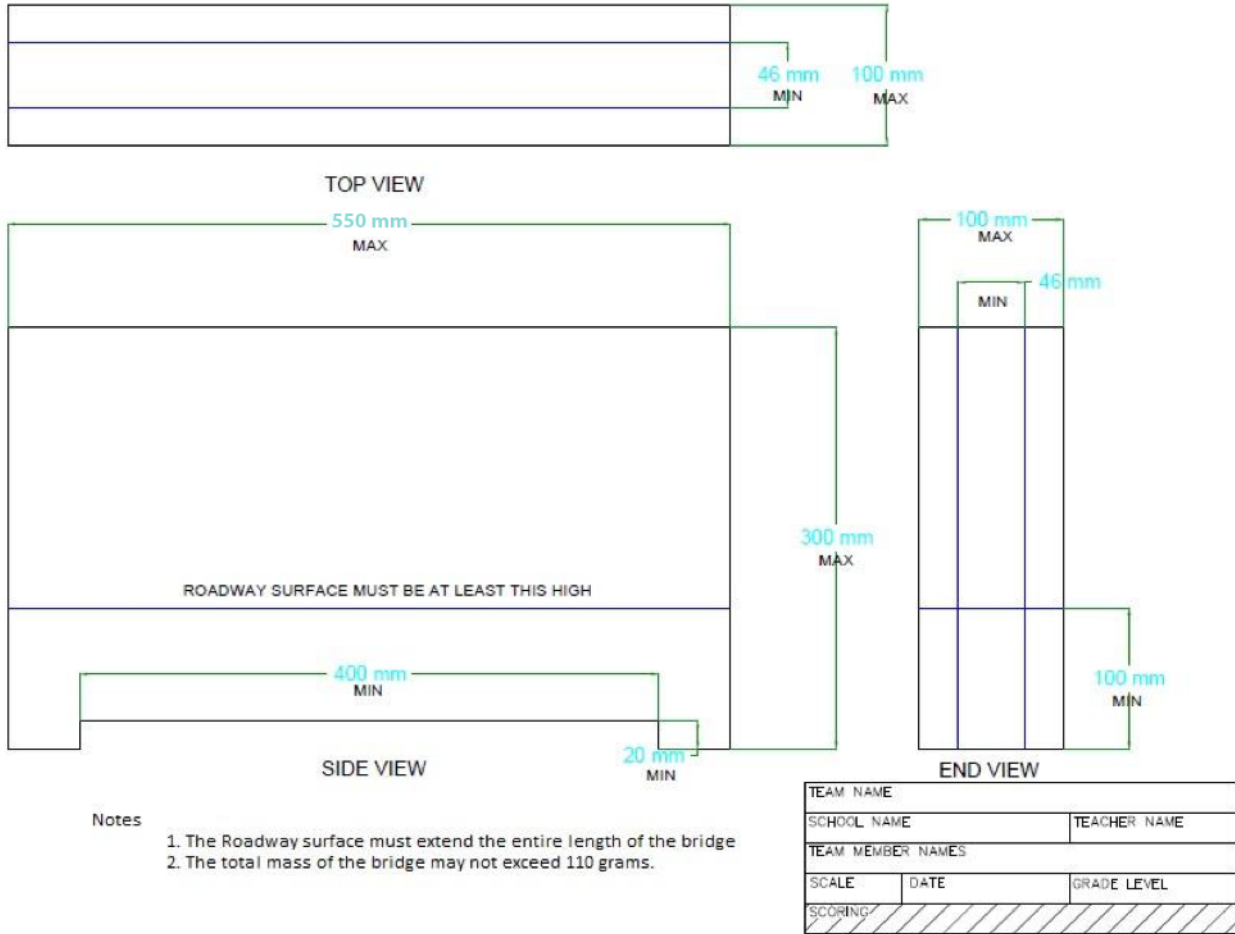
6.4 At minimum height, length and width needs to be present.

6.5 Top, front, and side views need to be present.

6.6 Text and numbers can be handwritten or typed but MUST be readable and legible.

6.7 Non-graphing paper is preferred, but not required.

6.8 Example Drawing:



Section 7 - JUDGING

7.1 Bridges will be visually inspected, measured and weighed for compliance to the rules. Bridges failing to pass these requirements will not be scored in the competition. The failed bridges may be load tested at the discretion of the judges, if the team requests the test.

7.2 Bridge design drawings will be examined and compared with the completed Bridge.

7.3 Points will be given for craftsmanship, originality and design drawings.

Section 8 - SCORING

8.1 The Bridge contest will be scored on the following four areas of achievement:

8.2 Load capacity - The Bridge will be loaded to determine how much weight it can support.

8.3 Design Drawings - Score will depend on:

- a) **Resemblance** - The accuracy of the drawings in relationship to the Bridge. The drawings may be full size or to scale.
- b) **Dimensioning** - Proper indication of the height, width and length of various parts of the Bridge.
- c) **Completeness of Title Block** - Must indicate: Team’s name, School name, Teacher(s) name, team members’ names, scaling, grade level(s), and date of completion.
- d) **Appearance and Neatness** - Quality and cleanliness of the representation.

8.4 Craftsmanship - The workmanship and care taken in constructing the Bridge.

8.5 Originality - Imaginative or innovative concepts used in design and construction of the Bridge.

8.6 Point Distribution - Points are used in determining the scores of the Bridge and their teams. Points are distributed as follows:

- a) **Load Capacity**
 - 1. 1st Highest 70 Points
 - 2. 2nd Highest 60 Points
 - 3. 3rd Highest 50 Points
 - 4. 4th and Below 30 Points
- b) **Design Drawings**
 - 1. Points range from 0 to 10 Points
- c) **Craftsmanship**
 - 1. Points range from 0 to 10 Points
- d) **Originality**
 - 1. Points range from 0 to 10 Points

8.7 Placings - First and Second place winners are determined by the two teams with the most points. There will be the two (2) winners for each school group (Middle and High School), and one (1) overall efficiency winner,

Section 9 - TIES

9.1 If two (2) bridges attain the same load capacity at failure, the determination of a front-runner will be decided by comparing the efficiency of the bridges.

9.2 The efficiency of each bridge will be determined by dividing the load at failure by the weight of the Bridge.

$$\text{Efficiency} = \frac{\text{Failure load}}{\text{Weight of Bridge}} \times 100$$