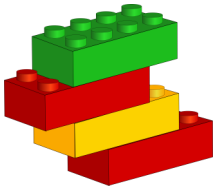
Structures

Earthquake Resistant Structures	W/C: 1st June 2020



Earthquakes are a naturally destructive effect of our earth's constantly changing surface; thousands of them happen every day. However, loss of life can be avoided through emergency planning, education and the construction of buildings that sway rather than break under the stress of an earthquake.

Subject: Geography

Activity 1) Locating where earthquakes occur.

Revise why earthquakes happen by watching: https://www.bbc.co.uk/bitesize/topics/z849q6f/articles/zj89t39 and https://www.youtube.com/watch?v=-zNyVPsj8zc

Now, you are going to apply the map skills you learned during our dictatorship topic, to locate where historical earthquakes occurred in the world. Read and plot the 4/6 figure grid-references on the map provided.

Stuck? Use these two helpful links https://www.bbc.co.uk/bitesize/guides/z6j6fg8/revision/4 and https://www.bbc.co.uk/bitesize/guides/z6j6fg8/revision/4

Remember, *'along the corridors and up the stairs.'*

Subject: D&T

Activity 2) Design an earthquake-proof (jelly-proof) building.

Read through the information on how to prepare for an earthquake. Design a jelly-proof building to construct ready for activity 3. Pick 3 of the characteristics from the table to include in your design. Draw and label the building to describe the characteristics you have chosen and explain why you have included them.

An Interesting Watch… *LA's most earthquake-proof building https://www.youtube.com/watch?v=iZoHoPFHAtw*

Making jelly requires the use of boiling water so make sure you have your parents' permission and help before conducting this activity.

Subject: D&T

Activity 3) Build and test your building on a tray of jelly!

You will need: Jelly, a flat rectangular dish, straws and marshmallows

Watch: https://www.youtube.com/watch?v=mMnEXukSmdg

After you have constructed your building, test it by shaking your jelly. Begin with soft shakes and steadily use more force to simulate increasingly powerful earthquakes. *Does your building remain upright? How easy or hard was it to topple? Does parts or all of your building collapse?*

Subject: D&T

Activity 4) Evaluate your building.

Now that you have constructed and tested your building, it is time to evaluate how well it met your design criteria.

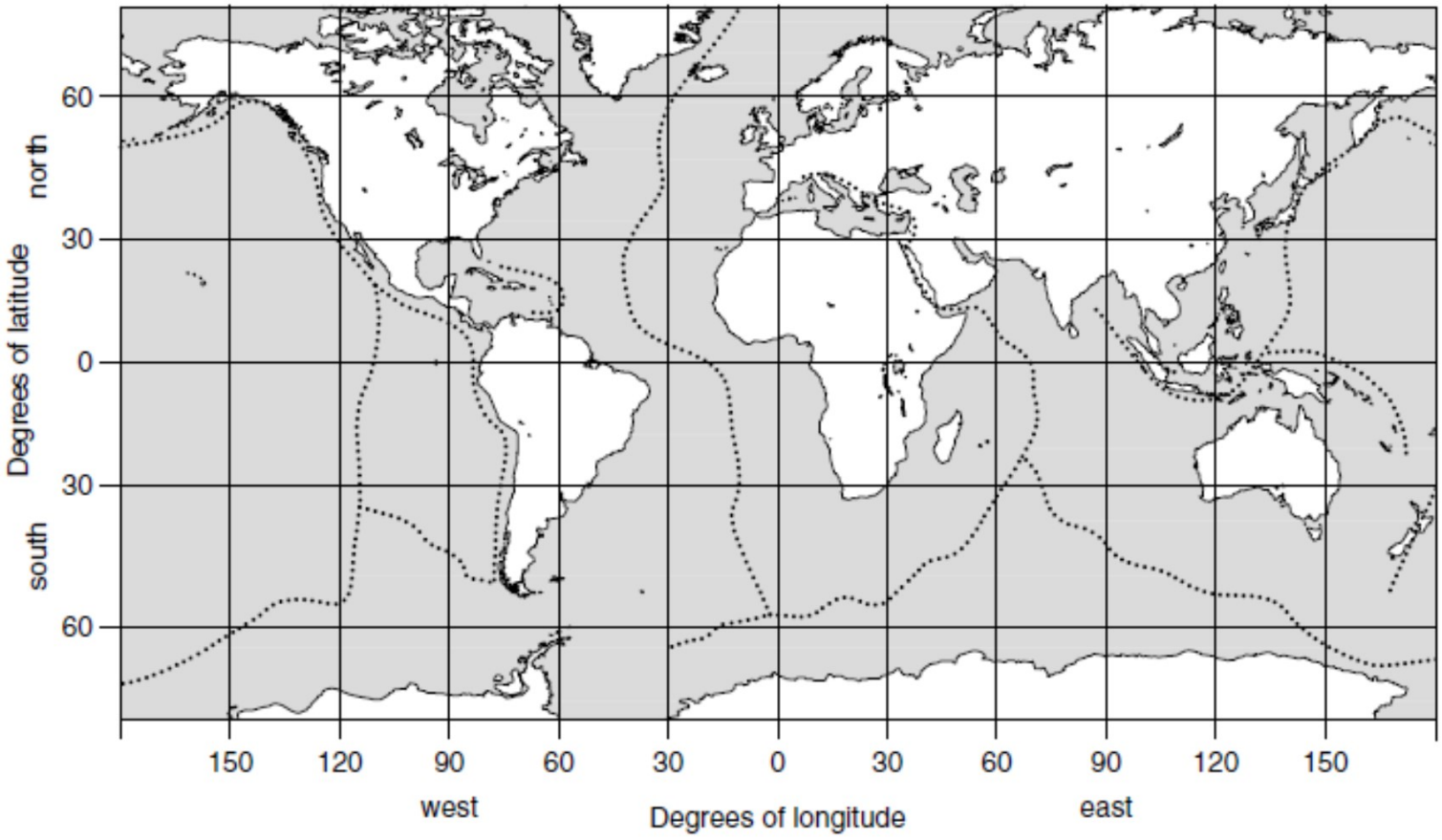
Insert the three design characteristics you chose in activity 3 and comment on how successful they were. Then, work through and answer the questions listed. By the end of the questions, you should have a firm idea of what went well and what you would change in you next build to make your structure even more stable. This is exactly how an architect works!

