Northeastern University
College of Engineering

Weekly STEM Newsletter 4 (April 10 - April 17, 2020)

Civil Engineering

Introduction

What is “Civil Engineering”? What do Civil Engineers do? How can I learn more about it? You might be quite familiar with the term engineering, but what about the different types of engineering, specifically Civil Engineering? This week’s newsletter is going to be all about Civil Engineering and will help answer some of these questions.

Civil Engineering is a type of engineering that focuses on developing the physical world around us to make our lives easier. Civil Engineers design, maintain, and construct things such as buildings and towers, bridges, roads, railways, and pipelines. Civil Engineers solve big problems that can range from communities not having access to clean water to designing an earthquake-proof building. It involves math and science, such as physics, material science, and environmental science. This branch of engineering has many applications, with no two civil engineers doing the same exact thing.

Waste management, water treatment, construction, coastal protection, designing structures, forensics (scientific tests used with the detection of crime), nanotechnology (changing small particles), and transportation are just a sample of the different areas Civil Engineers work in. The main goal is to improve our lives by utilizing the world around us.

Here's a video that explains what civil engineering is and introduces three civil engineers in different work environments:
https://youtu.be/cJaRjI7K-Lw

Northeastern Connection

At Northeastern University, the School of Civil and Environmental Engineering has several student run and faculty advised organizations that focus on a range of civil engineering topics. In these organizations, students can build and design concrete canoes and steel bridges, or even network with civil engineering professionals and companies!

In Northeastern's Steel Bridge competition team, students work to design and build a small-scale steel bridge that can be put together as fast as possible over a fake river. The students with the strongest bridge and the fastest build time win!

In Northeastern's chapter of the American Society of Civil Engineers (ASCE), students meet with civil engineering companies, listen to lectures from speakers, and participate in community service.

Student Hannah Mellecker (Pictured on far left with steel bridge) is the Spring of 2021 ASCE president and also participates in Steel Bridge. She has been in ASCE for 2 years and has been in steel bridge for 1 year. Hannah says that she "loves being a part of the civil and environmental engineering community at Northeastern. The department is a great group that's very easy to get involved with. Being a part of ASCE is great because it gives me an opportunity to learn about real-world applications of material we learn in our classes. Being a part of Steel Bridge is a fun and hands-on way to get involved and apply classroom knowledge!"

Do Now

Watch the following video to learn about structural engineering!

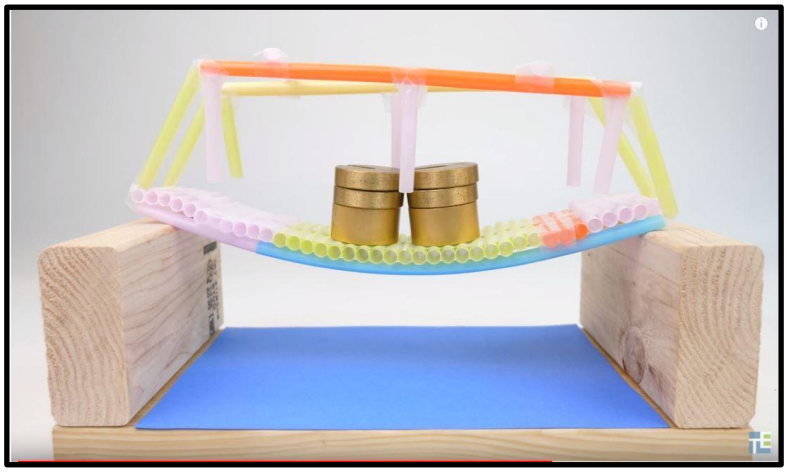
https://tinyurl.com/wcrhcus

After watching the video, look inside your house, out a window, or on the internet and find 3 examples of structures that need to be strong so they don't fall down. Examples could be as large as a skyscraper, or as small as a bookshelf. For each example, answer the following:

- What forces might cause the structure to fall down?
- What would happen if it fell down? Could anyone get injured if it did?
- How do you think the structure was designed so it does not fall down?

