STRUCTURES

A. The Problem

Structures (e.g., buildings, homes, bridges, etc.) are typically designed to withstand varying degrees of static weight (forces placed in one direction, usually straight down) but only marginal amounts of dynamic loads (forces impacting from several different direction, down, sideways, up, etc.). For example, during the recent earthquakes in Los Angeles and San Francisco many buildings, houses, roadways, and bridges simply collapsed resulting in major loses in life and property. Other structures were able to withstand the static and dynamic loads much better and only suffered minor damage. Why is this? Of course a major factor is the location of the structure in relation to the center of the earthquake but other factors that are more human controlled can play significant roles in the survivability of the structure. What are these design factors that provide greater strength and flexibility in structures? That's the question you are to answer!

Your Challenge

Design and construct a structure to support as much weight as possible while complying with the limitations and specification described below. Base your design and construction on solid research & design principles and calculations.

In addition to the construction of the structure, ***a detailed design (mechanical drawing), procedure, and explanation of the rationale for the design must accompany each structure***. The rationale must be based on appropriate design principles and computations identified in research literature that explain why your design approach was acceptable for this particular problem. This part of the problem should be limited to 2 to 4 pages.

B. Limitations/Specifications

1. The structure will be made from of 12 - 1/8" X 1/8" x 24" strips of balsa wood and glue. No nails, strings, straight pins, etc. are allowed except for construction purposed. These must be removed prior to competition. Each student will test their structure in the strength analyzer until it fails / destroyed.

2. No laminations are allowed. A lamination is extended to strips placed together which are or are not glued. (See Figure 1)

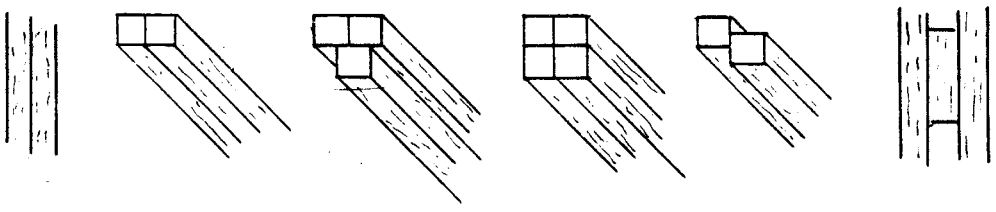


Figure 1: Laminations (glued or not)

3. The height of the structure must be between 5.5 and 6 inches.

4. The weight must not exceed 40 grams (1.4 oz.).

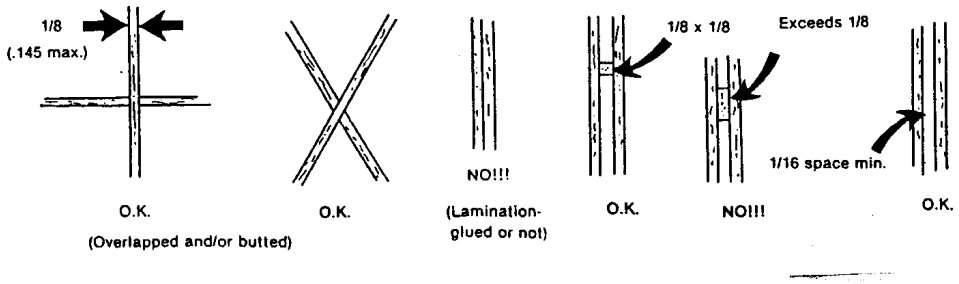
5. The balsa wood may not be painted, fiberglassed, or strengthened in any way.

6. Balsa wood is the only wood permitted.

7. Any 1/8" strip exceeding .145 inch will be disqualified.

8. Any adhesive is allowed in the construction of the structure.

Examples of construction are:



C. Testing the Structure in Competition

1. Place the structure in the strength analyzer, once the structure is in place and suitable to the student the testing will commence.

2. The structure will be considered failed when the computer program stops registering stress.

3. Maximum points will be awarded during functional tests when structure holds more than 300 lbs. and has a strength-to-weight ration in excess of 24.

D. Recommendations

1. Twelve strips of 1/8" X 1/8" X 24" balsa wood should be the amount of material used. However, you may use more as long as the weight limit is not exceeded.

2. Good craftsmanship will enhance the structure's ability to withstand the static load.

3. You may want to test your structure before the competition, this is allowable however, you will need to provide any additional balsa wood for second, third, or fourth structure iteration.

E. Scoring

Scoring will be based on your rationale for your solution (based on a strong research base), compliance with design notebook criteria, technical design of your solution (technical drawing & materials list), craftsmanship and construction of device, a functional testing of your device, and a post test analysis of your solution. You will be expected to give a short oral presentation describing the rationale for your design and structure. See *Re>E Experiment Evaluation Form* for details and point values.