Cardboard Beam

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

$$SWR = \frac{\text{Design Load (lb.)}}{\text{Beam Weight (lb.)}}$$

Beam Construction Rules

1. Beams must be constructed using standard medium-weight chipboard panels. The chipboard can be cut and glued together to develop any section required by the design team. Individual chipboard panels should have a thickness between 0.050 to 0.100 in. Figure 1 shows typical 12 in. x 12 in. x 0.05 in. chipboard panels.

![Figure 1. Medium weight chipboard panels.](image)

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 20 in. To ensure that the beam meets the span requirements and extends over the supports, it is recommended that the beam be at least 22 in. in length. The minimum width of the beam is 2 in. and the maximum width of the beam is 4 in.
5. Each beam must support 240 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. If your beam cannot support the 240 lb. design load, your beam is disqualified from the competition.

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 design load.

8. If the beam supports the 240 lb. design load, then its performance will be measured by the SWR. The team with the highest SRW will win the competition.

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