Navy Bridge Live Load Challenge (Middle School Students)

A bridge is a structure that spans a gorge, valley, road, railroad track, body of water, or any other physical obstacle, for the purpose of providing passage over the obstacle. There are many types of bridges: beam, truss, arch, suspension and cable stayed.

Mission: Research, design and construct a bridge within design constraints to hold as much weight as possible.

Engineers need to consider loads when building structures. Loads are weights and forces that a structure must withstand. The dead load of a structure is the weight of the structure itself. The dead load of the bridge, for example, includes beams, cables and the deck. The live load of a structure is the weight that is added to the structure, including people, cars and the wind.

Design Requirements:

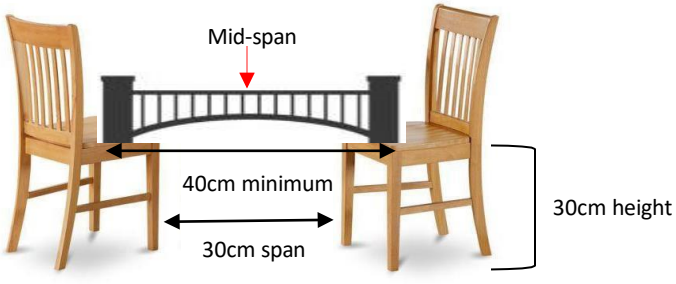
- Bridge must span a gap of at least 30cm. Minimum bridge length of 40cm.
- Bridge must have a continuous "road" surface that is at least 8cm wide. Bridge mid-span must be accessible for load testing.
- Ensure there is a ½" hole or gap in center of road surface. This will be used to accommodate the threaded rod of a mechanical structure tester.

Materials:

- Up to 100 popsicle sticks. Sticks may be mechanically altered (i.e. broken, cut). Sticks may not be soaked in any material other than water and may not be painted or coated except with markers, crayons, or colored pencils for decorative aesthetics.
- Water soluble white "Elmer's" glue only. Yellow wood glue or glues containing resin adhesives or cement binders are not allowed.
- Wax paper as surface to construct the bridge on and allow glue to dry.

Load Testing:

- **Load Test Challenge:** Load testing will be done using a mechanical structure tester. Force will be applied to the center most portion of the road surface until the bridge fails.
- **Home/School Testing:** Find items to use for load testing such as rocks, bags of gravel, cans of food, bags of rice, workout weights, and rolls of coins. Weigh each load test item and record the weight.
- Create a gorge approximately 30cm tall in a garage or outside space so that when the bridge collapses inside floors will not be damaged. This can be accomplished with two chairs, stacks of books, camping coolers, or various boxes of equal height.
- Position the "gorge walls" 30cm apart. Center your bridge on top of the gorge walls.
- Carefully add one load at a time to the bridge mid-span. Ensure your feet are out of the way when adding loads and when the bridge collapses. Record load weight as you add it.
- Consider taking a video of the load testing if you are able.



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