After finding these examples and answering the questions, draw a picture of a bridge, building, or any other structure you can think of! Then give your drawing to a partner and ask them to answer the 3 questions above for the structure you drew.

Activity



This week you will be building straw bridges! Please watch the following video to introduce you to the activity:

Straw Building Activity
https://youtu.be/keM4UJ4eFfo

Please watch the following video to learn a little bit more about how bridges are designed: **What Are Trusses?** https://youtu.be/DnStfurBIOE

**Instead of building a bridge testing area using blocks of wood, use two chairs facing each other with the seats about 10 inches apart!*

Materials:

- Tape or Glue
- Straws
    - *(Alternatives: Popsicle sticks, wooden dowels, q-tips, plastic cutlery, spaghetti, pencils, pens)*
- A cup (any material)
- Pennies
    - *(Alternatives: Stones, other coins, nails, screws, marbles, ball bearings)*

Procedure:

1. Gather the needed materials
2. Using the tape/glue and straws (or alternative building material) create a bridge that will span the gap between the chairs
3. After creating the bridge, place it over the gap and put the cup on the center of the bridge
4. Begin slowly adding weight to the cup using the pennies (or alternative material) until the bridge breaks or falls through the gap. Record how many pennies it took to break the bridge.
5. Repeat steps 2-4 two more times. Each time, try something different that you think will make the bridge stronger! Try to use the same bridge building materials for each trial.

Discussion:

- Did your first bridge hold more or less weight than you initially thought? Why or why not?
- Were you able to improve your design during the next two trials? What strategies did you use to improve your design?
- Why don't engineers build bridges using a giant, single block of steel? Do you think it would be more or less expensive this way?
- How do you think engineers design bridges that will be built in the real world? Describe what you think the process looks like.

Share Your Results

We'd love to know how the activity and/or the "do now" turned out! What worked and what didn't work? Please share pictures of your structure drawings or your bridges! Email us at stem@northeastern.edu.

Related links/Extensions

- A more in-depth video about civil engineering:
  - (Crash Course) https://youtu.be/-xbtnz4wdaA
- EdX: The art of Structural Engineering (8-week course from Princeton)
  - https://www.edx.org/course/the-art-of-structural-engineering-bridges
- Board Games related to Civil Engineering:
  - Aquaducts (free to play -> just print): http://bit.ly/1ECXIZk
  - Seeland: https://boardgamegeek.com/boardgame/63759/
  - Roads & Boats: https://boardgamegeek.com/boardgame/276502
  - Canalis: https://boardgamegeek.com/boardgame/144382
  - Aqua Romana: https://boardgamegeek.com/boardgame/20080
  - New York: 1901: https://boardgamegeek.com/boardgame/174660
  - Metro: https://boardgamegeek.com/boardgame/559
  - Erosion: https://boardgamegeek.com/boardgame/54372
- Video Games related to Civil Engineering:
  - Bridge Designer Educational Software (free): https://bridgedesigner.org/
  - Cargo Bridge (free): http://www.engineering.com/GamesPuzzles/CargoBridge.aspx
  - Cargo Bridge X-Mas (free): http://www.engineering.com/GamesPuzzles/CargoBridgeXmas.aspx
  - Poly Bridge (10$): https://store.steampowered.com/app/367450/Poly_Bridge/
  - Tricky Towers (15$): https://store.steampowered.com/app/437920/Tricky_Towers/
  - SimCity Buildit (freemium): https://www.ea.com/games/simcity/simcity-buildit
  - Cities: Skyline (30$): https://store.steampowered.com/app/255710/Cities_Skylines/
  - Factorio (30$): https://store.steampowered.com/app/427520/Factorio/
  - I Love Traffic (free): https://www.agame.com/game/i-love-traffic