

EduTrend Contents

W4C · EARTH SCIENCE & GEOLOGY · MIDDLE SCHOOL

Quake-Proof Towers

Design a building that survives a shake table.

Ages 12–14 | Level: Intermediate | 60 minutes | Groups of 3 · up to 30 | Activity 04

Inside: activity at a glance · step-by-step session plan · facilitator notes · 3 student worksheets · assessment checklist

ACTIVITY 04 · AT A GLANCE

Quake-Proof Towers

Students learn why earthquakes happen and how engineers design buildings to survive them. They test towers on a simple shake table, record how long each lasts at increasing shaking, then improve their design using bracing, a wide base and damping. The activity links plate tectonics with engineering design.

Learning outcomes

By the end of the session students can:

- explain how earthquakes are caused by movement at plate boundaries;
- test a structure fairly on a shake table;
- use results to improve a design;
- describe real techniques that protect buildings.

KEY WORDS

earthquake · plate · fault · seismic wave · bracing · damping · base isolation

CURRICULUM LINKS

Science and geography: plate tectonics, natural hazards. Design & technology: structures. Maths: timing and data.

1	2	3	4	5	6
QUESTION	**OBSERVE**	**PREDICT**	**TEST**	**RECORD**	**EXPLAIN**
What do we want to know?	Look and handle	What might happen?	Try it fairly	Measure and note	Read the evidence

Materials (per group)

- Shake table: tray on four tennis balls or marbles in a box lid
- 20 straws, card, masking tape, 4 small masses (e.g. 20 g)
- Rubber bands, sponge pieces for damping
- Stopwatch, metronome app for shaking rhythm
- Worksheets 1, 2 and 3

Before the session

- Build one shake table per group or share between two groups.
- Agree a shaking method: 10 cm push at a set rhythm.
- Prepare materials trays.
- Show a short map of world earthquake zones.

SAFETY

Shake gently and only by hand. Keep fingers clear of rolling balls. Masses must be taped securely.

ACTIVITY 04 · SESSION PLAN

Step by step

Timings are for 60 minutes. Use a metronome app so every group shakes at the same rate.

Time	What happens	Say or ask
0–5 min **Hook**	Show the world map of earthquakes and plate boundaries.	*"Why do earthquakes happen in lines?"*
5–15 min **Science**	Explain plates, faults and seismic waves with a model of two blocks sliding.	*"What happens when stuck plates suddenly slip?"*
15–30 min **Build v1**	Groups build a tower at least 30 cm tall carrying the masses at the top.	*"What will make it wobble less?"*
30–40 min **Test**	Shake at three rhythms for 15 seconds each and record damage.	*"Where did it fail first?"*
40–52 min **Improve**	Groups add bracing, a wider base or a damper and retest.	*"Did the change help? How do you know?"*
52–60 min **Link**	Discuss real techniques: cross-bracing, base isolators, tuned dampers.	

CHALLENGE CARD (print or copy onto the board)

Build a tower at least 30 cm tall, carrying 80 g at the top, that survives 15 seconds at the fastest shaking rhythm. Improve it once using your test results.

ACTIVITY 04 · FACILITATOR NOTES

The geology in brief

The Earth's crust is broken into tectonic plates that move a few centimetres a year. Where plates grind past or push into each other, stress builds up on faults. When the rock suddenly slips, energy is released as seismic waves that shake the ground.

Buildings fail when shaking makes them sway too much or when joints break. Engineers add diagonal bracing to make frames rigid, use flexible base isolators that let the ground move beneath a building, and fit dampers that absorb energy. Wide bases and low centres of mass also improve stability.

Common ideas to listen for

- "Stronger always means stiffer." Some flexibility helps absorb energy.
- "Earthquakes happen anywhere at random." Most occur along plate boundaries.
- "Taller buildings always fall first." Design matters more than height alone.

Adapting the activity

Support

Provide a basic tower design to improve rather than build from scratch.

Stretch

Measure the sway at the top with a ruler behind the tower and compare designs quantitatively.

WORKSHEET 1

Plates and earthquakes

Name: _____ Class: _____ Date: _____

Label the diagram and answer the questions.

Draw two plates at a fault and show how they move

What causes an earthquake?

WORKSHEET 2

Test results

Shake for 15 seconds at each rhythm.

Results

Design	Slow	Medium	Fast	Where it failed
Version 1				
Version 2				

What I changed and why

WORKSHEET 3

Engineer’s report

Explain your final design.

Sketch of final design

Label bracing, base and any damper.

Which real technique is your design like?

FOR THE TEACHER

Assessment checklist

Use during the session. One sheet covers up to eight students; copy as needed.

Student	Explains plate movement	Tests fairly	Improves with evidence

Suggested codes: W = working towards · E = expected · G = greater depth

ABOUT THIS ACTIVITY

Quake-Proof Towers is a sample activity from the EduTrend Contents W4C Earth Science & Geology programme (middle school, level: intermediate). Every activity in the programme follows the same format: a practical challenge, a clear session plan, facilitator notes and ready-to-print worksheets, so that teachers, club leaders and parents can run it without extra preparation.

Full 15-, 20- and 32-week programmes are available from EduStore at edutrend.org.

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