SEISMIC SHAKE-UP!

CHALLENGE SHEET

DESIGN squad Global

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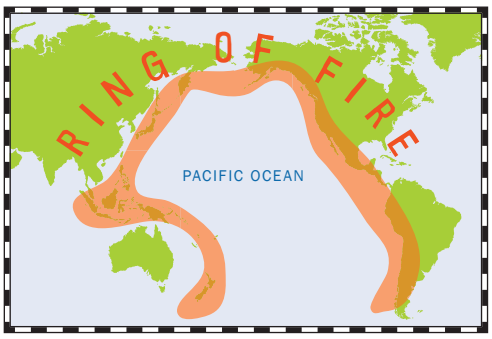
YOUR CHALLENGE

Design a structure that can survive an earthquake—then put it to the test!

DEFINE THE NEED

Hundreds of millions of people live in places around the world where earthquakes are common. Most of the destruction earthquakes cause is the result of collapsing structures, like skyscrapers, hospitals, and bridges. That's why earthquake engineering is so important. By designing buildings and other structures that can withstand the violent shaking of an earthquake, engineers save lives.



About 90% of all earthquakes take place along the Ring of Fire—a zone stretching around the rim of the Pacific Ocean.

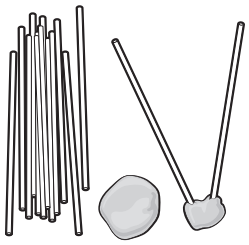
MATERIALS

Structure (per person)

- 20–30 wooden or plastic coffee stirrers (5–6 in long, or about 14 cm)
- ¼ lb (100+ grams) modeling clay (about half the size of a fist); non-hardening Plasticine® preferred
- manila file folder or thin piece of cardboard (8½ x 11 in or A4), as the base of your structure
- ruler

Shake Table

- 2 pieces sturdy cardboard (about 8½ x 11 in or A4)
- 2 thick rubber bands
- 2 tennis balls
- 2 large binder clips
- ruler or paint stirrer to make a handle
- masking tape



BRAINSTORM & DESIGN

Using coffee stirrers and clay, can you design a structure that's stable and sturdy enough to survive an earthquake's vibrations? It must be **at least 8 inches tall.** Sketch your ideas on a piece of paper.

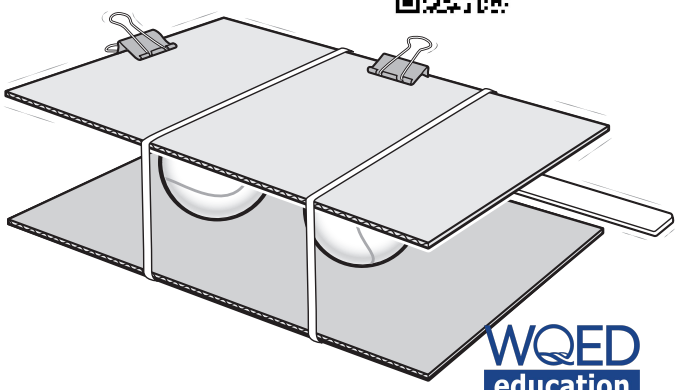
Video Link & QR Code
pbskids.org/designsquad/build/seismic-shake-up/

BUILD

Build your structure directly on top of the file folder, fixing the base of it to the surface of the folder. Use the ruler to make sure it's the minimum height.

Build a shake table, which is a device engineers use to simulate the back-and-forth shaking of an earthquake.

1. Wrap the rubber bands around the width of both pieces of cardboard. Space them about 4 inches apart.



WQED education

2. Slide the two tennis balls in between the pieces of cardboard, and position them underneath each rubber band.

3. Tape the ruler (or paint stirrer) under the top piece of cardboard to make a handle.

TEST, EVALUATE, & REDESIGN

- Test your structure using the shake table. Attach the file folder with your structure on top of it to the table with the binder clips.
- Use one hand to hold the bottom of the shake table against a surface, pull the handle with the other, and let go! Earthquake!
- How did your structure hold up during the seismic shake-up? If it wobbled, swayed, tipped over, or collapsed, it's time to redesign. You want your structure to be as strong and stable as possible.
- Success? Take it to the next level and build an even taller structure!

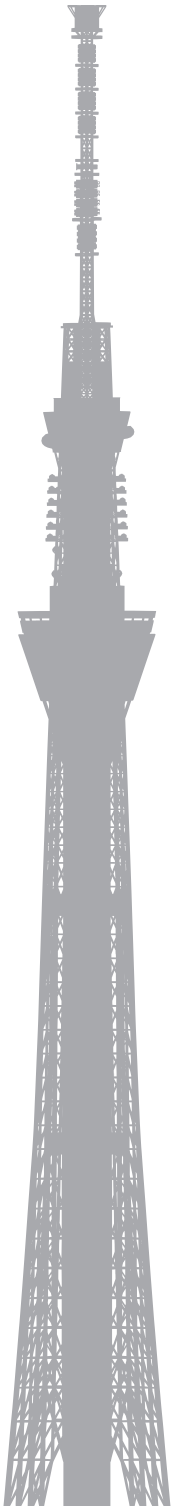
Problem-Solving Tips

WHAT IF YOUR STRUCTURE . . .

- **tips over?** Maybe your base is too small. Make it wider and sturdier.
- **collapses?** Add triangular shapes. Triangles are stronger than squares or rectangles because all three sides of a triangle carry some of the load (weight).
- **wobbles?** Try cross-braces. Turn squares into triangles by adding diagonal supports that go from one corner of the square to the other.

ENGINEERING AND INVENTION IN ACTION

Tokyo Sky Tree is the tallest tower in the world (634 m; 2,080 ft). It's also located right in the heart of an earthquake zone. So its engineers and architects needed to build a tower with the latest anti-earthquake technology. One way they did this was by standing the tower on a triangular, pyramid-shaped base. Another was by including massive dampers—shock absorbers that cushion the building during an earthquake. In March 2011, while still under construction, the tower was put to the test when a tremendous 9.0-magnitude earthquake struck Tokyo. Sky Tree's earthquake-resistant features worked beautifully—there was no structural damage and none of the construction workers caught in the building during the quake were injured.



Tokyo Sky Tree

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