

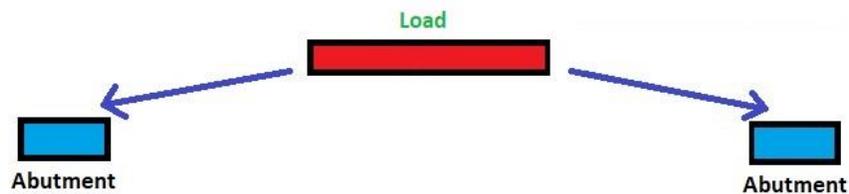


# Structural Engineering

## 2023 Middle School Design Brief

### BACKGROUND

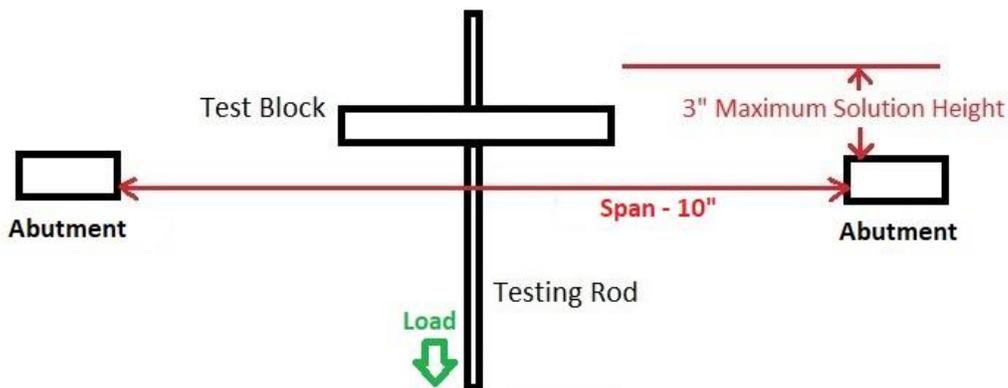
Individual structural members working together to support a load is the challenge for every engineering project. The design brief for 2023 is to design a balsa structure that will support the greatest load possible (in the center) using the least amount of materials. The solution must transfer the load to the top of the abutments as efficiently as possible.



### DIMENSIONS

The solution must meet the following dimensions:

Length	Minimum <b>10.5"</b>	Maximum <b>12"</b>
Width	Minimum <b>0"</b>	Maximum <b>3"</b>
Height	Minimum <b>0"</b>	Maximum <b>3"</b>
Test Block	6" long x 2" wide x 3/4" tall	
Span	The structure tester will have a span of 10"	



## BUILDING MATERIALS

Balsa strips (1/8"x1/8") is the only building material permitted. A maximum of **20** linear feet of balsa is allowed to construct the solution. Treated, conditioned, or coated balsa is **not** permitted. No other construction materials are allowed to be used in the construction of your solution.

The participants may choose a **glue** type; however, hot-melt glue is not allowed for the pre-built or on-site structures. Keep the time limit in mind when selecting the glue for semifinals.

## SPECIFICATIONS

1. The solution must be constructed using only **1/8"** by **1/8"** balsa sticks. The balsa sticks must be wood only – treated, conditioned, or coated balsa is **not** permitted.
2. A maximum of **20** linear feet of balsa sticks can be used in the construction of the solution.
3. The test block will be **6" long, 2" wide, and 3/4" tall** (placed with length horizontal).
4. The test block will be placed on the solution in the center. There is no minimum measurement from the bottom of the solution to the bottom of the test block. The solution must accommodate the placement of the test block to the center of the solution from the end or from the top.
5. No part of the constructed solution may extend above 3" (the test block may extend above 3").
6. The 1/2" test rod must pass vertically through the center of the solution.
7. The span of the abutments will be **10"**.
8. A tolerance of +/- 1/8" will be applied for the length, width, and height of the solution.
9. The solution may not contact any vertical surface of an abutment below the top of an abutment at any time.
10. No part of the constructed solution can extend below the top surface of the abutments when placed on the abutments for testing.
11. Lamination refers to the combining of two or more pieces of material with the glue grain running in the same direction. **Laminations of any kind are NOT allowed in the construction of the solution.**
12. Lap joints are allowed and involve the gluing of two pieces of Balsa material with the grain pattern normally at right angles; however, lap joints less than 15° or greater than 165° would circumvent the lamination guidelines and would result in a disqualification.
13. Gussets are not allowed to be used in the construction of the solution.
14. The use of glue for coating structural components is not allowed. Excess glue on joints is considered a gusset and will result in a disqualification.

## AUTOMATIC DISQUALIFICATIONS

1. Use of any material that is not 1/8" x 1/8" balsa sticks
2. Use of any laminations or treated, conditioned, or coated balsa
3. Use of gussets or over-gluing that emulates a gusset
4. The solution contacts any vertical surface of the abutments at any time

## DRAWING AND PARTS LIST

In construction, a builder uses a set of drawings along with a list of actual cut parts needed for construction. For this requirement, your drawing must be a full-size three-view drawing that includes a front, top, and right-side view of the solution. The title block on the drawing must include only the team ID number. The paper size is no larger than 11"x17". One page is allowed for the drawing.

A parts list is required. The parts list needs to be a list of the actual cut pieces used for the final solution. The list needs to include the length and quantity.

*Example of a Parts List:*

All material is 1/8"x1/8" Balsa Sticks

Part Name	Length	Quantity
Vertical Support	6"	16
Horizontal Connectors	2.75"	24
Diagonal Connectors	3.5"	16

## SPECIAL NOTE

When designing the solution, the solution must allow room above the test block for the coordinator/judges to apply the u-clip and wingnut to the 1/2" testing rod for testing. This applies to any cross members or other structural elements of the solution.

## REQUIREMENTS FOR CHECK-IN ON-SITE

1. The completed solution is placed in a single plastic storage box (size limit for the storage box is a maximum of 18" long, 16" wide, and 12" tall). The plastic storage box should have only the **team/chapter ID** on the outside.
2. The documentation materials (comprising a "portfolio") are required and must be secured in a **clear from report cover**, which is placed inside of the plastic storage box:
  - Team Verification Form
  - Analysis and Assessment Form
  - Full-size three-view drawing of the solution on one (1) piece of paper no larger than 11"x17" (folded as needed to fit into the documentation portfolio)
  - A parts list of all the structure's cut pieces used in construction

Note: The submitted documentation (drawings and parts list) will be scored and will contribute to the overall solution score used when judging structures.