Build Safer with Wind Tunnel Testing
2025 NSF NHERI Wall of Wind Florida International University
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- **Summary-**

  In this lesson, middle school students will explore the role of wind tunnel testing in engineering research and how it informs efforts to build safer, more resilient communities in hurricane-prone regions. Through hands-on engagement with charts, coding data, 3D models, and guided readings, students will learn how engineers use tools like the Wall of Wind (WoW) to simulate hurricane conditions, analyze structural performance, and apply findings to community resilience planning. Students will also develop their own research questions and simulate the engineering design process in a culminating project.

- **Engineering Connection-**

  This lesson connects directly to engineering by immersing students in the processes that structural and civil engineers use to test and improve the wind resistance of buildings. Students will analyze data from wind tunnel simulations, interpret performance results from scaled models, and understand how engineering innovations translate into real-world policies and designs that protect communities. The lesson highlights how engineers combine research, modeling, and community impact analysis to inform public safety and resilience efforts

- **Audience-**

  6th-8th (Middle School)

- **Lesson Objectives-**
  - Explain the purpose of wind tunnel testing in engineering.
  - Reproduce the steps of the engineering design process in their own projects.
  - Describe how wind hazard research contributes to community resilience.
  - Develop and present original research questions related to wind hazard mitigation or structural safety.
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- **Educational Standards-**
  - MS-ETS1-4 Engineering Design
  - MS. Human Impacts

- **Material List-**
  - 3D models, PowerPoints, Videos (Wind Testing and Natural Disasters), Articles
  - Structure Building Materials (i.e. straw, tape, scissors, playdough, paper, cardboard, etc.)
  - Fan
  - Engineering Design Process Worksheet

- **Introduction-**

  Extreme weather events like hurricanes can devastate communities. Engineers play a key role in helping us prepare for and withstand these disasters through wind tunnel testing and structural research. This lesson introduces students to how the Wall of Wind (WoW) simulates storm conditions and helps researchers study the impact of wind on buildings. Students will step into the role of engineers to explore how design decisions influence safety and community resilience, while developing their own ideas for disaster mitigation.

- **Procedure-**
  - Background knowledge
    - Introduce students to basic concepts: engineering design process, wind forces, structural integrity, and community resilience.
    - Discuss real-world hurricane impacts and the role of engineering in disaster preparedness.
    - Show short videos or visuals of the Wall of Wind facility in action.
  - Before the activity
    - Organize the students into groups of 2-4
    - Gather materials students will use to design their own wind resistant building. i.e. straw, tape, scissors, playdough, paper, cardboard, etc.
  - During the activity
    - Allow the students 20-45 minutes (depending on available time)
    - Students will use the engineering design process to design a wind-resistant building given the materials provided. Students will fill out Design Process Worksheet with the following sections: Define, Research, Brainstorm, Choose, Develop, Test, Improve
    - The structures the students created will be tested using a fan as a "wind simulator"
    - Students will take notes during their group's testing phase, noting how long the structure stood, what area of the building failed first, etc.
  - After the activity
    - Teacher/facilitator will explain some of the forces at play (i.e. pressure, lift, drag, gravity) and elaborate on the results of each groups' testing

- **Assessment-**
  - Students will complete an exit ticket with the following questions:

- What's one thing you learned about engineering that surprised you
- What would you want to test if you had access to the Wall of Wind?

- **Wrap-up-**

Students can complete a "Gallery Walk" where they circulate around the room to view and leave comments on each group's project ideas. This encourages peer learning and solidifies understanding by exposing them to multiple approaches to wind hazard mitigation.