

Middle School STRUCTURAL ENGINEERING

2016 PROBLEM STATEMENT

BACKGROUND

Your parents have decided to buy a lakeside lot on which to build a home. The front of the lot is bordered by an access road that follows the perimeter of the lake. The elevation of the lot varies from one side to another: the left side maintains a gradual slope from the front of the property down to the lake, while the right side has a steep drop off adjacent to the access road. For aesthetic and access purposes, your parents wish to have a bridge built that connects the front entrance of the home to a point just off of the access road.

CHALLENGE

Research truss and structural framing designs; use the research to develop and engineer a design for a bridge structure that will provide access to the home.

Be sure to consider the following in developing a design:

1. Aesthetics
2. Size constraints
 - a. Length
 - b. Width (inside and out)
 - c. Height
3. Railing requirements
4. Dead load of the structure
5. Live load of the structure
6. Materials durability and availability
7. Maintenance

DIMENSIONS, MATERIALS, SPECIFICATIONS

Actual dimensions

Length of bridge:	40'
Inside width of bridge:	8'
Overall height of bridge:	6'

Scale dimensions

Structure scale:	$\frac{1}{4}$ " – 1'
Structure length:	10"
Inside structure width:	2"
Outside structure height:	1 $\frac{1}{2}$ "

Materials

Balsa wood sheet - $\frac{1}{32}$ " (for the bridge platform/walking surface only)

Balsa wood strips

12 pieces, $\frac{1}{8}$ " x $\frac{1}{8}$ " x 24" (for structural framing components)

Balsa wood strips

2 pieces, $\frac{1}{8}$ " x $\frac{1}{4}$ " x 24" (for horizontal structural framing components)

Card stock (65 lb.)

1 sheet (for covering of the inner sides)

Specifications

1. Bridge sides: 3/8" thick
2. Bridge sides, inside covering: one layer of 65# card stock (outsides remain uncovered)
3. Bridge platform framing: 3/8" thick
4. Bridge platform: 1/32" sheet (only one thickness allowed)
5. The bottom of the structure framing will be placed on the horizontal surface of the abutment blocks of the testing device.
6. Substructures are not allowed.
7. The entire inside length of the structure must remain open above the platform; therefore, no supports are allowed across the top of the structure, side to side.
8. A one-inch (1") hole must be left in the center of the structure so that a testing rod can passed through.
9. 1/2" of each end of the structure will be placed on the abutment surfaces for testing; blocks will be attached to the abutment surfaces to establish the designated placement.
10. The test block will be 1 3/4" wide x 3/4" thick x 5" long.
11. For this event, *lamination* refers to the combining of two or more pieces of material with the grain running in the same direction; laminating pieces of same size balsa materials is not allowed for this event; laminating of card stock also is not allowed.
12. Lap joints are allowed and involve the gluing two pieces of balsa material with the grain pattern normally at right angles; however, any lap joint less than 10° or greater than 170° would circumvent the lamination guidelines and be ruled unacceptable.
13. The card stock may be used as gusset material to connect/reinforce butt and end joints of materials; card stock may not be laminated between structural members.
14. Any type of glue, other than hot glue, may be used for construction; the use of glue for coating structural components is not allowed.

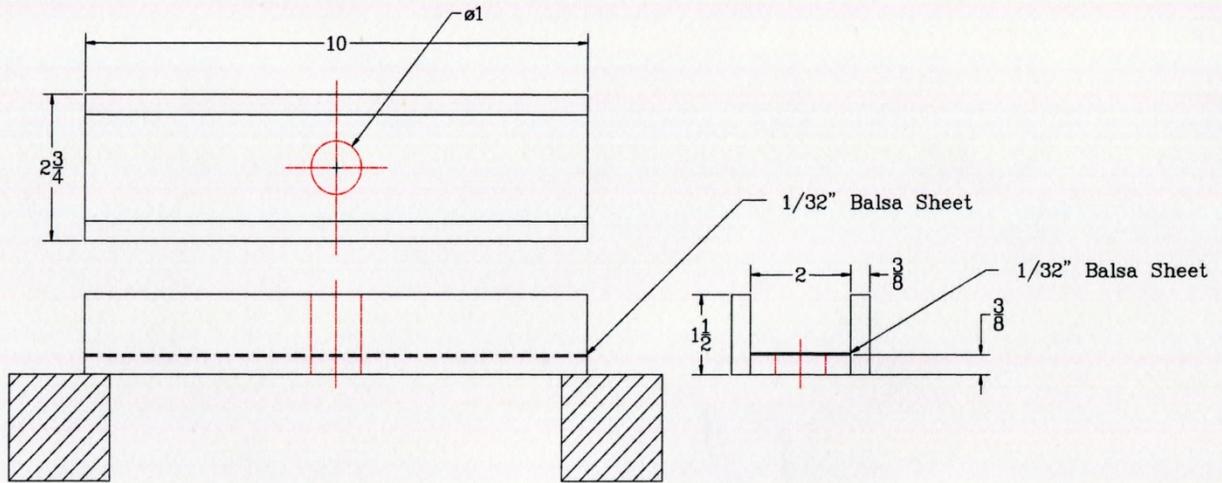
REQUIREMENTS FOR CHECK-IN

1. Completed model structure
2. Three-view drawing
3. Verification form
4. Assessment form (page 303, 2016 & 2017 MS Competitive Events Guide)

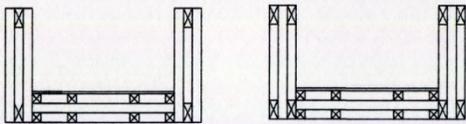
ILLUSTRATION

The illustration that follows provides information about size constraints, configurations, and types of joints allowed for the structure.

2016-2017 MIDDLE SCHOOL BRIDGE DRAWING DESIGN LAYOUT



Sample End Views



Examples of Material Configurations

- LEGAL**
- Lamination
Grain of middle piece at right angle
- NOT LEGAL**
- Lamination
Grain of middle piece parallel with others

