Western Engineering

Outreach

Bridges

Grade SK-2

Meet Today's ENG HERO!

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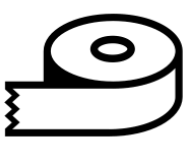
Learning Goals:

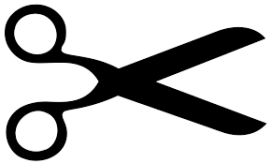
- Students will learn about bridges and why they are used
- The concept of gravity will be introduced to students
- Curriculum connections: Students will develop critically and creating thinking skills with the application of those skills to Materials, Objects, and Everyday Structures as well as Movements as recommended in the Ontario Science and Technology curriculum

Materials Needed:

- Toy bus/car
- Cardboard
- String
- Construction paper
- Markers



- Straws
- Popsicle sticks
- Tape
- Scissors
- Plastic cup
- Pencil or hole puncher



Engineering and Science Connections:

What is a bridge?

A bridge is a structure carrying a road or a path that connects two points across an obstacle such as a river, a lake, etc.

What is the importance of bridges?

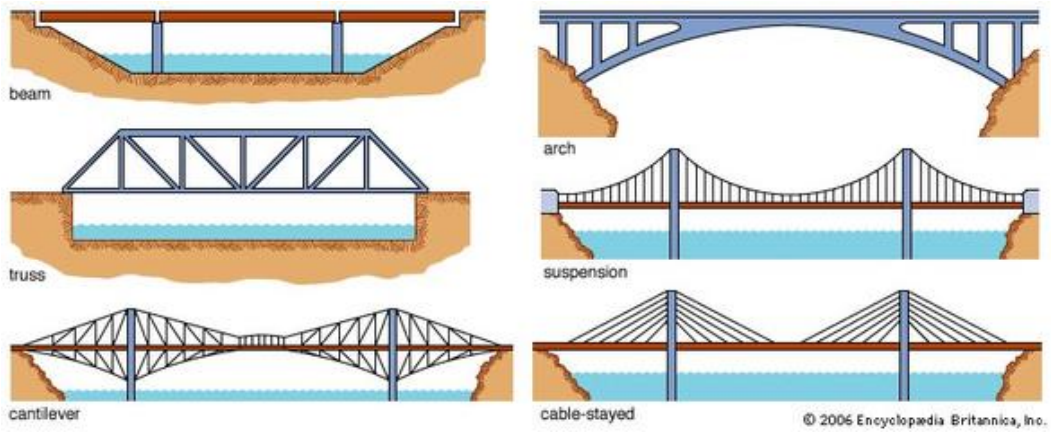
We use bridges all the time in our everyday life. Bridges make it easier to get from one point to another while avoiding an obstacle (such as a river or highway).

Requirements of a Good Bridge

Bridges are affected by the forces that act upon them such as gravity and tension. Therefore, they must be strong and stable to support cars and/or people crossing over the bridge.

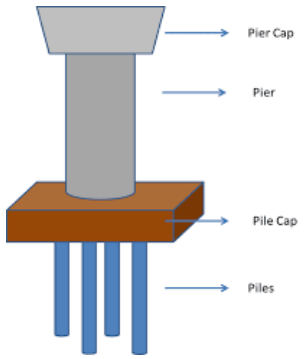
Different Types of Bridges

There are different types of bridges (beam, truss, suspension, etc.) for different purposes that span different lengths. This lesson's focus will be a simple beam bridge to get a toy school bus from one side of the river to the other.



BRIDGES

Beam Bridge



A beam bridge is one of the oldest and most common types of bridges. They are simply a horizontal structure as seen in the diagram above. They usually are used to cover a short distance by cars or people. Beam bridges have piers (supports as seen to the right) on each end for support.

Truss Bridge

A truss bridge uses many triangles to strengthen the structure. Therefore, a truss bridge can support more weight and force, due to the triangle that gives it more strength than a beam bridge. A truss bridge is usually made of a framework of metal or wood bars.

Cantilever Bridge

A cantilever bridge is like a beam bridge that has a pier at only one end, like a diving board. This bridge has many bars that help to add strength, as in a truss bridge.

Suspension Bridge

A suspension bridge is a bridge that hangs from strong wires called cables. What's unique about suspension bridges is that they can span longer distances than any other type of modern bridge. They are a type of bridge that has a lot of tension (pulling force).

