Cardboard Beam

The objective of this project is to develop a cardboard beam with the highest strength-to-weight ratio (*SWR*):

$$SWR = \frac{\textbf{Design Load (lbs.)}}{\textbf{Beam Weight (lbs.)}}$$

Beam Construction Rules

1. Beam must be constructed using standard corrugated cardboard panels. The cardboard can be cut and glued together to develop any section required by the design team. Table 1 lists the dimensions of standard U.S. corrugated cardboards that can be used for this project. Figure 1 shows the five standard shapes and flute profiles.

Table 1. Standard US Corrugated Flutes

Flute Designation	Flutes per linear foot	Flute thickness (in.)	Flutes per linear meter	Flute thickness (mm)
A flute	33 +/− 3	3/16	108 +/− 10	4.8
B flute	47 +/− 3	1/8	154 +/− 10	3.2
C flute	39 +/− 3	5/32	128 +/− 10	4.0
E flute	90 +/− 4	1/16	295 +/− 13	1.6
F flute	128 +/− 4	1/32	420 +/− 13	0.8

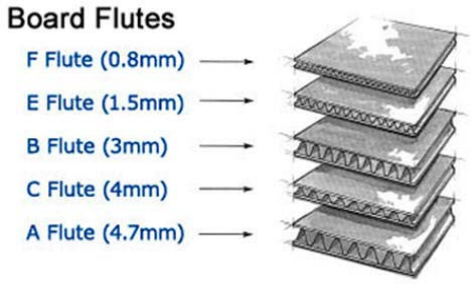

Figure 1. Standard Cardboard Shapes or Flute Profiles

2. Any type of glue is allowable.

3. The beam may be built-up for multiple layers of cardboard to form any thickness and shape required for the design. Individual cardboard sheets cannot be coated or treated in any way.

4. The beam must be designed to fit on the support shown in Figure 2. Beams may be supported off only the top surfaces of the support. Members may ***not*** brace off the sides or the horizontal bottom of the support.

   The beam must span an opening of 2 ft. (remember to allow additional length to account for the supports). The minimum width of the beam is 3 in. and the maximum width of the beam is 6 in.

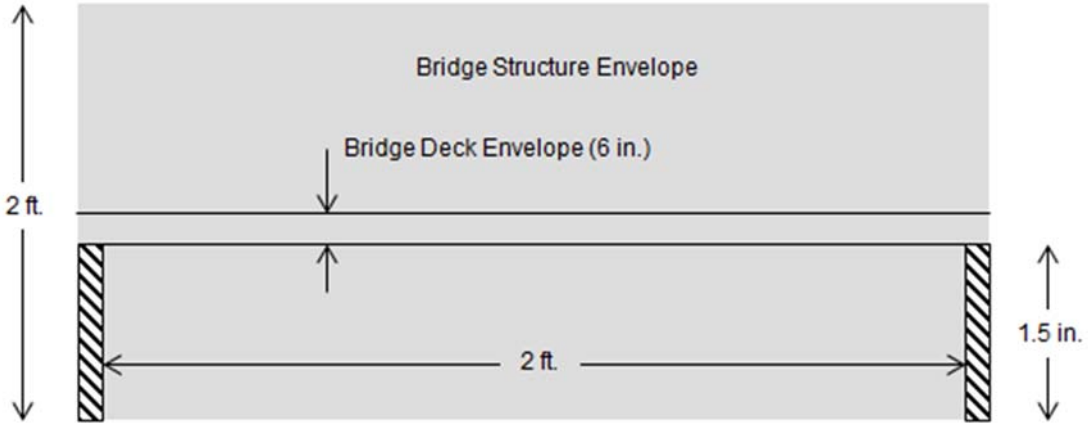

Figure 2. Bridge Supports and Geometrical Constraints

5. Each beam ***must*** support 250 lb. distributed over 6 in. at the center of the bridge (see Figure 3). Failure is defined as collapse or deflection (> 1.5 in.) resulting in contact between the bridge and the horizontal base of the support.

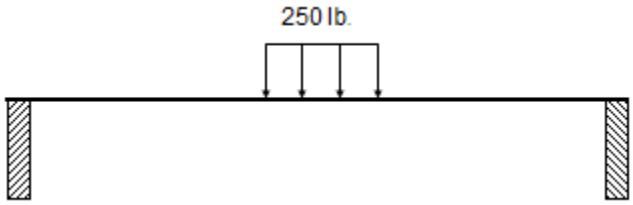

Figure 3. Uniformly Distributed Load

7. The beam cannot be higher than 6 in. above the supports at any point along the entire length of the beam. The shape and dimensions of cross-section of the beam may vary along the beam as long as they can support the two loading points.

8. If the beam can support 250 lb., then its performance will be measured by a *SWR*. The team with the highest *SRW* will win the competition.

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