

The Great West Sound BRIDGE CHALLENGE

COMPLETE INSTRUCTIONS

2016



Mission

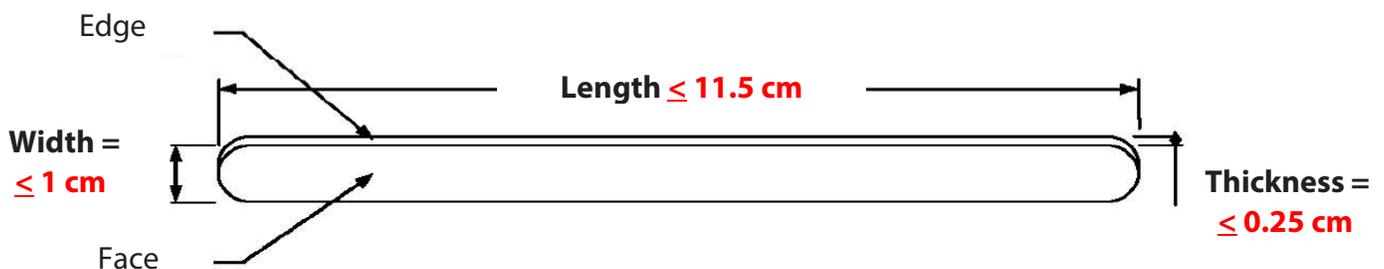
Your mission, if you choose to accept it, is to employ the engineering design process to construct an amazingly strong, light-weight, one-of-a-kind bridge. In order to do so, you'll need to research, design, test, redesign, retest, and ultimately build a bridge that complies with all of the criteria and constraints outlined below. Then, on **Saturday April 30th, 2016**, you're invited to unveil and test your final bridge design at the Kitsap Mall during this year's **West Sound STEM Showcase!!!**

Materials

Three common building materials may be used in this year's bridge challenge. **ONLY** the three materials described below are allowed to be used. However, you do **NOT** have to use all three types of the building materials in your design. You may use as much, or as little, of these materials as you'd like. Before deciding upon the types and quantities of the materials you'll use, carefully consider the evaluation criteria outlined later in this document. Below are the 3 types of materials allowed:

1. Popsicle or Craft Sticks that meet the following measurement criteria:

- Length ≤ 11.5 cm
- Width ≤ 1 cm
- Thickness ≤ 0.25 cm



2. Water soluble white "Elmer's" type glue.

***Note:** *Yellow wood glue or any glue containing resin adhesives, or other cement binders of any kind, are **NOT** allowed.*



3. Yarn: type #4



Alteration of Materials:

1-A (+) Sticks **MAY** be physically altered in the following ways:

- i. Cut or notched at any angle
- ii. Sanded to any width or shape
- iii. Bent or curved
- iv. Decorated using only; markers, crayons or colored pencils.

1-A (-) Sticks may **NOT** be altered in the following ways:

- i. Soaked in any material other than water
- ii. Painted or coated except with; markers, crayons or colored pencils.

3-A (+) Yarn **MAY** be altered in the following ways:

- i. Braided together
- ii. Frayed or spliced apart into smaller strands
- iii. Decorated using only; markers, crayons or colored pencils.

3-A (-) Yarn may **NOT** be altered in the following ways:

- i. Soaked in any material other than water
- ii. Painted or coated except with; markers, crayons or colored pencils.

