Structural Design and Engineering

2026 High School Problem Statement

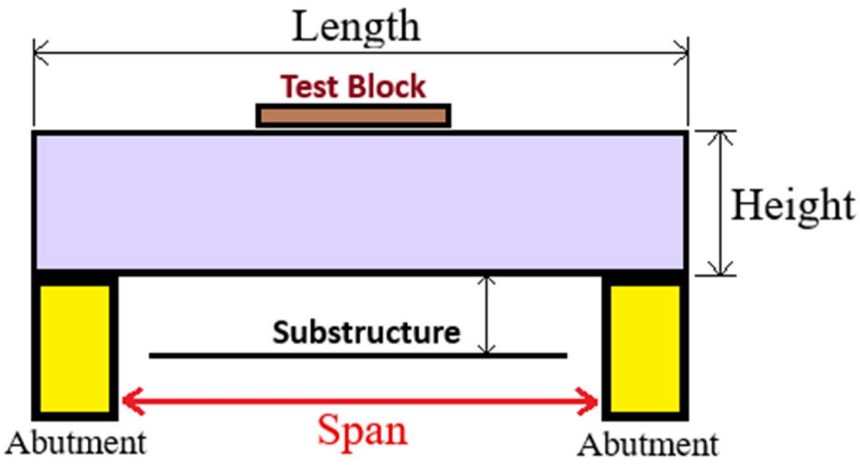
BACKGROUND

Individual structural members working together to support a load is the challenge for every engineering project. The problem statement for 2026 is to design a balsa structure that will support the greatest load possible (on the top and in the center) using the least amount of materials. A substructure element is permitted. 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 **13**"	Maximum **14**"
Width	Minimum **2**"	Maximum **3**"
Height	Minimum **3**"	Maximum **4**"
Substructure	Minimum **0**"	Maximum **1.5**"
Test Block	6" long x 2" wide x 3/4" tall	
Span	The structure tester will have a span of **12**"	



BUILDING MATERIALS

Balsa strips (1/8"x1/8" and 1/8"x1/4") are the only building material permitted. A maximum of **20** linear feet of balsa is allowed to construct the solution – a maximum of **14** feet of 1/8"x1/8" and a maximum of **6** feet of 1/8"x1/4". 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 **glue** type; however, hot-melt glue is not allowed for the pre-built or on-site semifinal structures. Keep the time limit in mind when selecting the glue for semifinals.

SPECIFICATIONS

1. The solution must be constructed using only a mixture of **1/8**" x **1/8**" and **1/8**" **x 1/4**" 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 – a maximum of **14** feet of 1/8"x1/8" and a maximum of **6** feet of 1/8"x1/4".
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 top of the solution in the center. The minimum 3" height must be maintained under the test block for the duration of the test block.
5. No part of the constructed solution may extend above the bottom of the test block. The solution cannot contact any surface on the test block except the bottom of the test block.
6. The 1/2" test rod must pass vertically through the center of the solution.
7. The span of the abutments will be **12**".
8. A tolerance of +/- 1/16" will be applied for the length, width, and height of the solution.
9. The solution may not contact any surface of the abutments at any time other than the top surface.
10. A substructure is not required but is permitted. If a substructure is included, no part of the constructed solution can contact the vertical surfaces of the abutments or any other surface at any time (even if due to bending or flexing). Touching, at any time, of the vertical surfaces of the abutment or any other surface will result in a DQ.
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 lamentation 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 disqualification.

AUTOMATIC DISQUALIFICATIONS

1. Use of any material that is not 1/8" x 1/8" or 1/8" x 1/4" 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 surface of the abutments other than the top surface at any time (even if it is due to flexing or bending).
5. The solution contacts any surface on the test block except the bottom of the test block.

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 team must develop a drawing. The drawing must be a three-view drawing that includes a **front**, **top**, and **right-side** view of the solution. If a full-scale drawing is not possible, a scaled drawing is permitted. The drawing must include the **test block** to indicate where the test block will be placed for evaluation. 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 parts list should include the length, size, and quantity. The parts list should provide the total inches for each size of material (for example, 135 inches of 1/8"x1/8" balsa and 46 inches of 1/8"x1/4" balsa).

Example of a Parts List:

All Material Is Balsa Sticks

Part Name	Length	Size	Quantity
Vertical Support	2"	1/8"	6
Horizontal Connectors	9"	1/4"	4
Diagonal Connectors	1.5"	1/8"	16

RESEARCH AND DEVELOPMENT

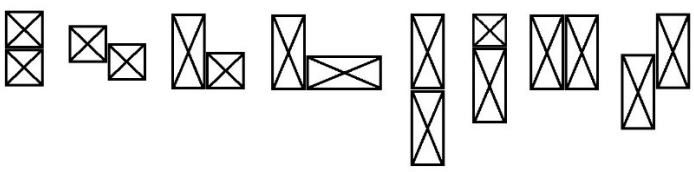
Photographic evidence is required for a minimum of three iterations tested to achieve the final solution. Each photo can be of a top or side view, however, the selected view must show as much detail as possible. Each individual photo should include a label and a written description of where the solution failed and what modifications were made for the next iteration. (Three pages maximum)

SPECIAL NOTE

When designing the solution, the solution must allow room for a 1/2" testing rod to pass through the solution from the bottom to the top in the center (length and width). The coordinator/judges will apply the u-clip and wingnut to the top of the test block for testing. Any cross members or other structural elements of the solution must accommodate the testing rod.

LAMINATION

Lamination refers to the combining of two or more pieces of material with the glue grain running in the same direction. The figures below are the end view examples of laminations (all possible illegal laminations are not shown below). **Laminations of any kind are <u>NOT</u> allowed in the construction of the solution.**



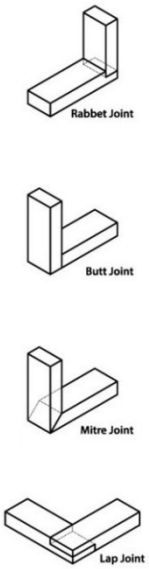
REQUIREMENTS FOR CHECK-IN ON-SITE

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 and the solution along with the documentation (portfolio) on the inside. ***The toolkit required for the semifinal round is a separate box and not submitted during the preliminary round submission. The only items permitted in the plastic storage box submitted at check-in are the four items listed in #2 below.***

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.
   - 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). The drawing includes the test block to indicate where the test block will be placed for evaluation.
   - A parts list of all the structure's cut pieces used in construction.
   - Research and development photos and written descriptions of at least three iterations.

   Note: The submitted documentation (drawing, parts list, and research and development photos and written descriptions) will be scored and will contribute to the overall solution score used when judging structures.

Sample joints: Not all types are shown.



Special Note: The solution must permit the testing rod to pass through the solution.