

# Western Engineering Outreach

## *Fighting the Wind* *Grades 3-5*

### *Meet Today's ENG HERO!*



*Girma Bitsuamlak* - Associate Professor with Western Engineering

Girma is the Associate Director WindEEE Research Institute and Canada Research Chair in Wind Engineering Tier II. His research focuses on the effects of wind on the built environment. At the Wind Engineering, Energy and Environment Research Institute, Girma supervises graduate students and research efforts to see how wind affects civil engineering creations.

To learn more about Dr. Bitsuamlak visit:

[https://www.eng.uwo.ca/civil/faculty/bitsuamlak\\_g/index.html](https://www.eng.uwo.ca/civil/faculty/bitsuamlak_g/index.html)

### *Learning Goal:*

- Students will learn what a structure is and its ability to maintain stability and strength
- Students will consider how forces play a role in affecting the strength and stability of structures
- Students will understand the major roles struts and ties play in increasing a structure's strength and stability
- Curriculum Connections: Grade 3 - Strong and Stable Structures; Grade 5 - Forces Acting on Structures and Mechanisms

### *Materials Needed:*

- Newspaper
- Duct Tape or Masking Tape
- Scissors
- A Fan



## Engineering and Science Connections:

Today we will be talking about structures!

What are some examples of some structures?

This building is a structure, the Eiffel tower is a structure but so is a shoe. A structure is any solid that has a shape, size, and a purpose. Most importantly, a structure also holds something.

### Strong and Stable Structures

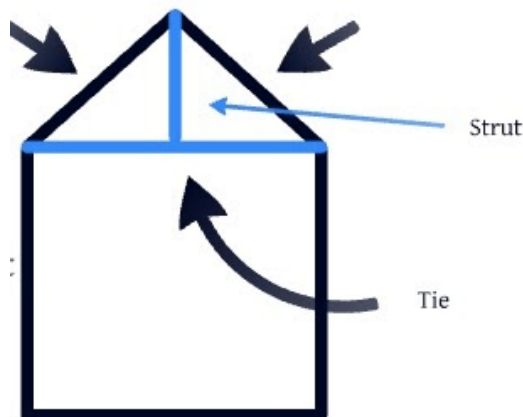
A structure must have two main qualities: it must be strong and it must be stable.

- The strength of a structure is its capacity to hold a load that is applied to it
- The stability of a structure is its capability to stand strong no matter the load placed on it.

To increase the strength and to make structures more stable, engineers use things called struts and ties.

- Ties are “beams” or “bars” used to stop two parts of a structure from being pulled apart.
  - In the house drawing below, the tie stops the roof from collapsing
- A Strut is a “beam” or a “bar” that supports a heavy load
  - The beam in the middle of the roof holds and supports it from caving in

Structures need to be strong and stable so it can withstand forces being applied to it. Forces can be a pull or push. All structures have forces acting on them. If a structure cannot withstand forces such as high winds or tornadoes, they can collapse and cost a lot of money.



Civil engineers design buildings such that they are strong and can support heavy loads. They have to think about all of the qualities of structures that we talked about and more before designing a strong and stable structure.

**Video Recommendation:** *Tornado Simulation at Western's WindEEE Research Institute:*

<https://www.youtube.com/watch?v=PreqRRXZXoE>

## Activity:

Before you start, think about the following questions:

- What is a structure? What are some examples?
- What are two things that can be used to make a house strong and stable?

## Today's Weather Forecast

The weather forecast is warning the citizens of London that very high winds at the speed of 150km/hr are headed for our city. We are the only civil engineers that London has and the Mayor has given us the task of designing and building strong buildings that can withstand the high winds that are headed for the city. With only the materials provided, we must build buildings that have at least 1 strut and 1 tie and must be stable through the wind. The building must be at least one foot tall (30 cm) and it must be free-standing - it cannot be taped to the ground or wall.

Be creative and try to make your foundation strong. Remember, the tighter you roll your newspaper, the stronger it will be! Use scissors to cut your newspaper tubes to any length you wish. Use tape to put your building together.

Test your building in the wind of the fan! Does it fall over? Do pieces come off? How can we fix any issues that arise.

## Skit

After your building is complete, it is your task to update the City of London! Create a weather forecast video that warns for the high winds. Put your building in the background, standing against the force of the wind.

Some examples are:

- one weatherman gives the weather forecast for the week and mentions the high wind warning
- one interviewer is out in London interviewing the engineer or a house owner something
- The engineer showing their strong building, or a house owner just talking about how strong the winds are etc.

Record your forecast and share it with us.

## What Did You Learn?



- What external force was working on our buildings?
- How did you adjust your building to withstand the wind?
- What makes your building strong and stable?
- What other materials would you use to strengthen your building?
- What are some other disasters that civil engineers must think about when designing their buildings? Tornadoes, earthquakes, floods. How would you protect your structure from these kinds of disasters?

## Future Learning



- Simulate a different disaster and see how your building stands up against that. What changes need to be made to protect and paper building from a flood? Or to protect a building from an earthquake? Or a volcano? Redesign your building and test again.
- How do engineers decide what kinds of buildings to build in certain locations?

## Share your creations!

We would love to see what you made. Email as at [discover@uwo.ca](mailto:discover@uwo.ca) or tag us on social media.

Instagram: @westernueng

Twitter: @westernueng

Facebook: @westernueng

*Thanks for discovering with us!*