Earthquake Madness

By: Om

Purpose

I was reading the news one day and I came across a story of an earthquake. I wanted to do something, so for this science fair I will try different ways to make stronger buildings to see if there is a way to make buildings survive a major earthquake(8 magnitude). For this experiment I will try 4 different ways(Stronger materials, pyramid, and underground poles) to make my control(a square based prism) stronger.

Hypothesis

My hypothesis is that the underground poles will be the most effective because they hold the structure in place and stop it from wobbling, which could topple the building. I think the pyramid will be the least effective because it will topple quickly.

Materials And Tools

- *No name spaghetti(600 grams)
- Normal sized marshmallows(250 grams)(Size: 2 X 2 X 3)
- Power Vibrator
- Modeling Clay(1 kg)
- Scissors
- Painters tape(half a roll)
- wooden skewers(12)(3 mm thick)
- Ruler(30 cm)

*You might need extra spaghetti because some spaghetti might break.

Procedure

Getting Ready:

1. Cut the clay into three 5.5X 2 X 12.5 cm pieces. Line these on the spot that vibrates on the powe vibrator.
2. Tape these pieces to the power vibrator from the opposite sides, and together.

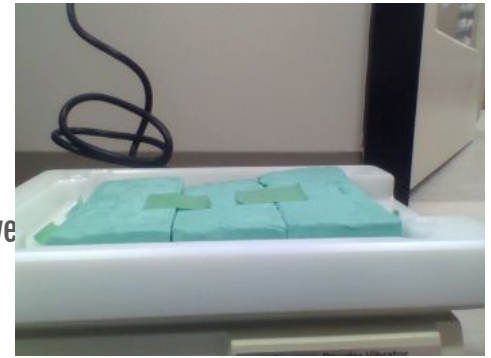
Control Building:

3. Cut 6 spaghetti in half.
4. attach one half spaghetti to a marshmallow. Repeat 3 times.
5. Attach these together so that there is a square.
6. Repeat steps 4 and 5 once more, but use tape rather than marshmallows for the vertices.
7. Use four spaghetti and the square to make a Square-based prism.

Pyramid Building:

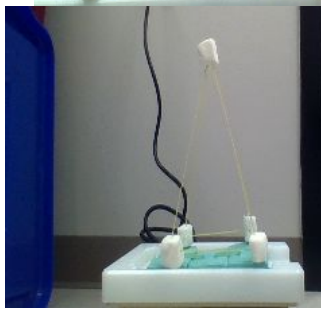
8. Repeat steps 4 and 5.
9. Attach spaghetti to the top, and join them together with a marshmallow to make a square-based pyramid.

Getting Ready:



Control:

Pyramid:



Procedure *(Continued)*

Underground Poles Building:

10. Repeat steps 2 to 7.
11. Poke skewers(sharp end down) through the marshmallows. These should be attached to the clay.

Stronger Materials Building:

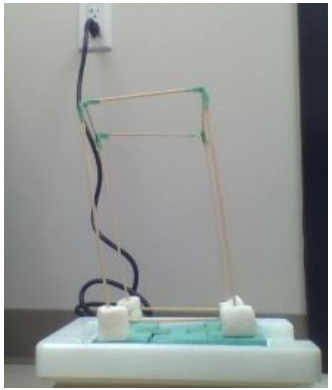
12. Cut 8 skewers into the size of the spaghetti.
13. Cut 4 of the new skewers so they are halves.
14. Repeat steps 4-7, but use skewers and half skewers rather than Spaghetti and half spaghetti.

Testing:

15. Put the buildings on the vibrator(one at a time), and if said, attach the skewers to the ground,
16. Turn on the vibrator and slowly raise the number of vibrations. When the building collapses, record the amount of vibrations.
17. Do all the steps, other than Getting Ready, twice more.

Underground Poles:

Stronger materials:



The Variables

Independent variable

The independent variable is the design of the buildings.

Dependant variable

The dependant variable is the strength of vibrations the building withstands.

Controlled Variables

The controlled variables are the same amount of clay, same way of measuring the vibrations, and the same size of marshmallows and spaghetti and skewers.

Observations

	Control	Pyramid	Underground Poles	Stronger Materials
Quantitative	**Test 1:** 4.3 magnitude.	**Test 1:** 7.4 magnitude.	**Test 1:** 6.4 magnitude.	**Test 1:** 6 magnitude.
Qualitative	Building toppled because of broken spaghetti.	The marshmallow added its wait making it collapse.	Spaghetti broke.	Tape lost connection at 5.5, then it collapsed
Quantitative	**Test 2:** 4.4 magnitude.	**Test 2**: 7.3 magnitude.	**Test 2:** 7.6 magnitude.	**Test 2:** 6.1 magnitude.
Qualitative	Building toppled.	Same reason as first.	Poles worked but it collapsed.	Collapsed.
Quantitative	**Test 3:** 4.6 magnitude.	**Test 3**: 7 magnitude.	**Test 3:** 6.2 magnitude.	**Test 3:** 5.6 magnitude.
Qualitative	Building collapsed because the tape let go.	spaghetti broke.	Spaghetti broke.	Tape quickly lost connection, and it collapsed.

