Ontario Tech Engineering Outreach

c_wonder AT HOME

Engineering Bridges

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Exploring Bridges

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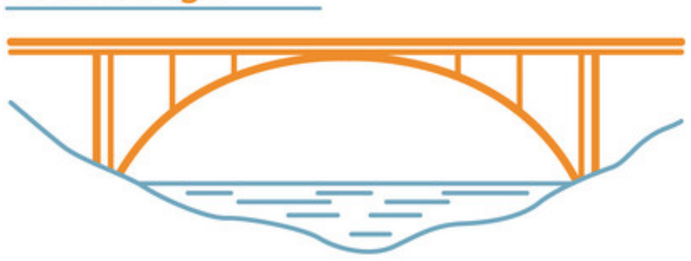
Types of Bridges

arch bridge



suspension bridge

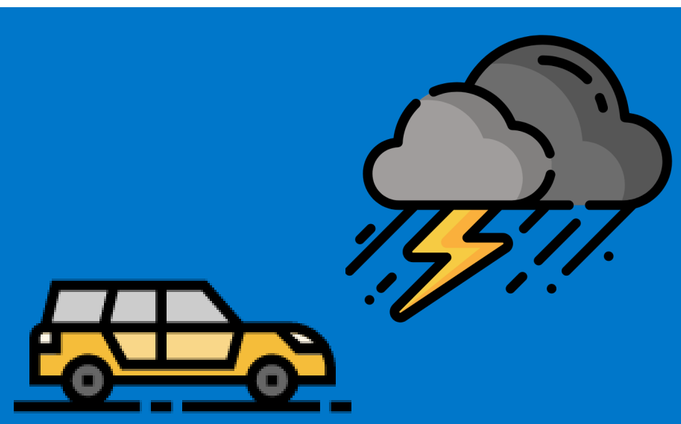
tied arch bridge

truss bridge

cable-stayed bridge

cantilever bridge

beam bridge



FORCES

A force is a push or a pull

There are a lot of things that cause forces to act on a bridge, such as:

- The mass of the bridge
- Cars and People (This is called a load)
- Weather
- Surronding land and water

STRONG SHAPES

Let's do an experiment to find out what shapes are the strongest.

Instructions:

1. Get three pieces of paper and tape
2. Fold one piece of paper into a triangular prism, one into a rectangular prism and one into a cylinder and use the tape to secure them
3. Grab some books to test out how much weight each 3D shape can hold.

Which shape do you think is the strongest? What would be the best shape to use when building a structure?

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Strong Structures

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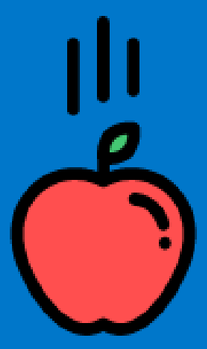
FORCES

A force is a push or a pull. All the forces acting on a bridge must be balanced in order for the bridge to stay standing and still.



The forces that act on bridges are:

- **Gravity**

This is the force that keeps all of us on the ground. Gravity acts on every object on the earth pulling them towards to earth. The more matter something has, the great the force of gravity acting on it, meaning heavier objects have a greater gravitational pull.

- **Tension**

This is an outward stretching or pulling force, like when you pull on a rubber band. Tension is often the opposite of compression.

- **Compression**

Compression is an inward pushing force, like you squeeze a pillow really tight. Compression is often the opposite of tension.

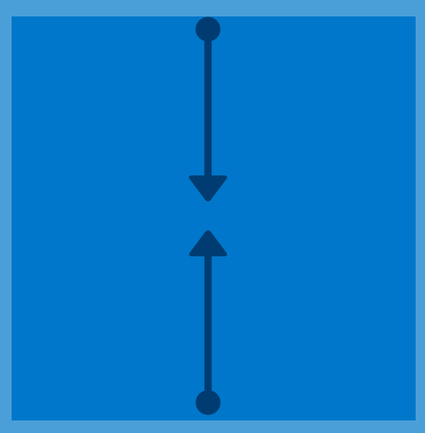
STRONG SHAPES

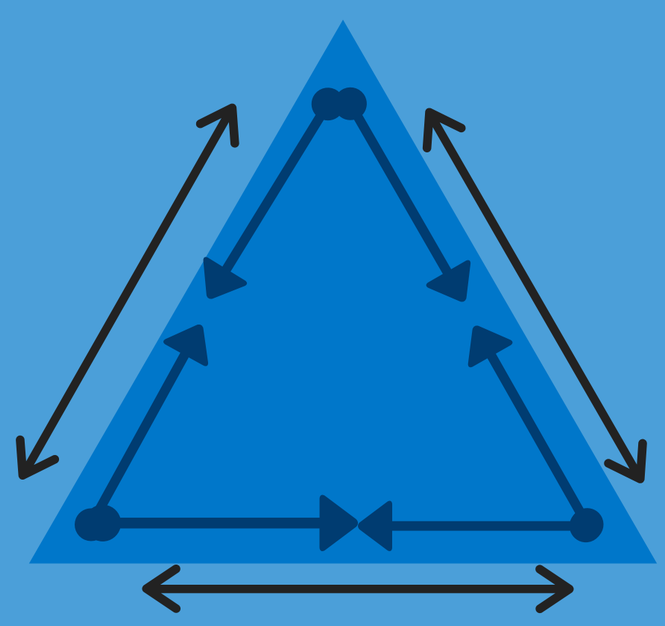
Let's review the results of your experiment.

