The Spring 2019 South Warren Balsa Wood Bridge Competition

Your task is to construct a bridge that can hold as much weight as possible while using the least amount of material. Each bridge team will be given 5 balsa wood sticks (610mm long each) and a small bottle of brightly colored glue from which to construct a bridge. The bridge must be constructed using *only these materials* and must meet the required specifications below. The bridge can be a Beam-style or a Truss-style bridge. Your science lab fee covers the cost of building and testing materials. Please register your bridge team using the Google form found on Mr. Bryant's website: mrbryant.net or on Mr. Kessler's Google Classroom page.

Objectives:

1. Structure – Build a bridge with the greatest calculated efficiency.
    - The bridge will be tested for maximum weight supported and sustained before breaking.
    - The bridge must hold the minimum weight of the empty load apparatus.
    - Efficiency is calculated with the following equation:

      Efficiency = (maximum weight sustained) / (weight of bridge)

2. Aesthetics – Build a visually pleasing structural form.
    - Scores will be given only by rank.
    - Judges will be looking for neat workmanship, clean lines, and overall structural creativity.
    - The aesthetics objective will not factor into the grade you receive.

General Bridge Specifications:

- The constructed bridge must measure within the bridge dimensions in Figures 1 and 1A. Beam-style bridges cannot be more than 30mm tall.
- There must be a clear passage through the bridge (Truss style) or on top of the bridge (Beam style) that allows a 50mm square wooden block to slide along the length of the bridge.
- The bridge must provide a place for the block to be positioned and loaded. A load must be able to be hung from the wooden block using a small metal hook that must pass through an opening in the roadbed of the bridge.
- The roadbed of the bridge must have at least two but no more than four main "girder" beams that make up the entire length of the bridge. These must be single linear beams parallel to the length of the bridge.
- The joints of the bridge (i.e., places where beams intersect) may be glued together only with the glue provided. Glue cannot be "globbed" to increase strength, meaning that there cannot be so much glue that the joint itself is held together more by the glue and less by the design of the joint. Figure 3 illustrates the "allowed" and "not allowed" types of joints.
- Paint or any other chemicals that coat the wood surface are not allowed.

Any bridge not conforming to these specifications will be required to be altered or be disqualified.

Project Dates:

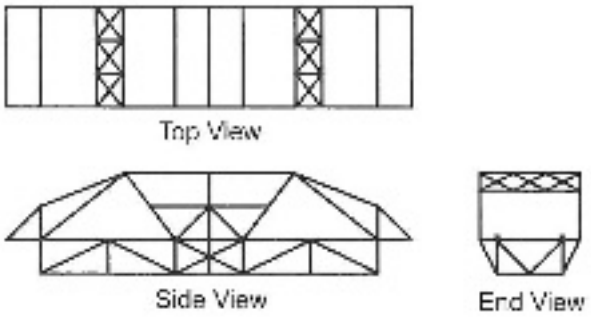
~Friday, February 15th, 2019	Project Assigned
Friday, February 22nd, 2019	Bridge Team Registration Deadline
Friday, March 1st, 2019	**Initial Design Plan Due/** Class time for bridge questions
Tuesday, March 26th, 2019	**Bridges & Final Design Plans Due**
Thurs./Fri., March 28-29, 2019	Bridge Testing

Design Plan Requirements:

You are required to submit a design plan for your bridge that includes scale drawings of your bridge design showing 3 views of the bridge:

- a *top view* (as if you were looking down from space on top of the bridge)
- a *side view* (as if you were standing outside the bridge so that a line connecting you and the length of the bridge would be perpendicular)
- an *end view* (as if you were actually going to travel across the bridge and the entire length of the bridge is directly in front of you).

These scale drawings should be 2 dimensional (flat, Somewhere on your design, state the scale you are using for your drawings. Additionally, it should not 3D). include measurements and a calculation of the total length of wood necessary to construct this particular design. (It should of course be less than the total length of wood given you!) Your final bridge design may change from this preliminary design, but it would be wise and time-saving if you make a good design before building.



Use the following checklist to help you make sure you have completed necessary steps for your design plan:

_____ My team's design plan has a scaled top view drawing with important measurements indicated.
_____ My team's design plan has a scaled side view drawing with important measurements indicated.
_____ My team's design plan has a scaled end view drawing with important measurements indicated.
_____ My team's design plan has the scale listed that we used to make our drawings.
_____ My team's design plan has a calculation of the amount (in millimeters) of wood required for our design.
_____ My team's design plan meets the required bridge dimensions.

Bridge Competition Rubric

Name: _____ Block: _____

Partner (if you have one): _____

Element	Description		Points Possible	Points Earned
Final Design Plan	Scaled Top View	2 points	15	
	Scaled Side View	2 points		
	Scaled End View	2 points		
	Design Meets Required Dimensions (Length, Width, Height—2pts. each)	6 points		
	Total Wood Calculation	3 points		
Bridge Length	• Constructed bridge is between 250 and 300 millimeters long. • Constructed roadbed is between 200 and 300 millimeters long.		5	
Bridge Width	• Constructed bridge is between 50 and 75 millimeters wide.		5	
Bridge Height	• Constructed Truss bridge is between 0 and 100 millimeters tall, including optional substructure no more than 20 millimeters beneath the bottom of the roadbed. OR: • Constructed Beam bridge is between 0 and 30 millimeters tall.		5	
General Bridge Specifications	• Constructed bridge has a clear passage for the 50mm block to slide along the length of the bridge. • Block can be positioned and loaded. • Roadbed contains at least two but no more than four main girder beams. • Joints of the bridge are not laminated or split and contain appropriate amounts of glue. • Constructed bridge does not contain any paint or chemicals not allowed and is not suspiciously massive.		5	
Efficiency	Mass of Bridge (g): Weight Held (N):	Efficiency of Bridge:	5	
	The bridge holds the bucket.	2.5 points		
	The bridge holds 200x its weight or less.	+0.5 points		
	The bridge holds 200x to 300x its weight.	+1.0 point		
	The bridge holds 300x to 400x its weight.	+1.5 points		
	The bridge holds 400x to 500x its weight.	+2.0 points		
	The bridge holds over 500x its weight.	+2.5 points		
Failure Analysis	• Indicated the strong and weak points of the bridge's design and/or construction. • Indicated how much the bridge design could be improved.		5	
Teamwork Grade	How much did you contribute to your team's success?		5	
	Overall Grade		**50**	

See the back of this page for the failure analysis and teammate evaluation.

My Name: _____ My Teammate's Name: _____

Bridge Failure Analysis

After observing your bridge tested to failure, what do you think were the weakest areas of your bridge? Why?

Do you think these areas were weak because of a poor design or because it was poorly executed and constructed? Why? (It's not a good idea to admit that you were lazy or inconsiderate—talk about some *unintended* results that you saw.)

What was a strong area of your bridge? Why do you think so?

How would you change your bridge so that it would have a better efficiency rating if you had a chance to redesign it? Make a sketch as well.

Teammate Evaluation

Using the following 1-5 scale, I would <u>honestly</u> grade my *own contribution* to the project as:

1	2	3	4	5
I did not contribute much		I contributed some		I contributed a great deal

Using the following 1-5 scale, I would <u>honestly</u> grade my *teammate's contribution* to the project as:

1	2	3	4	5
I did not contribute much		I contributed some		I contributed a great deal