



# 31<sup>st</sup> Annual Model Bridge Competition

## 2022 - 2023 Technical Specifications

LIVE! Watson Hall, Wentworth Institute of Technology AND  
Broadcast via Teams [LINK TO WATCH ON COMPETITION DAY](#)

Competition Date: Saturday, February 4th, 2023

(Remote Teams will need to arrange testing by 1/21/2023)

**DOCUMENT LAST MODIFIED: 10/21/2022**

Register for the competition at [www.engineeryourfuture.org](http://www.engineeryourfuture.org)

Direct link: [CLICK HERE](#)



## WELCOME TO THE 31ST ANNUAL MODEL BRIDGE COMPETITION!

The Boston Society of Civil Engineers Section (BSCES) is proud to present the THIRTY FIRST annual Model Bridge Contest. This competition serves the important role of introducing students to the world of engineering and design. Through this contest, the BSCES hopes to provide positive role models for the students and allow students to visualize future opportunities in the STEM and engineering fields.

First, thank you for your interest in the BSCES Model Bridge Competition. This document contains all you will need to know regarding model bridge specifications, basic bridge design concepts, and competition schedule including materials delivery and built bridge delivery information (for remote teams only). The following are the rules and regulations to be followed for the Model Bridge Contest. It is the responsibility of the contestants to follow and construct their bridges in accordance with the rules contained herein.

While in general, teams competing simply bring their models on February 4<sup>th</sup> at 8:30 AM to Watson Hall, we are still making provisions for teams to compete remotely. This would involve arranging for models to be tested, which may be by setting up the device at a school, or by visiting AECOM at 1 Federal Street in Boston. Students, in this case, will need to finish their models before their testing day and that day must be arranged before January 21<sup>st</sup>, 2023. For those competing in the past, read the rules this year carefully – much has changed since last year. The biggest changes are:

- Students will need to be sure to follow specifications. The rules have more or less reverted to those three years ago, eliminating the deduction system utilized in the past two competitions. Detailed instructions are on form. A blank form is included as an appendix and all educators will be sent one to distribute to students as a template.
- One improvement over last year: “Teams” this year will be actual TEAMS, having either 2 or 3 members, there will be no “TEAMS” OF ONE!
- While this is always a rule, it needs to be emphasized more than ever: All decisions by judges are final.
- This will be a public event both in-person and online. We will not mention any student last names on the broadcast. If there are any issues with the mention of first names, please email [reed.brockman@aecom.com](mailto:reed.brockman@aecom.com) and we will work it out. We are excited to have the contest so visible!
- The competition will make heavy use of the website [www.engineeryourfuture.org](http://www.engineeryourfuture.org). Registered educators will be invited to access a special page under the “MORE” tab on the navigation menu for registered Model Bridge educators. Please accept the invitation, as this will give access to all specification updates and allow better communication. Revisions and clarifications do not appear in the document but are considered addenda to the rules. Mentors and teachers can also email [bscesmodelbridge@gmail.com](mailto:bscesmodelbridge@gmail.com) and we will answer right away.
- We are happy to help you find mentors for your teams. We found that virtual mentoring was easier for volunteers but either live or virtual is okay. An educator must be present either way.

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## BRIDGE SPECIFICATIONS CHECKLIST

This checklist is to help you make sure your bridge complies with specifications. Make sure you read through the full specification!

- The bridge is completely made of 7.75-inch recyclable paper drinking straws, 6mm diameter, of brown Kraft paper material, and brown Kraft paper natural rubber self-adhesive tape (single sided), nominal 2" wide, 7 mil thickness. YOU ARE READING CORRECT – just straws and tape.
- The bridge weighs 16 ounces or less. The winner is determined by efficiency ratio (see the Bridge Specifications Section 1). You do not need to build up to the weight limit.
- The bridge height is not greater than 23". Teams needing to ship models will be given boxes 8" x 24" x 48" and the model must fit in that box. The maximum model dimension is 7" x 23" x 47". The minimum model dimension is 4 1/4" wide x NO MINIMUM HEIGHT x 38" long. All dimensions are square to the bridge and the minimum at any point will be considered for the minimum allowable, and the maximum will be considered for the maximum allowable.
- The bridge length must be greater than or equal to 38". If the bridge is to be placed on the table surface in between the concrete blocks it must also be less than 40" in length. The bridge length should be greater than 42" if the bridge is to be placed on top of the concrete blocks. See the Bridge Specifications Section 3.3 for a figure explaining the bridge lengths and load test setup. Bridges under 38" in length will not test well. Similarly, bridges should not be between 40" and 42" long, as the bridge will have a very short bearing area on top of the cinder blocks.
- The bridge shall have a roadway that either runs through the bridge or runs over the top side of the bridge. The roadway must be along the entire length of the bridge so that a scale truck (4" wide by 4" tall by 8" long) could drive from start to end over or through the bridge. The roadway does not need to be a continuous surface, but make sure there are strong supports for the truck to be placed on at any point along the bridge roadway length!
- If the roadway goes through the bridge (like a through truss or through arch), the scale truck shall fit along the length of the roadway, and the loading apparatus bars shall extend out the sides of the truck (See figures 3B and 3C).
- The bridge shall be at least 4 1/4" wide, but not wider than 7". Bridges wider than 7" may interfere with the loading device chains, which could cause the bridge to fail. If the bridge is a through truss or through girder type, the roadway between the main carrying members must be 4 1/4" wide.
- If being tested remotely, each educator must coordinate the logistics with Reed Brockman [reed.brockman@aecom.com](mailto:reed.brockman@aecom.com) well before January 21<sup>st</sup>, 2023.