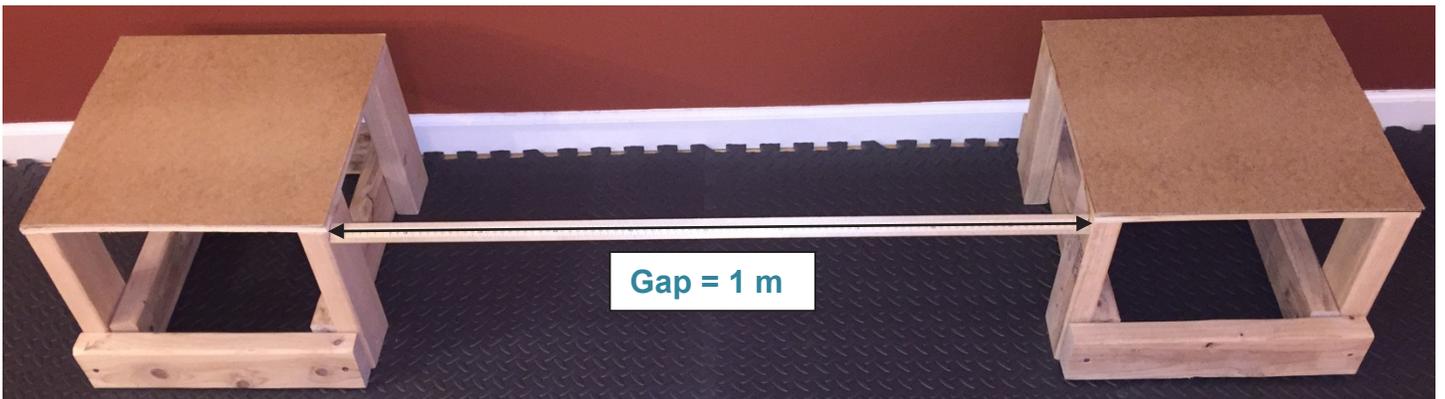
Criteria & Constraints

A) Two Support Blocks will be provided for your bridge to sit upon. These Support Blocks will have the following dimensions:

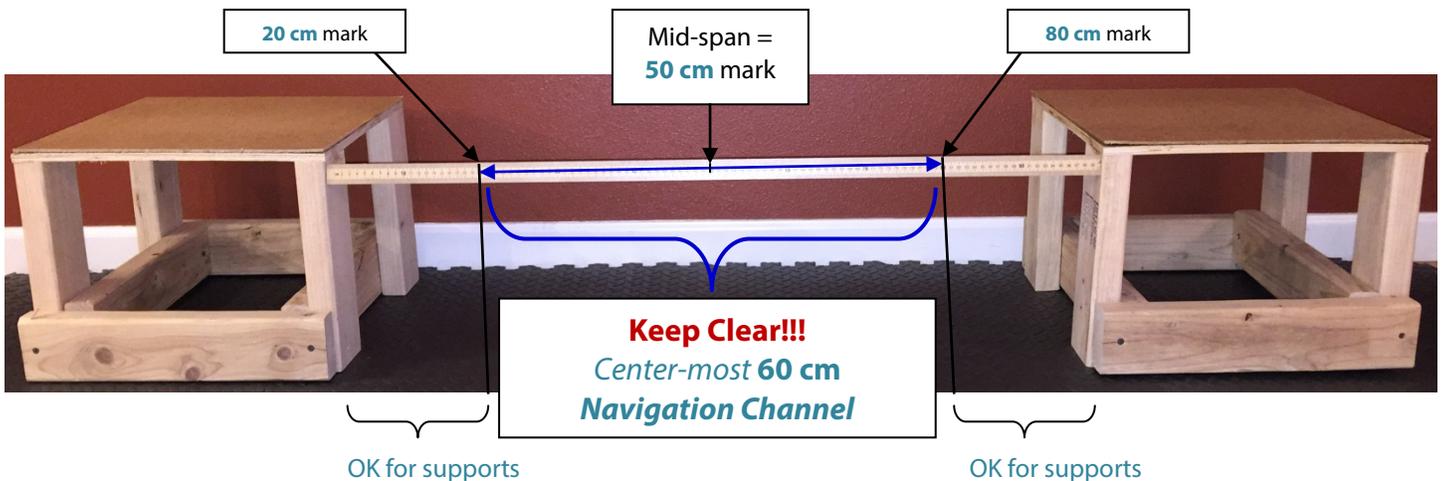
Length = 40.5 cm, Width = 40.5 cm, Height = 30 cm



