TeachEngineering
STEM curriculum for k-12

Hands-On Activity

Testing Model Structures: Jell-O Earthquake in the Classroom

Groups of 1. Estimated materials cost is $1 per group.

Grade Level 5 (3-5)

Subject Areas Earth and Space

Time Required 50 minutes

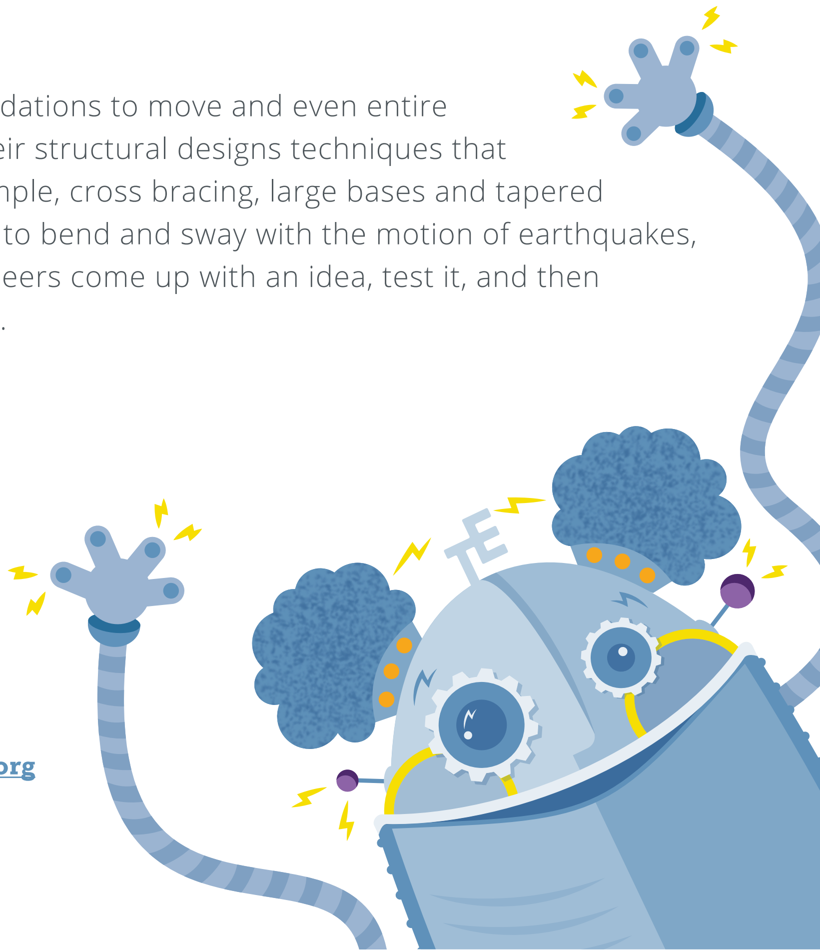
Contributed by Integrated Teaching and Learning Program, College of Engineering, University of Colorado Boulder

Summary

Students learn how engineers design and construct buildings to withstand earthquake damage by building their own model structures using toothpicks and marshmallows. They experiment to see how earthquake-proof their buildings are by testing them in an earthquake simulated in a pan of Jell-O®. *This engineering curriculum meets Next Generation Science Standards (NGSS).*

Engineering Connection

Because earthquakes can cause walls to crack, foundations to move and even entire buildings to crumple, engineers incorporate into their structural designs techniques that withstand damage from earthquake forces, for example, cross bracing, large bases and tapered geometry. Earthquake-proof buildings are intended to bend and sway with the motion of earthquakes, or are isolated from the movement by sliders. Engineers come up with an idea, test it, and then re-engineer the structure based on its performance.



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Learning Objectives

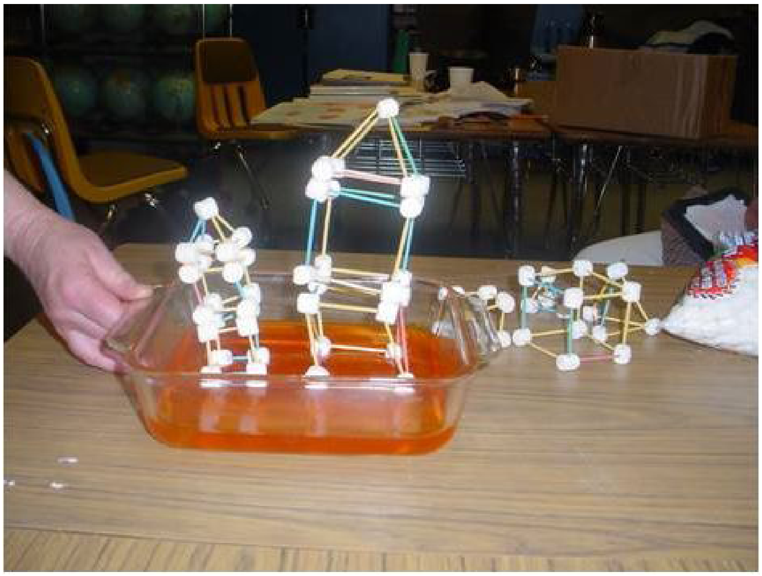
After this activity, students should be able to:

- **Model** an earthquake-proof structure using simple materials.
- **Compare** a model structure with what it represents.
- **Understand** why engineers need to learn about earthquakes.
- **Identify** some of the factors that make buildings earthquake-proof, including cross bracing, large "footprints," and tapered geometry.

Introduction/Motivation

Earthquakes can cause much loss of life and millions of dollars worth of damage to cities. ***Surface waves*** and ***body waves*** from earthquakes can cause walls to crack, foundations to move and even entire buildings to crumble. Engineers continually strive to make buildings stronger to resist the forces of earthquakes.

Engineers face the challenge of designing more robust buildings to withstand earthquakes. Earthquake-proof buildings are intended to bend and sway with the motion of earthquakes, instead of cracking and breaking under the pressure.



A student's marshmallow-toothpick structure resting on a bed of Jell-O®. Copyright.

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Introduction/Motivation Continued

Have you ever looked at a really tall building, such as a skyscraper? What does it look like? Does it appear fragile and unstable? It might, but it is most probably quite sturdy and can withstand wind, rain and other natural elements and phenomena. Earthquake-proof buildings typically have cross bracing that forms **triangles** in its design geometry (like a bridge). Such buildings also typically have a large **"footprint"**, or base, and a **tapered shape**, decreasing in size as the building gets taller (or simply, smaller at the top). Short buildings are more earthquake proof than tall ones. Why do you think that is? Have you ever climbed up a tree or been on top of a playground jungle gym in the wind? Do you sway more when you are up high than when on the ground? All buildings shake at the same frequency as the shaking of the Earth, but the movement is magnified as the building gets taller. Sometimes, as can be the case during earthquakes, buildings sway too much, crack and crumble and fall.

Aligned Educational Standards

NGSS Next Generation Science Standards (3)
ITEEA International Technology and Engineering Educators Association (2)
CCSS Common Core State Standards (3)
CO Science (2)

The full activity includes the materials list, procedures, specific aligned standards, attachments and assessments.

SEE THE FULL ACTIVITY