## SECTION 1: INTRODUCTION

The goal of this competition is to design and construct a structure with the specified materials that can adhere to the following:

- Span a gap between 2 tables spaced 36 inches apart (to avoid length issues, all bridges must be at least 38" long). This can be done in one of three ways:
  - 38" – 39  $\frac{3}{4}$ " without packing shims made of index cards between the bridge and the concrete blocks at the back of the loading device, which are 40" apart, as horizontal end restraints
  - 39  $\frac{3}{4}$ " to 40" using index cards packed between the bridge and the concrete blocks to provide horizontal end restraint.
  - 42" to 47" sitting on top of the cinder blocks. (Lengths between 40 and 42" have short bearing areas and may fail by sliding off under deflection).

See Section 3.3: Bridge Span for more information.

- Fit a model truck (4" wide x 4" tall) through the bridge or along the topside of the bridge. To accomplish this with the truck interior to the bridge cross section, the bridge roadway (space between trusses or through girders) must be minimum 4  $\frac{1}{4}$ ". See Section 3.4 & 3.5 for more information.
- Hold at least the weight of the model truck plus loading device (which is approximately 9  $\frac{1}{2}$  lbs.).
- Weighs at most 16 ounces. For reference, 400 straws weigh 13 ounces and 55 yards of tape weighs 9 ounces.

At the end Prizes will be awarded based on the following categories:

- Most Efficient: Bridge efficiency is defined as the ratio of total load supported to self-weight of the bridge. The winner of this award will be the bridge with the highest efficiency value. In the event of a tie, the bridge with the higher aesthetic ranking will be declared the winner.
- Most Aesthetic: Aesthetics is based on craftsmanship, creativity, and display of sound design principles. The winner will be determined by the judges. In the event of a tie, the more efficient bridge will be declared the winner. As it pertains to remote teams, all qualifying failed models will be brought to the competition for aesthetic judging. Teams will be allowed to do cosmetic repairs.

## SECTION 2: COMPETITION PARTICIPANTS

This competition is available for students Between the 5<sup>th</sup> grade and 12<sup>th</sup> grade in the greater Massachusetts area. For this year, TEAMS MUST BE EITHER 2 OR 3 PARTICIPANTS No teams bigger than 3. BSCES strives to emphasize the importance of working in a group which is essential to engineering. Participants shall not be on multiple teams and no team may register more than one bridge for the competition.

All design and construction work for the model bridge (including devices that assist in fabrication, such as templates) shall be done only by the team members. Teachers, parents, and mentors are encouraged to provide education and guidance; however, they should not take control of design and construction. The overall goal of the competition is for students to learn how to think like an engineer and feel the pride that an engineer feels as they successfully build a model bridge of their own design.

Because the competition is live again, there is no upper cap on the number of teams competing.

## SECTION 3: BRIDGE SPECIFICATIONS

All the rules and specifications within this section must be followed to qualify for this contest. BSCES will allow testing of all bridges, but if specifications are not met, bridge will not qualify for prizes.

### 3.1 Materials

1. Bridges shall be built entirely of the following materials
  - a. 7.75-inch recyclable paper drinking straws, 6mm diameter, of brown Kraft paper material. Each team will receive 400 straws, weighing in at about 13 ounces. These can be cut, and each team will receive a pair of safety scissors with their materials. These straws can also be bent / warped. Only the material from these straws and the tape below are allowed and no substitutes. These can be painted or drawn on, but there should be no other coating or tape other than the tape below on these straws. The straws do not need to be visible. Any bridge decorated with any disrespectful messaging will be disqualified, not that we should need to say that. Please do not use any cutting tools or equipment that you would envision as giving an advantage to your team: no dremels, no lathes, no laser cutters, etc. We will allow utility knives and we understand these can be hazardous. We supply scissors but of course any scissors can be used. ONLY THE ACTUAL PARTICIPANTS CAN MAKE THEIR OWN MODEL – NO OTHERS MAY DO THEIR CUTTING OR EVEN DRAW OUTLINES TO BE CUT.
  - b. Brown Kraft paper natural rubber self-adhesive tape (single sided), nominal 2" wide, 7 mil thickness. This material is not far different than thick masking tape. Each team will receive one roll, which weighs 9 ounces. Obviously, either not all tape or not all straws will be used since the bridges will be limited to being 16 ounces. This tape can be used in any way desired, but the adhesive should not be used to attach to the loading device or supports.

