Ramona Convent Science Department

Bridge Competition

Your task in this project sounds pretty simple: you are going to build a bridge out of wood and glue. Your bridge will be evaluated on its "efficiency"—how much weight it can hold compared to its own weight. You will bring a pre-made bridge on the day of the Ramona Challenge and you will test it with our Structures and Materials Tester, but before you just start gluing sticks together take a look at the other requirements for the bridge!

MATERIALS

Your Team's popsicle stick bridge:
Vernier Structures and Materials Tester (VSMT)

BRIDGE DESIGN REQUIREMENTS

The following bridge competition rules are modified from the Illinois Institute of Technology's International Bridge Competition rules from 2016 and from Vernier's website. For more information, see http://bridgecontest.phys.iit.edu/public/international/index. Also, go to http://www.vernier.com/products/sensors/vsmt/ for more information on the structures tester we will use.

The constraints for the design and construction are as follows:

- The design will be drawn on paper with a 1:1 scale. Include side, end, and top views.
- The bridge must be constructed from popsicle sticks with the following dimensions: 4 ½ " x 3/8 " x 1/12 in and Elmer's white glue (no wood glue).
- The wood may be notched, cut, sanded or glued together in any manner but must still be identifiable as the wood species provided.
- No other materials may be used. The bridge may not be stained, painted, or coated in any

fashion with any foreign substance.

The bridge complies with the following physical constraints (**Note**: All lengths are intended to be accurate to the nearest mm, unless otherwise noted.): The bridge mass shall be no greater than 100.00 g.

- The bridge must span a gap (**S**) of 30 cm, be no longer (**L**) than 40 cm, be no taller (**H**) than 10 cm above the support surfaces, and have a width (**W**) between 5 and 7 cm.

- Important: The bridge must accommodate a ¼ inch screw through the center of the entire bridge and a 5cm x 5 cm loading block. That is the mechanism for the load to be applied. (See picture above.)

COMPETITION PROCEDURE

At the time of the competition, participants will (one at a time) center their bridge on the loading surfaces. The participant will connect the bridge to the VSMT with the provided hardware. Once there is coordination between the participant and those performing the data collection that everything is ready, the participant will turn the wheel to apply the load to their bridge.

The goal of the competition is to have the bridge with the highest efficiency. Efficiency, *E*, is calculated by taking the force applied to the bridge at failure and dividing it by the weight of the bridge and then multiplying it by 100 to make it a percentage. (You can also think of this as a ratio of mass of an object supported by a bridge to the mass of the bridge itself multiplied by 100.)

$$E = \frac{\text{force applied}}{\text{weight of the bridge}} \times 100$$

The maximum scoring load supported by any bridge will be 490.5 N (50 kg). Any amount over this quantity will not count in the calculation of the bridge's efficiency.

- Bridge failure is defined as the inability of the bridge to carry additional load, or a load deflection of 2.5 cm, whichever occurs first.
- The bridge with the highest structural efficiency, *E*, will be declared the winner.

SCIENCE:

PLEASE RETURN THIS PORTION TO RAMONA BY FRIDAY, APRIL 20TH

SCHOOL NAME: _____

TEACHER(S): _____

Applicants for grade 5/6 division:

Name/Grade _____

Name/Grade _____

Name/Grade _____

Applicants for grade 7/8 division:

Name/Grade _____

Name/Grade _____

Name/Grade _____