S T E M

Science, Technology, Engeneering and Mathematics

ENGINEERING: Building bridges

It is important to expose students to the areas of STEM that will promote problem-solving skills and make them competitive learners.

By learning how to build bridges, students will learn how engineers work and what goes into designing and building a complex, but necessary structure that is used by people in all parts of the world every day.

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What is a bridge?

A bridge is a way to get across something.

How are Bridges Used?

Walkways	Highways/Roads
Railways	Pipelines
Connecting Lands	Crossing Rivers
Stadiums	Roofs

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After the Industrial Revolution, bridges became more and more sophisticated as iron and steel became more commonly available.

Engineers could design bridges capable of supporting larger loads and spanning greater distances, making it possible to link cities and communities through shorter and more direct routes, crossing obstacles such as waterways.

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How the bridge design may contribute to the purpose of bridges?

What similarities do you find between the bridge types?

Why these choices might be the most common?

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Arch Bridge

A bridge with connections at each end that is shaped like a curved arch.

Stari Most bridge, Bosnia and Herzegovina

Truss Bridge

A bridge whose structure is supported by combined elements that form triangular units.

Baltimore, Maryland

Suspension Bridge

A bridge in which the weight is supported by cables that are connected to towers.

Golden Gate Bridge, California

The biggest difference is the distances they can cross in a single **span.**

Arch bridge
up to 240 - 300 meters

Suspension bridge
up to 2 100 meters

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What does a bridge need?

A good bridge must have a firm foundation.

A good bridge must be sturdy (strong).

A good bridge must last a long time.

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What Makes a Bridge Stay Up?

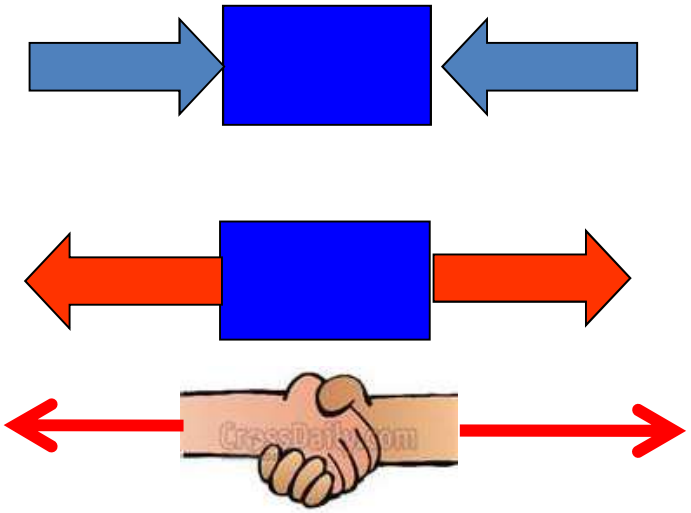
Forces – 2 Types

1st - Compression

> Pushing or Squeezing Force

2nd - Tension

> Pulling or Stretching Force



By balancing these forces, bridges channel the weight or load of the bridge onto the main supports, so there is no overall force to cause motion and do damage.