Use of any other material may be grounds for disqualification, if deemed intentional by the judges. Schools will be provided with enough supplies to build the number of bridges initially requested, which is 400 straws and 55 yards of tape per team. While of course we could not be able to figure out exactly how much of each material would be used, please limit the straws in the model to the 400, and similarly do not use more than one roll of tape in the model.

Structures may not be brushed, sprayed, or dipped in any coating material. This includes, but is not limited to, coatings such as stickers, glue, fabric, or any filmlike coating. Non-structural decoration (tempura or watercolor paint, markers, pens, pencils, crayons, etc.) of the bridges is allowed. All questionable materials should be checked with the model bridge coordinator ([bscemodelbridge@gmail.com](mailto:bscemodelbridge@gmail.com)) before being used. BSCES requests that any decorations be tasteful and appropriate. Inappropriate markings on the bridges will be grounds for disqualification at the judging panel's discretion.

2. Once the bridges are loaded, another inspection of the bridges by the judging panel can be made to ensure that the proper materials were used that were not visible prior to testing.
3. In general, all students should follow this as a rule of thumb: if you feel you are bending the rules, please don't. Which leads us to the last rule:
4. ALL DECISIONS OF THE JUDGES ARE FINAL. During the building, if you have any questions or need any clarification about rules or specifications, please contact reed.brockman@aecom.com.

### 3.2: Bridge Weight Limit

The total weight of the structure shall be no more than 16 ounces. Bridges at the competition have until 10 AM to comply and can return to the model registration tables repeatedly before that time to check conformance. Not giving too much of a hint here, but it is sometimes strategic to make bridges well under the weight limit.

### 3.3: Bridge Span

The bridge will span between tables that are 36 inches apart. There will be 7 5/8" tall concrete (CMU) blocks that will be secured to each table 2" from the edge. The bridge may rest on the top surface of the table between the concrete blocks OR may sit on top of the concrete blocks. The bridge cannot be adhered or attached to the blocks in any way, however it may contact and bear on the blocks. The bottom of the bridge ends (the bearing area) must be level and stable and the bridge must be able to stand on its own under the effects of gravity when set onto the loading device.

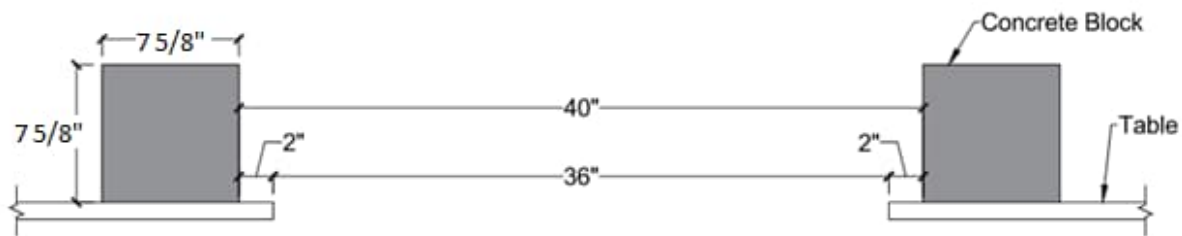


Figure 1: Span of Bridge

Bridges Placed on the Table Surface: If the bridge rests on the table surface, it will need to span across the 36" gap, but shall be less than 40". It is recommended that bridges designed for this setup be at least 38" in length to allow for proper bearing area on the table. If a model is between 39 3/4" and 40", the ends can be shimmed with index cards to resist horizontal thrust.

Bridges Placed on Top of Concrete Blocks: If the bridge rests on top of the concrete blocks instead of the table, it will need to span across the 40" between blocks. This means that the bridge deck will need to be longer than 42", having enough length to rest on each block. Models can be no longer than 47".



### 3.4: Bridge Configuration

1. No portion of the bridge shall extend more than 23" above the table surface (15" above the top surface of the concrete blocks)
2. No portion of the bridge shall extend below the top surface of the table. Bridges will be permitted to extend below the top surface of the table only if it is due to incidental deflection of the bridge under loading (but note the amount of deflection permitted due to load is limited). See *Failure of Bridge* Section 3.6 for more information.