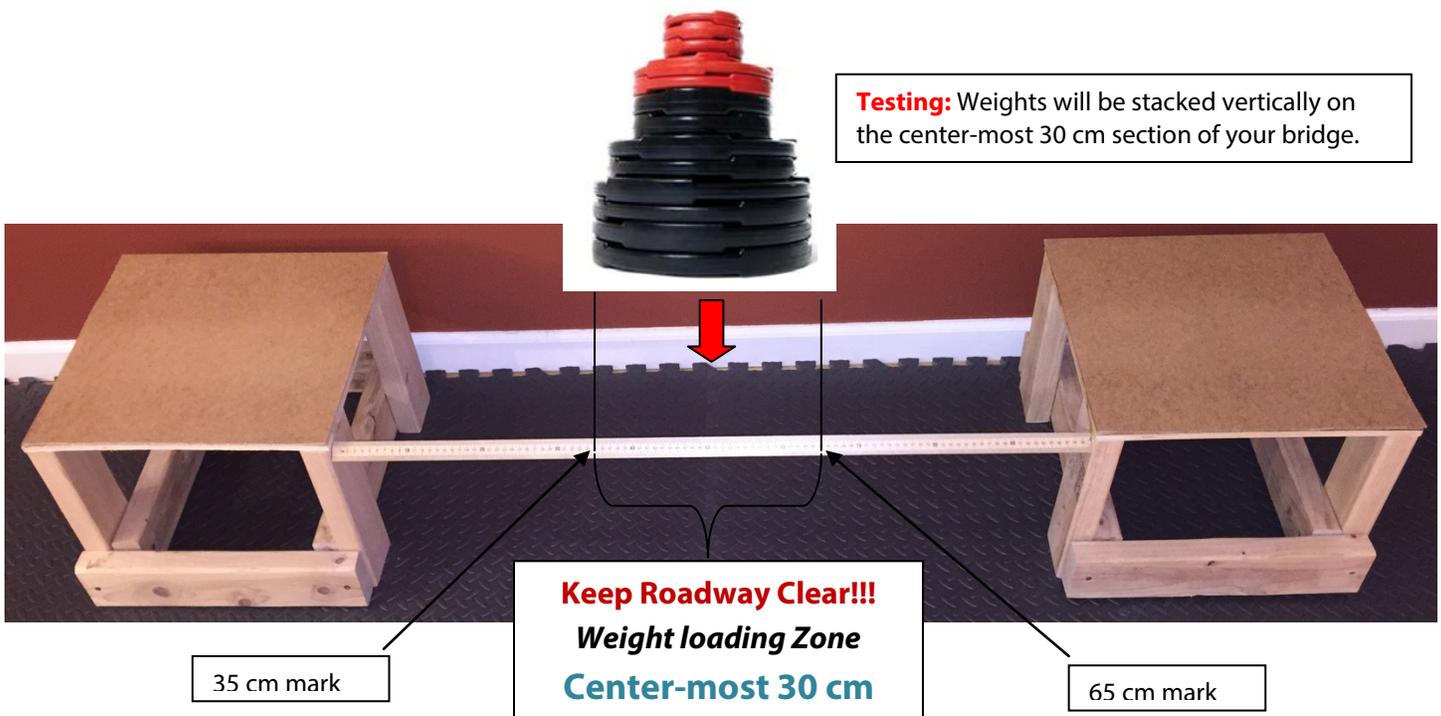
B) Your bridge must be able to span a **1 meter gap** between the two **Support Blocks** described above. Your bridge is allowed to rest upon the top surfaces of the **Support Blocks** and should have an overall length of **> 1 m and \leq 1.8 m**. This overall length includes **ANY** supporting bridge components.



C) The **center-most 60 cm** under the mid-span of the bridge **MUST** remain clear of any support columns to allow for a necessary **60 cm navigation channel**. This means that the bridge is required to have a minimum **clear span distance of 60 cm** in the middle portion of the design if you choose to include any supports.



D) Your design needs to include a continuous (*no gaps*) **Roadway/Bridge Deck** that is ≥ 14 cm wide. The **center-most 30 cm** of the Roadway/Bridge Deck must allow for circular weight-plates to be stacked vertically upon it. This is a very important requirement because it is how we will be testing to determine the live load limit of your bridge at the STEM Showcase.



- E) Your bridge should **NOT** be designed and/or constructed in such a way as to **exert any horizontal loads** on the Support Blocks provided. Frictional forces between the top surfaces of the Support Blocks and the under surface of your bridge, where it rests upon the Support Blocks, are allowed.
- F) **No adhesive material** of any kind can be used to help secure your bridge to the Support Blocks provided. This would include, but not be limited to, glue, tape, resins, Velcro, putties, etc... Your bridge is also **NOT** allowed to be tied, tethered, or lashed to the Support Blocks in any way.

Bridge Evaluation

As is the case in most real bridge construction projects, your bridge will be evaluated in several important categories. The three categories that we will be evaluating are:

- Strength:** It's the responsibility of the engineers to ensure that their bridge design is safe. One measure of a bridge's safety is to determine the maximum live load that the bridge can support. In this challenge, the live load limit will be determined by adding weights to the center-most portion of the Roadway/Bridge Deck until the bridge collapses OR until you ask the judges to stop adding weights.
- Design Aesthetic:** In general, most people prefer an attractive, creative, and inspirational bridge design. If a bridge is strong but unattractive that design will most likely not be selected over other, more creative designs. The ability to design and build a bridge that is both appealing to the eye and strong is an important consideration. For this challenge, a team of judges will score your bridge on a scale from **1-100** and then take an average of the scores to determine your final **Design Aesthetics Score**.



- Strength (Live Load) to Weight Ratio:** Engineers never have the luxury of unlimited funding, time, and talent. Customers are looking for the strongest, most functional **and** attractive bridge they can build within their budget and time constraints. In order to determine your score in this category, your bridge will be weighed prior to testing. After your live load is determined, we will then calculate your Live Load to Weight Ratio. **The larger the ratio the better!**

$$\text{Strength (Live Load) to Weight Ratio} = \text{Live Load (lbs.)} \div \text{Bridge Weight (lbs.)}$$