ENGINEERING

Building Bridges

Building Bridges

NGSS

3-5-ETS1-2; 3-5-ETS1-3

Objective

The student will understand the engineering process and various types of bridges.

The student will be able to construct a bridge and apply their knowledge of bridge components to build a bridge that can hold the most weight.

Vocabulary

Engineering: Applying scientific and mathematical knowledge to create solutions for various technical problems. There are different disciplines that include chemical, civil, electrical, and mechanical engineers.

Truss: A framework, typically consisting of rafters, posts, and struts to support a roof, bridge, or other structure.

Crossbeam: A horizontal or transverse beam, especially a structural beam resting on two supports.

Background

Bridges are important and should not break. Humans rely on bridges to support travel and trade. Bridges are largely used for transporting goods and people over various obstacles. Bridge design can range from small and simple to very large and complex. Important weight-bearing components of bridges include crossbeams and trusses.

Think about all the types of bridges that you may have seen. For example, pedestrian bridges, bridges that support cars or trains, bridges that lift to allow boats to go through them. There are so many types, but all use those same fundamental components to function.

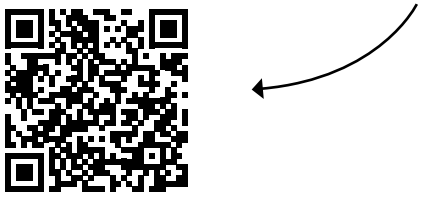
Materials

Groups of 2-3 students

- 100 wooden skewers
- 1 meter of masking tape
- Scissors
- Construction paper (Purpose: road across the bottom of the bridge)
- Weights (ranging from 0.1 to 5 grams)
- Hot Wheels car
- Scale (if masses of weights are unknown)

Procedure

1. Start with an icebreaker question to work on community building amongst the group.
2. Necessary Explanations
    a. Opener. Talk about bridges. Reflect on what students know and briefly share relevant examples (e.g. https://www.youtube.com/watch?v=G3bkkKvBoOg).



3. Start the experiment.
    a. Split into groups of 2-3 students per group.
    b. Propose the challenge to students: Build the strongest bridge you can with the materials available. The bridge must cover the foot distance from table to table (variable), must be wide enough to accommodate a Hot Wheels car, and will be judged based on the amount of weight it can support without breaking. (Possible variations: longer distance, bonus for multiple “lanes”, maximum weight limit, alternative materials, etc.)
    c. Check bridges: This is the best part of the challenge! Check each bridge ceremonially, so everyone gets to watch as the strength of each bridge is tested until it breaks. First, push the car across the bridge. Then, gradually add weights until the bridge breaks. Record the amount of weight each bridge supported.

d. Discuss which techniques/structures worked and which did not. Be specific. Ask why certain designs are inherently weaker (or stronger) than others. What forces enable the most successful bridges to hold the most weight?

Guiding Questions

Where is the support of the bridge most important?
Why is it important to conduct annual checks on bridges that support car traffic?

Career/Future Application

Teamwork and problem solving are part of Every job. Individuals must work together to identify solutions, accomplish goals, and be cooperative. This can be a good team-building exercise as well as an experience for students to learn from each other.

Engineering is cool. Engineers apply advances in science to create more useful products and machines. Examples: building rockets, buildings, cars, particle accelerators, etc. Engineers are constantly designing things to be stronger, better, and more aesthetically pleasing. Engineering concepts are not limited to bridges. Architecture and engineering are involved in almost every aspect of our day-to-day lives in the 21st century.

Sources

http://www.sciencekids.co.nz/sciencefacts/careers/engineer.html

http://www.oxforddictionaries.com/us/definition/american_english/truss

http://www.thefreedictionary.com/crossbeam