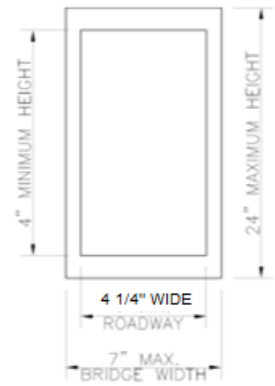
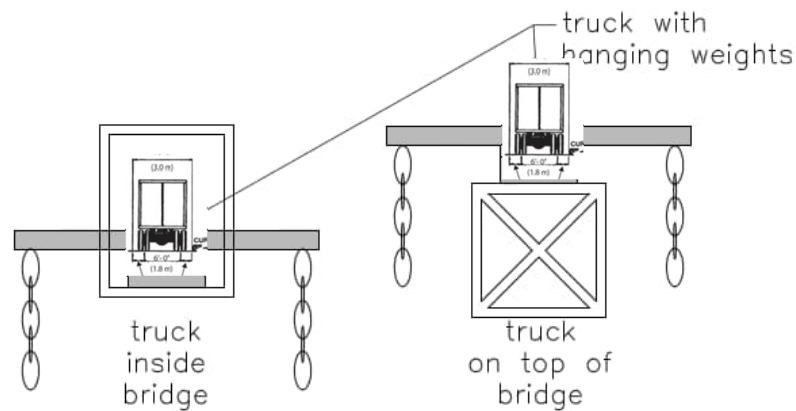


Figure 2: Cross Section of Bridge with Roadway through Bridge

3. The overall width is limited to 7 inches maximum. The roadway width shall be a minimum of 4 1/4 inches. The roadway is defined as the distance between the sides of the bridge (in the case of a through



truss) or the overall width of the bridge when the roadway is on top of the bridge. See Figure 2 and Figure 3a.

Figure 3a: Different Ways to Load the Bridge - Section Views

4. The roadway/loading surface must be provided at all potential wheel support locations (refer to Figure 7). Since the truck that is loaded has "wheels" that are each 2" wide, the roadway shall have enough material to prevent the wheel from falling through. There should not be any obstructions that would prohibit the truck from "driving" across the bridge span.
5. The 4 1/4" minimum shown in Figure 2 shows a roadway inside the bridge. The same width rule of 4 1/4" minimum applies if the roadway is on top, which coincides with the minimum width rule for a bridge being 4 1/4". See Figure 3.

### 3.5: Loading the Bridge

We are well aware that this particular section gets a little abstract, being that students will only see these images herein and their bridge being tested during a webcast, but reading this section carefully will allow the bridges to be safely loaded up with weights and also allowing students to avoid deductions. The model truck that will be placed on the bridge has the following dimensions and properties:

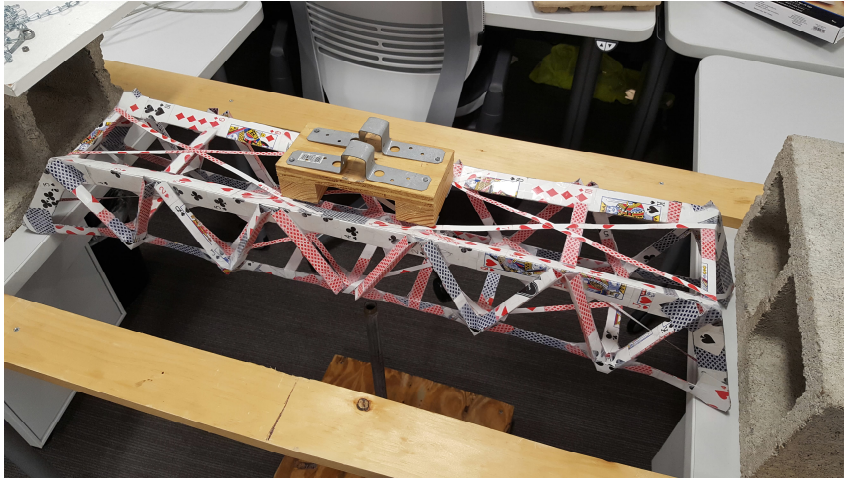


Figure 3b:

Top: Example of Loading device placed on top of bridge. (Obviously – this is not this year's materials but the same loading device!)

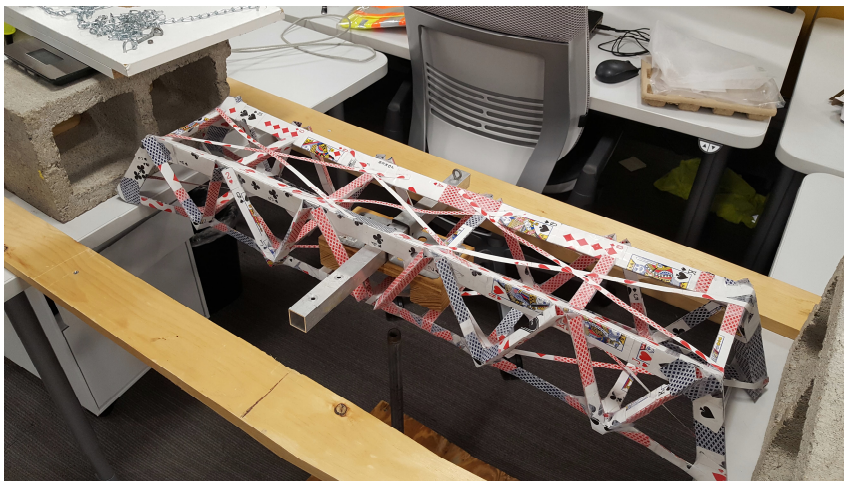


Figure 3c:

Bottom: Example of loading device located inside the bridge. There must be room for the loading device to fit inside the structure as well as room for the transfer bar to fit in between truss members.