Results

My results were not what I was expecting, as my hypothesis was that the underground poles would be the strongest. As it turns out, the pyramid was the strongest, at 7.2 magnitude and the underground poles was the second strongest, at 6.7 magnitude. The stronger materials was the second weakest, at 5.9 magnitude and the control, at 4.4 magnitude, was the weakest.

Conclusion

The pyramid survived the largest magnitude because the weight was evenly distributed outwards. The underground poles was the second strongest because the poles helped it stay in place. The stronger materials was the second weakest because the tape didn't hold, it let go of the top structure causing it to fall over and topple onto itself. The control was the weakest because it had no extra support. According to my results and observations, I can say that the results disproves my original hypothesis of the underground poles being the strongest, and the pyramid being the weakest.

Through my experiment, I was curious what would happen with an indirect earthquake, such as a tsunami. I also wondered what would happen if I made a bigger structure (ex. 5 ft, 8ft...). I also wondered what would happen if I used rubber for another structure, which would make it way more flexible.

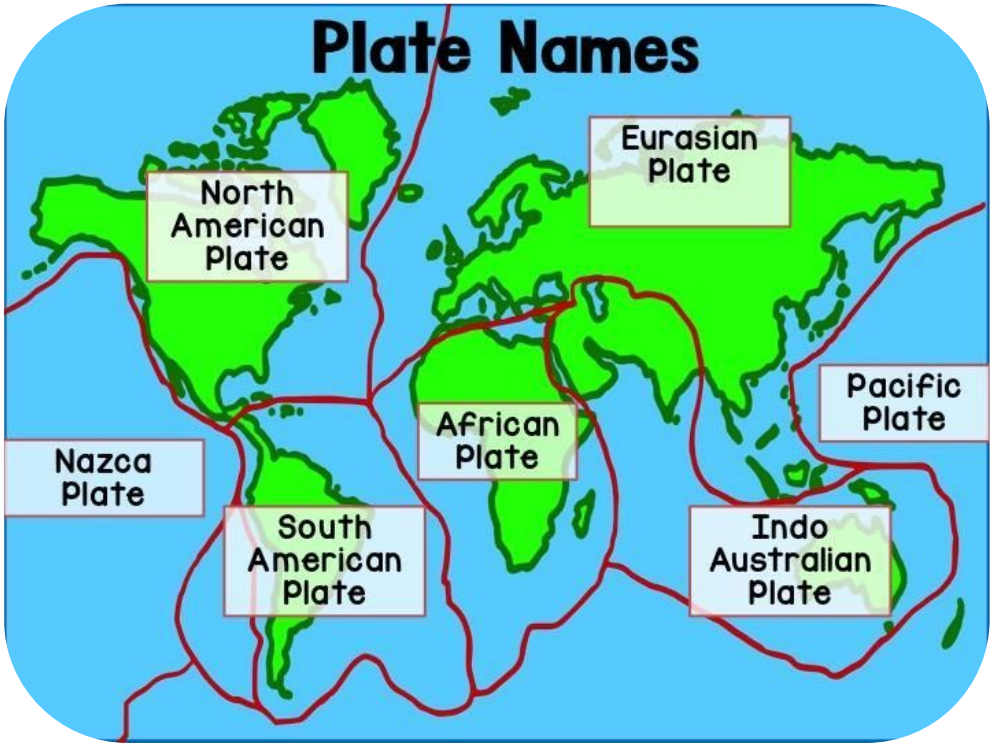
Background Research

What Is An Earthquake?

An earthquake is a natural disaster that results in rapid movements of tectonic plates(the plates that make up the Earth). This could mean that the plates have slid over each other. A major earthquake can flatten buildings and uproot trees.

How Do Earthquakes Happen?

Tectonic plates are always slowly moving, but they get stuck at their edges due to friction. When the stress between the two plates overcome the friction, the plate slip, which makes the ground shakes, creating an earthquake.



Bibliography/ Reference Page

- “Why Do Earthquakes Happen?- Incorporated Research Institutions for Seismology.” *IRIS*, www.iris.edu/hq/inclass/fact-sheet/why_do_earthquakes_happen. Accessed 25 January 2021.
- “Earthquake Glossary.” *U.S. Geological Survey*, earthquake.usgs.gov/learn/glossary/?term=tectonic+plates+-. Accessed 25 January 2021.
- “The Geological Society of London - Home.” *The Geological Society*, www.geolsoc.org.uk/. Accessed 25 January 2021.
- Vedran. “Earthquake House.” *Earthquake House | Free SVG*, freesvg.org/earthquake-house. (“Earthquake house | FreeSVG”). Accessed 20 January 2021.
- “Plate Tectonic Matching: MONTESSORI Inspired Activity: Plate Tectonics, Montessori Lessons, Plate Tectonics Lesson.” *Pinterest*, www.pinterest.nz/pin/388576274093881539/. Accessed 17 February 2021.