Cable-stayed Bridge

Cable-stayed bridges have cables that run directly between the towers and the roadway. Cables are attached in straight diagonal lines, making a tower shape in the middle of the bridge.

Do you think it's easier for a bridge to hold a little bit of weight or a lot of weight? Why?

Holding more weight is harder for the bridge because of a force acting upon it called gravity.

What is gravity?

Gravity is a force that acts upon everything that has a mass. It's the force pulling us and everything else towards the ground. Therefore, on earth, we can walk on the ground without floating. If you throw two objects with different masses, they will hit the ground at the same time, because gravity is a constant. When designing the bridge, remember to make the platform for the bus to drive over STRONG because gravity will try to pull the bus down.

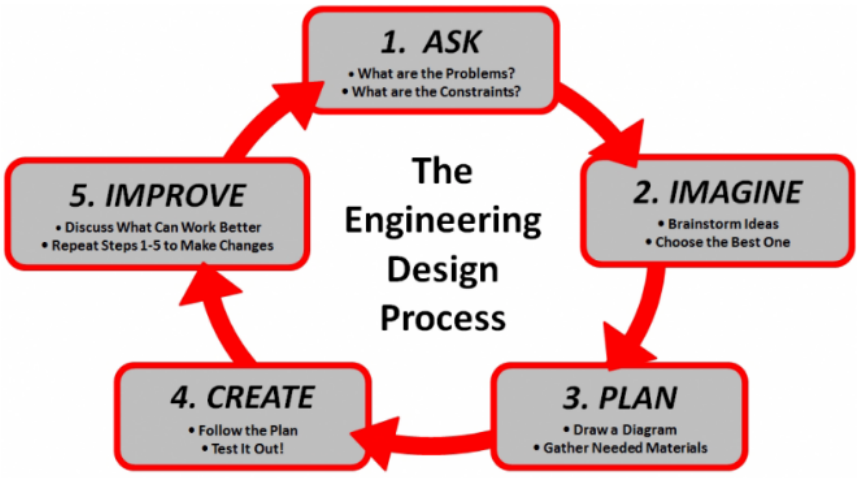
The Engineering Design Process

The engineering cycle or design process is a series of steps that engineers follow to come up with a solution to a problem. Many times, the solution involves designing a product (like a machine or computer code) that meets certain criteria and/or accomplishes a certain task.

BRIDGES

The Steps of the Engineering Design Process

- Define the Problem
- Do Background Research
- Specify Requirements
- Brainstorm Solutions
- Choose the Best Solution
- Do Development Work
- Build a Prototype
- Test and Redesign (ITERATE)



Engineers do not always follow the engineering design process steps in order, one after another. It is very common to design something, test it, find a problem, and then go back to an earlier step to make a modification or change to your design. This way of working is called iteration, and your process will likely do the same!

Activity:

Today you are going to build and design a bridge When designing the bridge, remember to make the platform for the bus to drive over STRONG because gravity will try to pull the bus down! You can design your bridge using the engineering design process with the materials listed above or you can follow the following steps for building this bridge. For the suggested bridge you do not need all the materials on the list.

Step 1: Creating the base of the bridge

- Simply cut a rectangular piece of cardboard as big as your forearm to make the base of your bridge.

Step 2:

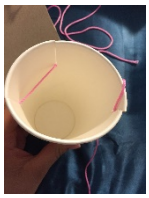
- Poke four holes in the base. Poke each hole with a pencil or hole puncher on the corner.

Step 3:

- Tie a string inside each of the four holes.

Step 4:

- Cut three lines in each cup or cardboard tube (like a paper towel roll).



Step 5:

- Place the strings around the cups and tie it.

Step 6:

- Place any weight inside the cups to stabilize your bridge. Then test your bridge and place the toy bus/car on the bridge.

Recommended Video:

Watch the following video about gravity.
https://www.youtube.com/watch?v=S1pyZlfzAD0

What Did You Learn?

- The engineering design process and what it is
- The importance of bridges in our lives
- The different types of bridges and their uses
- What is gravity?

Future Learning

- Turn this design activity into a project! With the engineering design process start building your bridge with the provided materials. If the bridge does not survive the bus try to reinforce the bridge using the engineering design process.

Share your creations!

We would love to see what you made. Email us at discover@uwo.ca or tag us on social media.

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Thanks for discovering with us!