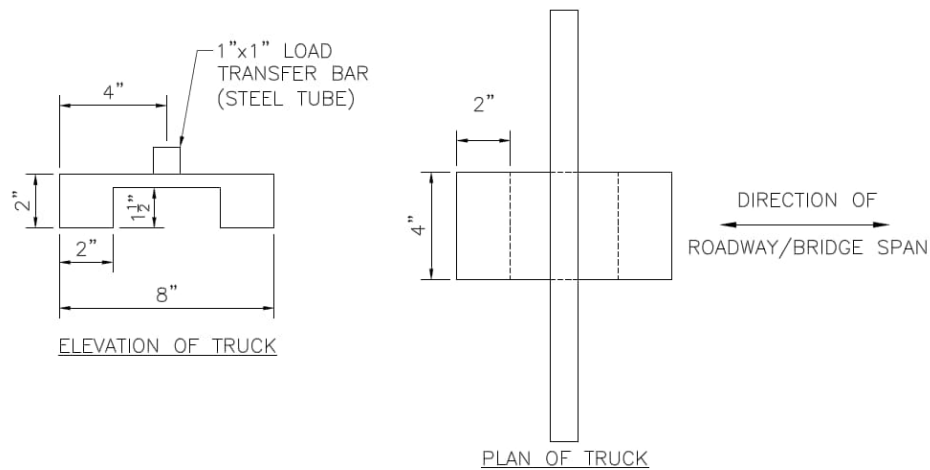


Figure 4: Details of Truck

1. In order to be loaded, the bridge shall (at a minimum) be capable of supporting an initial weight of the loading apparatus (approximately 2 lb truck + 7.5 lb loading platform = 9.5 lbs).
2. The truck will be placed on the loading surface at a point that will be determined by the roll of a die, which will take place at the time all bridges are received (see Figure 7). The random point will remain the same for all teams. A load transfer bar will be placed across the top of the truck with chains connected at each end extending downward to connect to a loading platform beneath the structure. Volunteers will test each structure by placing the supplied weights onto the loading platform until failure. All bridges will be checked to assure the crossbar will fit prior to the competition and if the truck needs to be shifted, a deduction will be assessed.
3. Loading is limited to 250 lbs. of free weights. Loading is also limited to the top of the center support pole (18.5"). Lighter weights, when stacked, will take up more height than heavier weights, when stacked so keep this in mind when selecting which weights to load. Once loads are applied (touch the weight below), they cannot be removed. Any load being applied at the time of bridge failure will not be counted towards the recorded loading. At the moment a newly applied weight touches the weights below it all weights below are official. It is completely the responsibility of the design team to decide how best to apply the loads, and they can communicate their plans for loading through the linked form.
4. The loading apparatus (truck + loading platform) must be capable of being supported on the loading surface (roadway) as shown in the diagram. This means that your structure **MUST** have enough roadway surface for the truck to be placed at one of the six locations along span (see Figure 7), but each bridge does not need a continuous surface. The roadway should be reasonably level (some arch is permitted) from one end of the bridge to the other without obstruction. Bridges with roadways that have excessive slope causing the truck to slide off of the bridge will not be aided in the loading process and tested as best possible, with a deduction.

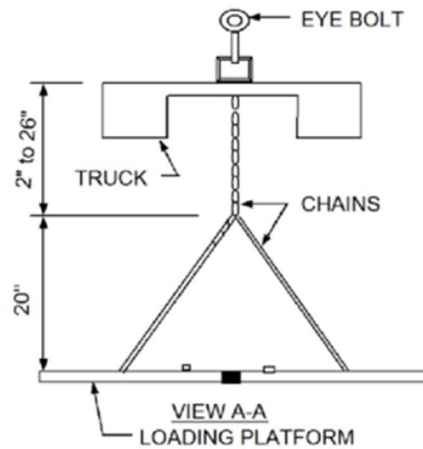


Figure 5: Loading Apparatus with Truck

5. If the roadway surface is not along the top of structure, the design must allow for a 1" x 1" load transfer bar (see Figure 4) to be passed through the bridge transversely with the bar's underside 2" above the loading surface, without causing interference with the structure during testing. The design must accommodate the truck being placed in any of the possible loading areas.

