Tom's Tips for Structures Competitions:

My advice for building winning structures starts with commitment. Your dedication and attention to detail is the winning combination. My list of tips will help you succeed but only if you are dedicated to the project. Be sure you understand the event rules before designing your prototype.

1) **Draw your preliminary design with full wood outlines.** This should help you to decide whether to use butt joints or lap joints.

2) **ALL joints should have absolutely flush surfaces before applying glue.** Anytime glue is used as a "gap filler", it dooms the structure! Cut the wood precisely and carefully sand the part so that it fits flush. Then, number the part and use it as a template to make numbered duplicates in assembly sequence (i.e.: two for bridges, four for towers).

3) **Structures are symmetric.** When building a bridge or a tower with two or four sides, build the two primary sides one on top of the other. Once the first side is built, cover it with wax paper and **build the second side directly on top of the first.** This helps insure the structure's symmetric integrity.

4) Most competitions require these structures to be weighed. **Up to 20% of the structure's mass may be from over gluing.** Adhesives do not work better when they are drooled all over the structure. Use the adhesives sparingly where any more than a translucent, moist surface becomes wasted, excess mass.

5) When building a balsa wood structure, **pre-test all the strips for tensile strength before assembly.** A simple deflection test works best. Anchor half of the strip on a surface and ballast the free end using clay on a bent straight pin. Use a simple gauge to categorize the strips. Group similar tensile strengths together. The strips that deflect the least are the strongest. Use those for the longest pieces. The ones that deflect the most use as the shortest pieces. When the structure is finished, it should have a relatively consistent load carrying capability.

The above tips can also be viewed at the following URL:

[http://www.midwestproducts.com/structtits.htm](http://www.midwestproducts.com/structtits.htm)
Bridge Efficiency

Efficiency of your bridge can be determined using the following formula:

\[ E = \text{Efficiency} = \frac{(\text{LOAD IN kg})(1000 \text{ grams})}{(\text{MASS OF BRIDGE IN grams})} \]

Remember: The load has been measured in kilograms, while the mass of the bridge has been measured in grams. By using the 1000 multiplier we will compensate for the two different units of measure.

Example: If your bridge weighed 22 grams, and supported 42 kilograms of weight for 30 seconds during the test, you would calculate efficiency as follows:

\[ E = \text{Efficiency} = \frac{(42)(1000)}{22} = 1909 \]