

Earthquake City

Grade Level: 5, 6, 7, 8, 9

Duration: 40 - 60 minutes

Classification: Classroom

Subject(s): Civil Engineering, Construction

Categories (STEM): Technology, Engineering

Keywords: Earthquake, Stability, Building, Jell-O

Introduction

- Summary: Compete to create the most earthquake-stable city by experimenting with different building materials!
- Description: Students will learn how earthquakes move and simulate an earthquake of their own. Students will be challenged to design a city that can survive an earthquake - the team with the longest-standing city wins!

Vocabulary

- **Earthquake:** The shaking, rolling, or sudden shock of the Earth's surface
- **Plate Tectonics:** The theory of continents drifting from place to place breaking, colliding, and grinding against one another
- **Epicenter:** The point on the Earth's surface directly above the source of the earthquake
- **Richter scale:** A measurement of an earthquake's intensity. (4 = minor, 8 = great)

Online Resources: https://www.teachengineering.org/activities/view/earthquake_city
<https://www.bigrentz.com/blog/earthquake-proof-buildings>

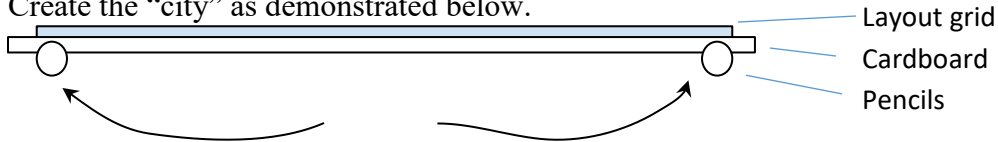
Materials

Materials	Quantity	Reusable?
Sugar Cubes	15 cubes per 2-3 students	No
Jell-O*	1 tray per 30 students	No
Pencils	2 per 2-3 students	Yes
City Layout Grids	1 per 2-3 students	Yes, if laminated
12 x 12 Cardboard Base	1 per 2-3 students	Yes, use discretion
Plastic Knives	1 per student	Yes, use discretion
Small Spatula	1 per classroom	Yes

*Needs to be made prior to the visit with ½ the water used

Directions

- Discuss earthquake vocabulary and explain the parts of the world where earthquakes are most common.
- Put students into groups of 2-3 and pass out 2 pencils, 15 sugar cubes, a cardboard base, and a city layout grid.
- Create the “city” as demonstrated below.



- Build 3 skyscrapers, each 5 cubes tall, at the following corners:
 - A and 1st
 - B and 2nd
 - C and 3rd
- Tap on the corner of D and 4th with the eraser of a pencil until at least one cube falls.
- Discuss results. Ask students if they believe location impacts the damage done to a building.
- Have each team designate an epicenter on their city.
- Using the rules below, give students 7 minutes to build their earthquake-stable city.
 - Each group will get 15 sugar cubes and 5 Jell-O cubes (no replacements)
 - Each group must design a city with at least 3 buildings
 - Each building must be at least 3 sugar cubes tall
 - The epicenter cannot be changed after the timer begins
- Test each city by having the SRMs tap the epicenter with a pencil. Stop as soon as a cube falls, if a city makes it to 150 taps it is automatically a winner.

Activity Extension

- Retry the activity with new supplies. What changes would students make to the design?
- Add 5 more sugar cubes to the existing design. Does it hold up with a taller skyscraper?

Discussion Questions

- Why is it useful to build skyscrapers out of different materials?
- Which materials were the best to use for taller buildings?
- Which cubes were the most earthquake resistant? Why?

- Which skyscrapers fell first in the earthquakes? Where were they located in respect to the epicenter of the earthquake? **Buildings closest to the epicenter are the most impacted**
- What happens when the top of a skyscraper is heavier than the bottom, or when the bottom is heavier than the top?
- What challenges did you face? (limited materials, limited time, team work) Discuss how these are issues that engineers face as well.

What is happening?

- Concrete or plastic rings may be used around buildings, underground, to dampen the impact. Similarly, hydraulics on the sides of buildings may be used.
- Some buildings have a flexible foundation to allow room for the building to move during an earthquake.
- Builders may use a large steel ball or other heavy weight to act as a pendulum against the swaying of the earthquake.



Applications:

- Majors
 - Architecture
 - Civil/Construction Engineer
 - Geologist/Physics
- Jobs
 - Architect
 - City Planner
 - Architectural Engineer
- Hobbies
 - Storm Chasing
- Real-World applications
 - Cities along the “Ring of Fire” are more likely to experience earthquakes