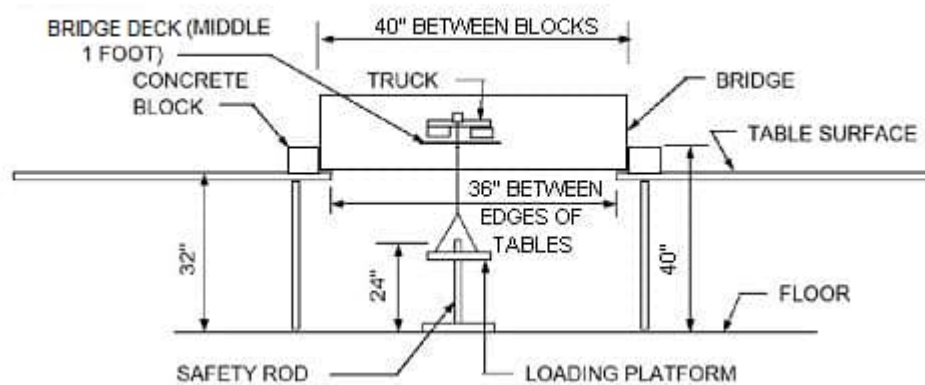


Figure 6: Sketch of Bridge with Roadway Surface through Bridge

6. The concrete blocks provided on the loading tables are there for bridges that exert a horizontal force (e.g. arch bridges). These concrete blocks will be restrained and unable to slide apart. In cases where the bridge exerts a horizontal force on the blocks (e.g. thrust from arch bridges), the blocks can be counted on to resist horizontal forces. If your design intent is to utilize the concrete blocks to resist horizontal thrust, please limit the end to end length of your structure to be under 40" by at least 1/16". The judges will fill the small gap with index card shims. It is the responsibility of the designers to have gaps of consistent width. Each shim will be placed alongside and parallel to each other.
7. Make sure your bridge fits between the concrete blocks or on top of them. The blocks will be placed in the loading frame on the tables and will not be removed at any time during the competition.

8. In order for a bridge to be selected as the most aesthetically pleasing bridge, it must carry the minimum specified weight (9.5 lbs = loading device + truck).

The random loading points shall be as shown in the figure below:

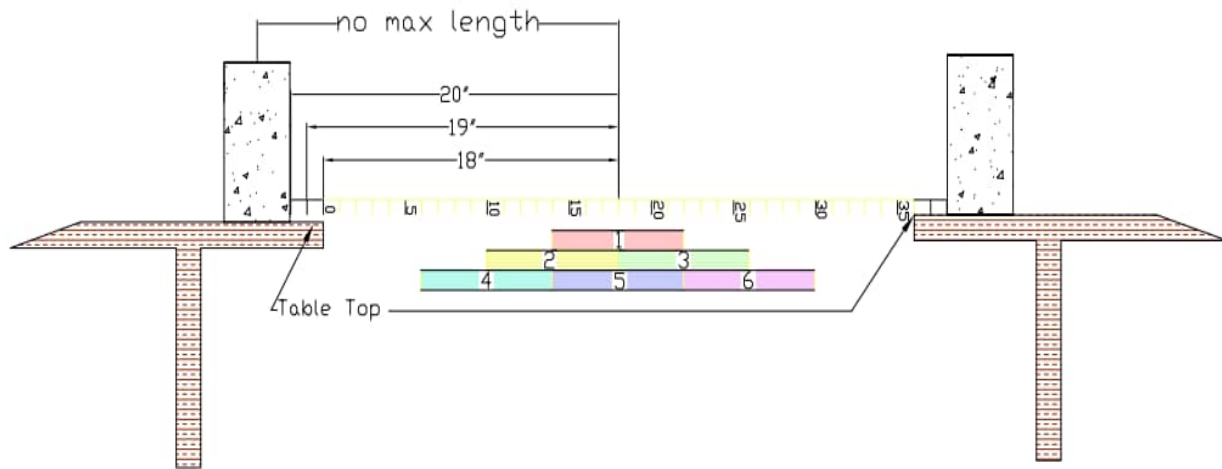


Figure 7: Possible Loading Positions

The various colored blocks represent the 8" long truck, each color representing a possible loading position. Position 1 and 5 are centered on the bridge. All other positions are 4" intervals of position 1.

### 3.6: Failure of the Bridge

1. Failure is defined as a fracture of primary members causing either the "truck" to not bear on the roadway or an abrupt drop in elevation for a truck that would be extremely hazardous for a driver. It is also considered failure if the deflection of the structure causes the truck to settle more than 4" (dropping the weights to the base). Slippage from the bearings or overturning of the structure is also considered failure.
2. Settlement is measured by the distance of the underside of the loading device to the top surface of the centering device. Upon placing the loading device on the bridge, the cables are set snug with 4" blocks holding a 4" space available for deflection.

The bridge fails when any of the above criteria is exceeded (the bridge fractures, slips off bearings, overturns sideways or deflects out).