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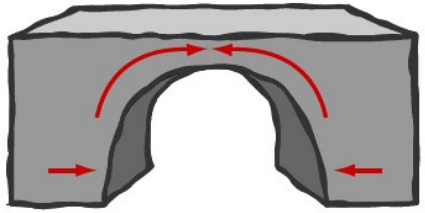
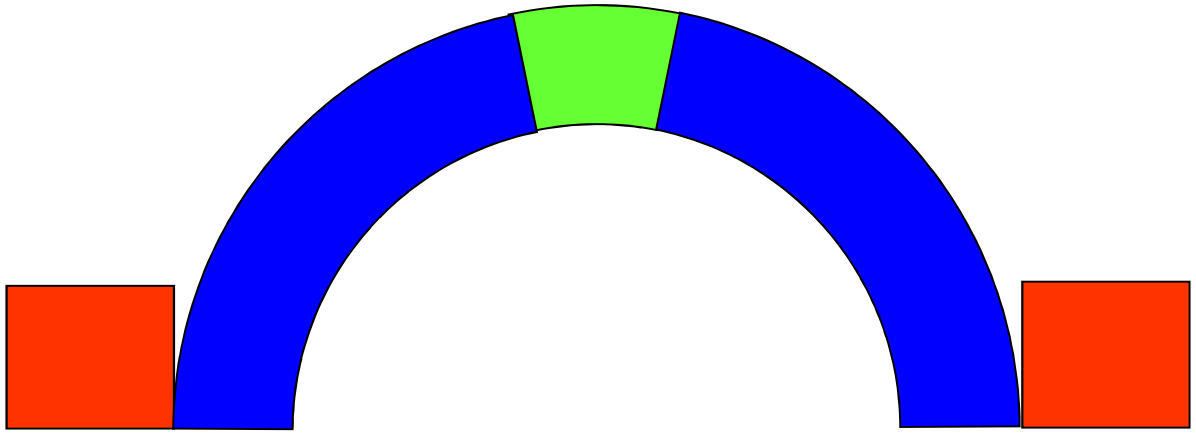
Arch Bridges

Keystone – the wedge-shaped stone of an arch that locks its parts together

Abutments – the structures that support the ends of the bridge





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Arch Bridges

Where have you seen these bridges?

Bayonne Bridge – N.J.

Sydney Harbor Bridge

Hoover Dam Bridge

Apollo Bridge Slovakia

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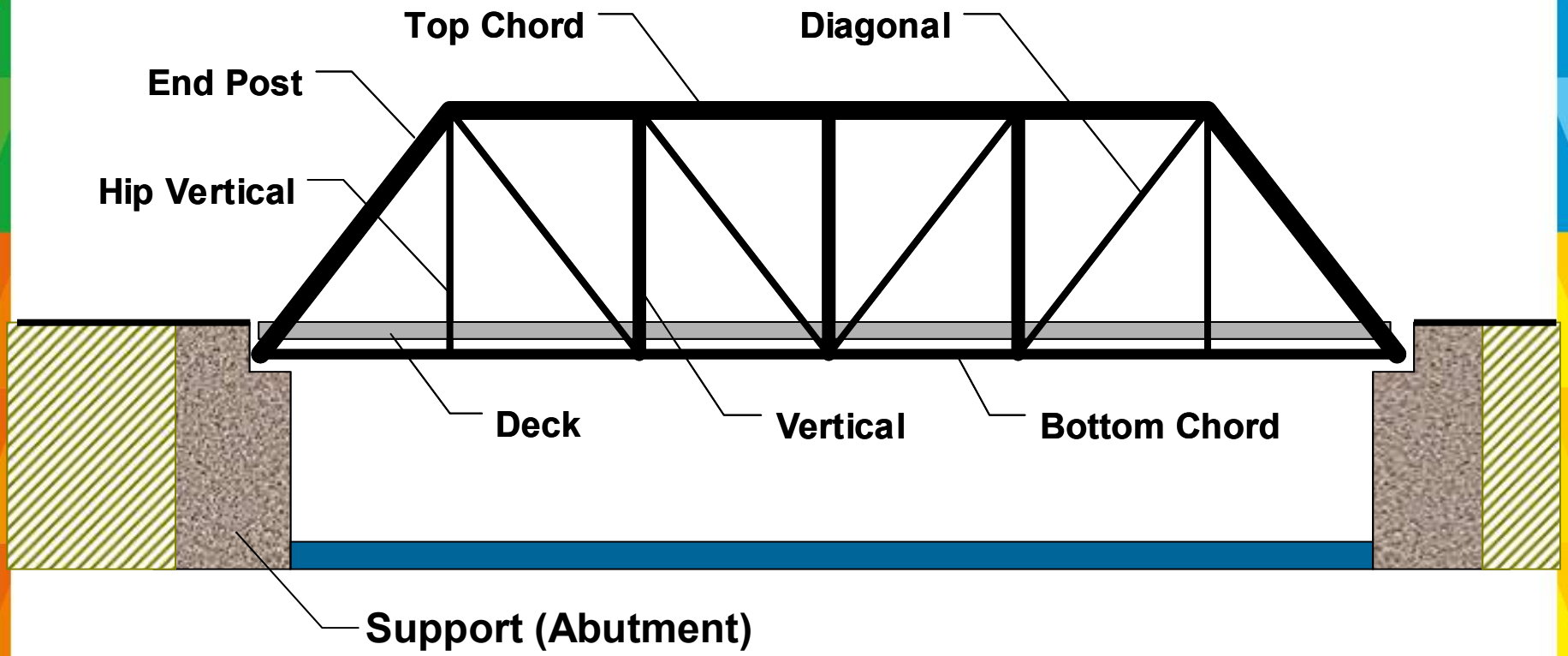
Truss Bridges



