PLTW Engineering

12/Bridge Design Challenge

May 6, 2020

12/EDD

Lesson: **5/6/2020**

Objective/Learning Target: Students will apply the design process solve the challenge of creating a bridge from spaghetti sticks

Background

Many people in different branches of engineering work to build bridges. Civil engineers are responsible for design and construction of such structures, however they also work with mechanical engineers and material engineers to design the most stable structures. These engineers must consider many variables when creating plans, such as the distance to be spanned, where the bridge is being built, the expected type of traffic it will have to withstand, materials available, budget and what the bridge will look like.

Background

Most commonly, civil engineers design structures such as buildings, dams, highways and bridges.

Today, you will explore the field of engineering by making a bridge using spaghetti as the primary building material.

Then you will test your bridge to see how much weight it can carry before breaking.

Helpful links

Basic bridge building and design considerations

Science based look at how bridges work

Compression and tension in bridge design

Gather materials

You will need the following materials for today's challenge:

- 1 pound dry spaghetti
- glue gun
- glue sticks, 1 package
- various weights from 1 to 5 pounds
- large tub (or newspapers to spread out), to make clean-up easier
- 2 tables (place 1 foot apart)
- String or narrow rope (to hold the weights)

Brainstorm

Brainstorm ideas related to structural bridge design.

Use the internet to find examples of the different ways engineers span gaps and distribute loads.

Pay special attention to the different shapes used in structural design and record notes and calculations you can use in the next step; generate ideas.

Generate Ideas

Use a piece of paper big enough to draw your bridge design to scale.

It is important you adhere to the constraints below when drawing your bridge design.

Only construct bridge of spaghetti and glue
Bridge must span a minimum of 1 foot gap
Bridge must have a place to attach string near the center

Build your prototype

Construct your bridge using only the supplied materials.

Make sure to follow your drawing exactly.

If you decide to build your bridge slightly different from what your design drawing was, you must redraw your bridge to reflect the as built bridge.

Test your prototype

Place your bridge between 2 tables that are equal in height, but spaced 1 feet apart.

Find the exact center of the bottom of your bridge and attach your string or cord securely to that point.

Begin adding small amounts of weight to load your bridge. As you add each weight to take a moment and observe how your bridge changes and reacts to the increased load.

Test your prototype

Continue adding weight until your bridge fails.

Recover your bridge and set it in front of you.

Reflection questions

On your as built drawing, make a note where your bridge failed.

What happened when you added more weights?

What does the bridge look like?

Does adding more height to the bridge make it stronger?

What are some ways to further improve your design?