### 3.7: Deductions

Unlike the past two years, there will be no deductions. Bridges need to conform to specifications by 10 AM. Since we will be sharing this via Teams, these methods of disqualification still apply:

INAPPROPRIATE OR DISRESPECTFUL MARKINGS ON A BRIDGE MODEL – Disqualification.

CHEATING – Using a stronger material in a clandestine manner, using any reinforced tape or strong packaging tape, or any other action that upon judge review is considered cheating is grounds for disqualification. Please, don't cheat.

INAPPROPRIATE OR DISRESPECTFUL COMMENTARY TOWARDS ANYONE posted during the YouTube broadcast will be grounds for disqualification. If there are such postings, the site will be reviewed, the responsible party disqualified, and the rankings re-worked.

## SECTION 4: MATERIALS DELIVERY, PRE-COMPETITION DELIVERABLES / REQUIREMENTS, AND MODEL DELIVERY INSTRUCTIONS

### MATERIALS DELIVERY

Around Halloween, materials will be delivered to each educator. It is up to the educator to distribute materials to students. To avoid shipping costs, BSCES may contact educators to deliver materials, but many may be shipped.

For every model, the following will be supplied:

- 400 paper straws
- 1 roll Kraft paper tape (55 yards)
- 1 pair safety scissors
- 1 retractable tape measure
- Copy of Handbook

\*NOTE: Educators may purchase additional materials. The amazon products will be linked in an email. BSCES is only supplying the materials listed above for each team.

### MODEL DELIVERY

To avoid shipping costs, educators can contact [reed.brockman@aecom.com](mailto:reed.brockman@aecom.com) to arrange delivery other than shipping.

### ELECTRONIC AND HARD COPY BRIDGE MODEL INFORMATION FORM SUBMISSION INSTRUCTIONS

Students competing remotely must fill in the participant form. One copy must be included with the model and the form should also be emailed to [reed.brockman@aecom.com](mailto:reed.brockman@aecom.com). PDF is the preferred format. The electronic file should be FULL SCHOOL NAME – FULL STUDENT NAME. By full name, we mean not abbreviations – name must be of a length to adequately identify the school or student. A file named MHS – RB.pdf is not acceptable.

### POST-COMPETITION PACKAGE DELIVERY FROM BSCES

Prizes, results, T-shirts, etc. will be sent within 2 weeks after the competition (I deeply apologize for last year). All packages will be delivered to the teachers for distribution. Model bridges will not be returned to students participating remotely.

## SECTION 5: BRIDGE MODEL INFORMATION FORM (REMOTE PARTICIPATION ONLY – IF ATTENDING COMPETITION, THIS DOES NOT APPLY)

Each remote team is required to fill in a "Bridge Model Information Form", and that needs to be submitted both as a printed copy placed with the model AND electronically. This form is attached at the end of this handbook as an appendix and can be downloaded from a drobox that educators are invited to join. Completed forms can be emailed to [reed.brockman@aecom.com](mailto:reed.brockman@aecom.com) or shared in any way that can be worked out between us and the teacher, really.

We strongly recommend every participant reviews the form closely and spends an appropriate amount of time filling it out. And, of course, every participant needs to assure it gets to us. We will reply with confirmation as each is received.

## SECTION 6: MOST AESTHETIC MODEL JUDGING

The aesthetics will be judged in person by judges at the competition.

The judges in general consider the following factors equally in judging this award:

- Craftsmanship (symmetry where appropriate, precision cutting/folding/connecting)
- Sound design practices (wider hollow members in compression areas and thinner in tension areas, adequate bracing, high moments of inertia of areas in high bending, thickened cross sectional members in areas of high shear / crushing, etc.)
- Visual appearance

## SECTION 7: COMPETITION DAY

February 4<sup>th</sup>, 2022, 9 AM – noon (registration table opens at 8:30).

This competition will be via Microsoft Teams; details will follow. This competition will be open for public viewing. No student last names will be used during the competition.

All bridges will be weighed, measured, checked/scored for deductions, and judged for the "Most Aesthetic" award prior to the start of the competition at 10 AM.

**Format:** The competition will be live with a camera showing the competition via a Teams meeting. Virtual teams will be tested by judges/volunteers first, followed by the in-person participants. Our hope is that this contest will be viewable by the entire public, so we will not mention full names of students in the broadcast.

**Challenges:** Because of the hybrid virtual nature of the competition this year, it must be clear that the volunteers are doing the best they can, have no bias.

Any CHALLENGES during the live competition must be brought up immediately. A STUDENT must present the challenge directly to the contest coordinator, Reed Brockman, at the time it is recognized as an issue. The competition will pause, and the issue will be discussed by the judges.

The judges' decisions will be final. Any challenges, complaints, or appeals after the competition will not be allowed.