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Truss Bridges

Where have you seen these bridges?

Francis Scott Key Bridge
Maryland, USA

Betsy Ross Bridge
Philadelphia, PA

Under Truss Bridge

Truss Connections

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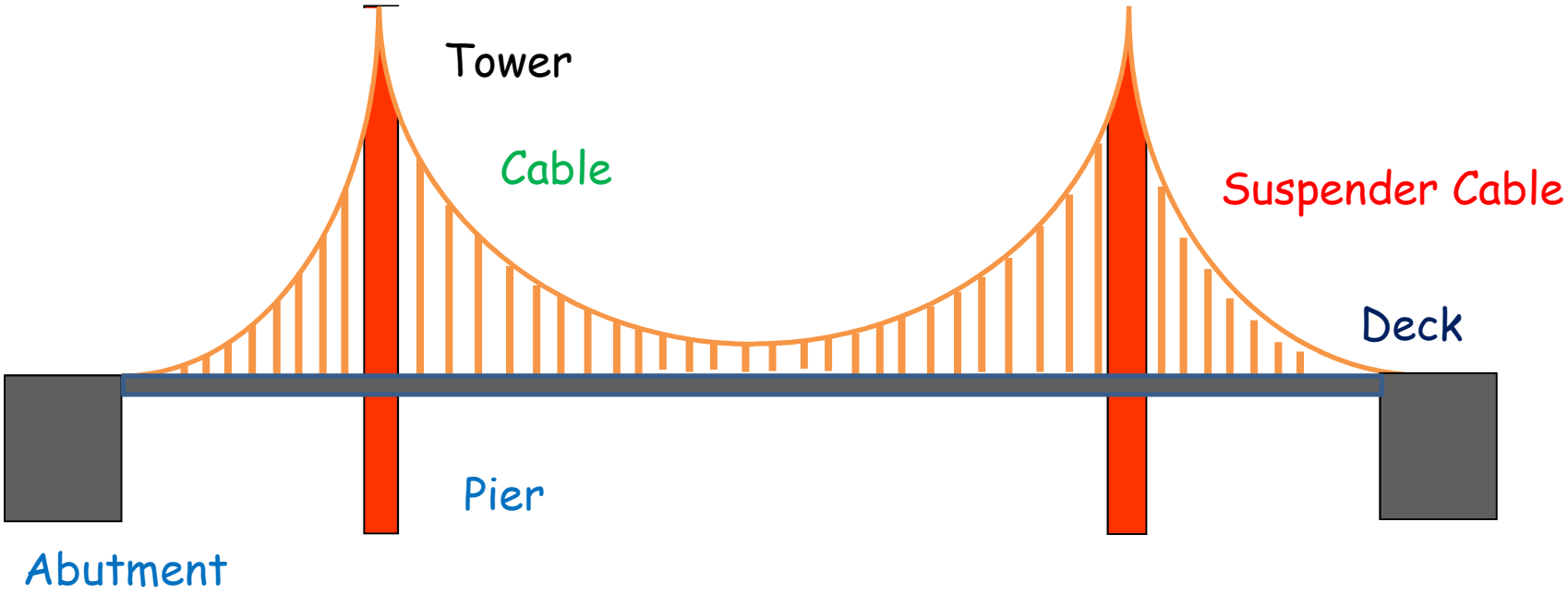
Suspension Bridges



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Suspension Bridges

Where have you seen these bridges?