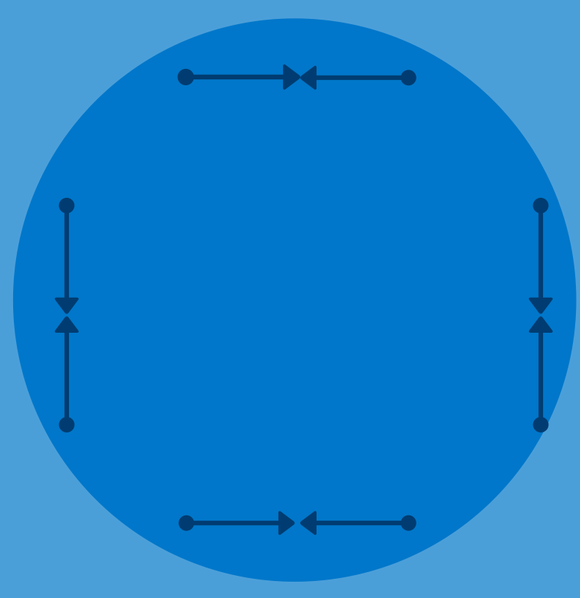
The triangular prism should have been the strongest shape, this is due to its ability to balance the forces of **tension** and **compression**. This shape is used in Truss and Cantilever Bridges.

Cylinders are the second strongest because it has internal **compression**.This shape is used in Arch Bridges and in the beams that hold up most bridges.

The cube or rectangular prism is the least strong because the **compression** caused by a force is not balanced by tension.







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Building Bridges

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CIVIL ENGINEERING

This activity will explore Civil Engineering! Civil engineers design and build parts of our physical and natural environment like buildings, roads and bridges.

ENGINEERING DESIGN PROCESS

We are going to be going through the Engineering Design Process.
Click here to check out the video!

IDENTIFY THE PROBLEM

Your problem is that there is a 30 cm wide river that makes it difficult to transport supplies to the local grocery store.

TEST AND EVALUATE

When you finish building, add some weight like books to your design! This is like the load of cars or people on your bridge.

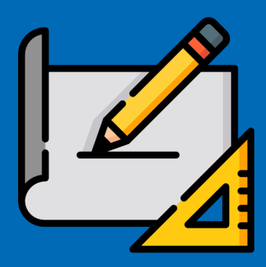
Did it work? How would you make it better? Try again and improve your design!

BRAINSTORM IDEAS

- What might your bridge look like?
- What are some strong shapes you could use in your design?
- What kind of materials would make a strong bridge?

MAKE A MODEL

Time to build! Use glue, tape and scissors safely to put together your materials to make a bridge that spans a distance of 30 cm. Make sure it is free standing; this means it is not leaning against anything.



DESIGN A SOLUTION

Grab a piece of paper and draw out your bridge! Use a ruler to help figure out how big your bridge is going to be. Make sure to make a materials list of things you can find in your recycling bin or home to use.

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Some Ideas!

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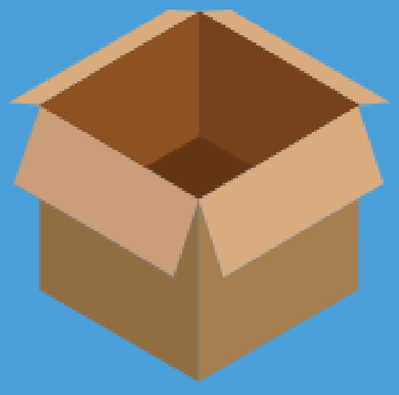
SOME IDEAS FOR MATERIALS

Don't be limited to these materials! Feel free to use anything you have access to.

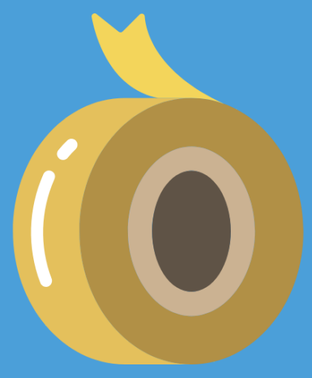


Cardboard

Popsicle Sticks

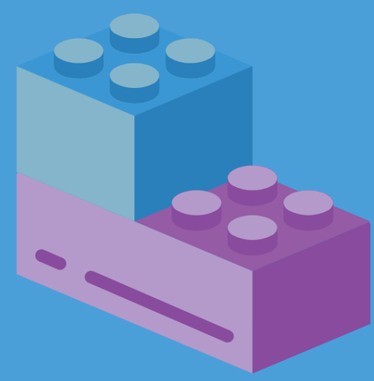
Recyclables

Hot Glue



Tape

Newspaper



LEGO

SOME IDEAS FOR DESIGNS

To make the best design you can learn from other people's work but make sure not to copy a design.
Find some designs you like and improve on them!

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