The only ways to disqualify this year are to have inappropriate markings, to intentionally strengthen a bridge in a way considered by judges to be clearly cheating.



or to post a completely inappropriate comment online during the contest. These models disqualified in these ways will not be load tested and the educators will be sent a note explaining what happened. There is no challenging disqualifications.

- Aesthetic: The bridges will be examined for the most aesthetic award (see criteria elsewhere in this handbook) before any bridges are load tested. Please note that for a bridge to be selected as the most aesthetic bridge, it must carry the minimum load of *9.5 lbs (the weight of the loading apparatus)*.
- Load Testing: Each bridge (aside from those requested not to be tested fully) will be loaded as previously described until failure. Failure is defined as fracture, inability to support loads, or deflection of the structure causing more than 4" of deflection (measured from the original elevation of the "truck" assembly). The maximum load supported by the bridge (ultimate load) prior to failure will be recorded. Individuals that do not want their bridge tested to failure may request this on competition day. We recommend loading the bridges to failure. There is no set plan for preserving bridges after the competition anyway, other than in video and photographic form.

## SECTION 8: FINDING A MENTOR AND OTHER BSCES ASSISTANCE

Schools wanting mentors can request this of BSCES. Overall, it works best to keep them virtual.

While we expect that your school will CORI check volunteers, we also check on our volunteers and have them take a training about working with school children (see the "[Flip the Switch](https://www.fliptheswitchcampaign.org/)" effort, sponsored by gymnast Aly Raisman).

In general, it is between the educator and mentor to arrange virtual meetings with competitors. Mentors are not to be working with competitors without an educator involved.

The BSCES also runs hands-on activities to help teach about a wide variety of bridges and run tours of the bridges in Boston. We are back doing this full force!

As an added bonus for those who read things until the end, here are some helpful hints that the volunteers developing this year's rules came up with: (a) this tape has some properties that you may want to consider; (b) look up the phrase "development length"; (c) this material sounds easy but it has its challenges, so take the time to experiment and see how it behaves. (d) The tape and straws behave differently, and one may be favored over the other for a beam depending on if it will be in tension or compression (e) the straws can be cut with standard scissors, but the safety scissors supplied may snap if one tries to cut through multiple straws bound together with the tape. (f) thin members buckle if they have excessive unbraced lengths. (g) you cannot push on a rope. We could just keep going! (h) Think like an engineer, do the research on all tips listed above, sketch out designs, make test models (as best you can) and improve on what you have, work together as a team and talk ideas through. Lastly,

# HAVE FUN WITH IT!

# APPENDIX X: BRIDGE MODEL INFORMATION FORM FOR REMOTE PARTICIPATION

BRIDGE MODEL INFORMATION FORM – FORM DUE JANUARY 24TH	
NAME THIS FILE AS FOLLOWS: SCHOOL FULL NAME – STUDENT FULL NAME AS FILLED OUT BELOW. PDF FILE IS PREFERRED, BUT IF NOT POSSIBLE, OTHER FORMATS ACCEPTABLE	
EMAIL THIS FORM TO <a href="mailto:REED.BROCKMAN@AECOM.COM">REED.BROCKMAN@AECOM.COM</a> AND INCLUDE PRINT OF FORM IN BOX WITH MODEL. IF A PRINTER IS NOT AVAILABLE, HANDWRITE ANSWERS ON PAPER INCLUDED WITH MODEL. IF NO FORM IS INCLUDED, THIS WILL CAUSE EXTENSIVE CONFUSION AS BRIDGE WILL NOT BE READILY TIED TO A PARTICIPANT. IF THERE IS AN EMAIL ISSUE, CONTACT <a href="mailto:REED.BROCKMAN@AECOM.COM">REED.BROCKMAN@AECOM.COM</a> RIGHT AWAY.	
School or Organization Full Name (no abbreviations)	
Student Full Name	
Educator Name	
Student Grade	
Name of Bridge	

FOR JUDGES ONLY:

PRE-COMPETITION:

WEIGHT (includes additional weight penalty for tape used as structural member @ 1oz. per 6" member)

BRIDGE WEIGHT (POUNDS, 2 DECIMALS)	POUNDS
DEVICE WEIGHT	9.50 POUNDS
APPLIED LOAD WITHOUT WEIGHTS	POUNDS

FOR JUDGES – COMPETITION DAY

BRIDGE NAME	
SCHOOL	
PARTICIPANT	
GRADE	
EDUCATOR	
ROADWAY LOCATION	
SELF-WEIGHT	
AESTHETIC RANK (N/A IF NOT TOP 5)	
LOADING METHODOLOGY SELECTED	
TOTAL WEIGHTS APPLIED (Last weight added at failure does not count)	POUNDS
TOTAL LOAD APPLIED (TLA) (SELF WEIGHT, LOADING DEVICE AND WEIGHTS)	POUNDS
EFFICIENCY RATIO (COMPETITION WEIGHT / SELF WEIGHT OF BRIDGE)	