Akashi Kaikyo Bridge
Japan

Golden Gate Bridge
San Francisco

Chesapeake Bay Bridge
Virginia

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https://www.pbs.org/wgbh/nova/bridge/build.html

http://www.pbs.org/wgbh/buildingbig/bridge/basics.html#susp

VIDEO:

https://www.youtube.com/watch?v=oVOnRPefcno&list=PLRnZTaGtkHr3G_rVN041M6MUF15QKTihR

SIMULATION:

http://www.pbs.org/wgbh/buildingbig/lab/forces.html

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The challenge

You are part of a team of engineers who have been given the challenge to design a bridge out of linguini and glue.

Bridges must be able to hold a specific weight. The bridge must span at least 40 cm in length because when it has been constructed, it will be placed between two chairs so it is at least 50 cm above the floor for a weight bearing test.

In addition to meeting the structural and weight bearing requirements, the bridge will be judged on its aesthetics as well, so be creative!

You are encouraged to use the fewest linguini possible to achieve your goal.

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The challenge

Materials:

- Linguini (pasta)
- Adhesive tape or hot glue

How to improve your bridge design?

- Incorporate truss structure (triangles)
- Design a 3-D structure from the start
- Avoid overloading joints
- Use short members in compression
- Strengthen base supports and load point

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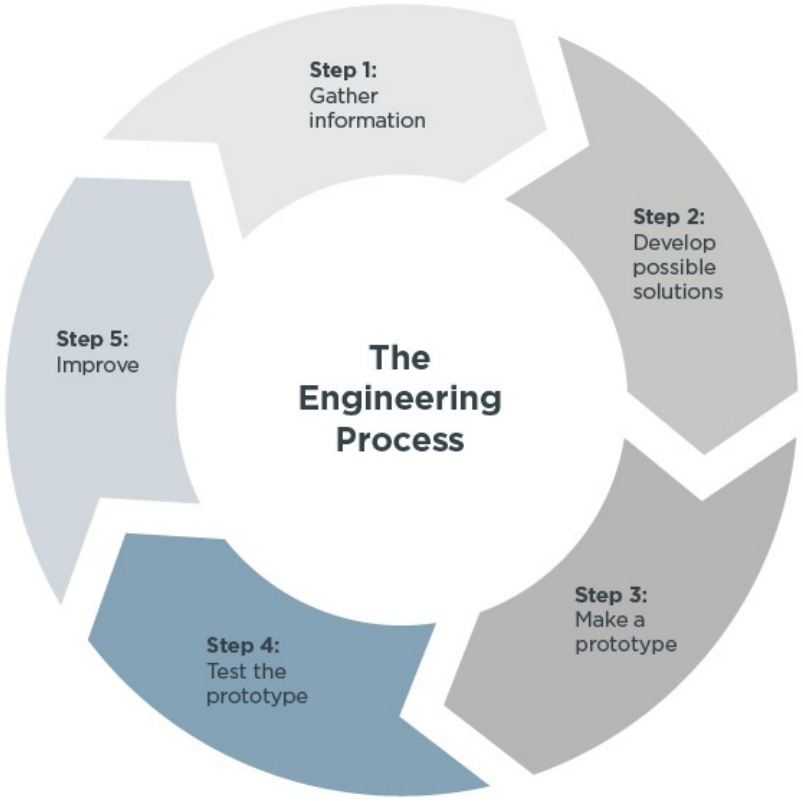
The challenge



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The challenge

More ideas…

- Build shelters for earthquakes, floods, …
- Known monuments

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- https://www.youtube.com/watch?v=caTaBeKUh-U

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- https://www.stem.org.uk/resources/community/collection/285271/structures

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