Challenge Yourself: *Redesign and construct a second building using the improvements from your evaluation. Can you make it more stable?*

Activity 1) Locate Earthquakes

Use the co-ordinates below to plot on the map where earthquakes happen. Do you notice a pattern? Can you use your previous learning of how earthquakes are formed to explain this pattern?

EARTHQUAKES
Turkey (1999) 39N 41E
San Francisco, USA (1906) 38N 122W
Naples, Italy (1857) 40N 14E
Anchorage, Alaska (1969) 61N 150E
Santa Cruz, USA (1989) 36N 122W
Tokyo, Japan (1923) 38N 139E
Mexico City, Mexico (1985) 19N 99W
Talca, Chile (1939) 35S 71W
Hawkes Bay, New Zealand (1931) 39S 176E
Managua, Nicaragua (1972) 8N 86W
Skopje, Yugoslavia (1963) 42N 21E
Hio Santo, Peru (1970) 8S 77W



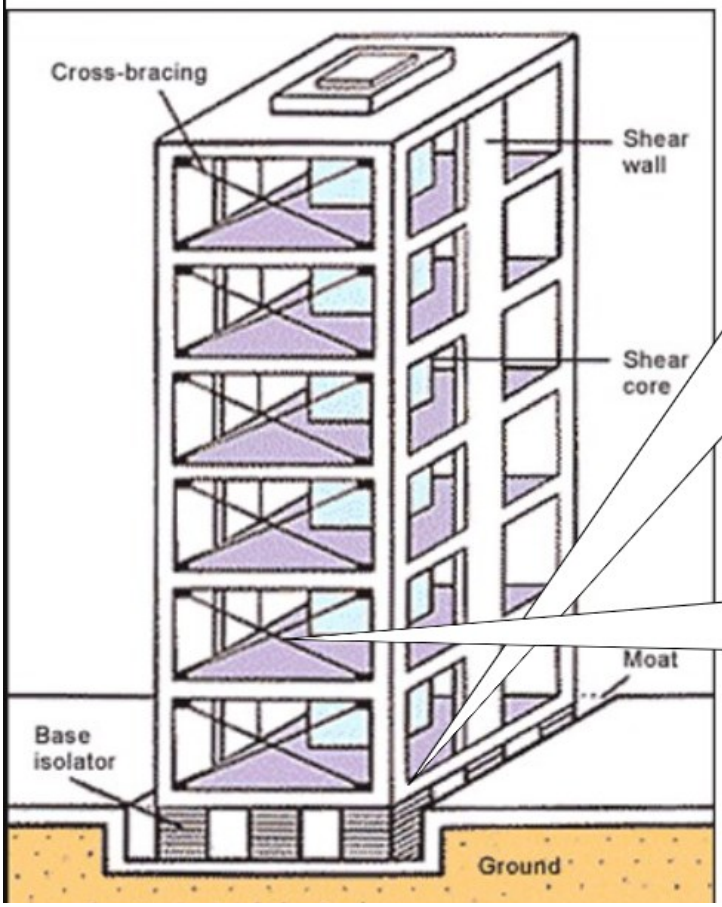
Activity 2) Design an earthquake-proof building

How do we manage earthquake hazards? There are three choices:

1. Do nothing—accept the hazard
2. Adjust to living in the hazardous place—get insurance, strengthen your home and prepare
3. Leave the area

If people plan and prepare for earthquakes, then the risks can be reduced. **Advances in building design** means that many new buildings are 'earthquake proof'. Older buildings can be **retrofitted** (fitted with new technology) to strengthen them in order to reduce the effects of earthquake shaking.

Earthquake proof buildings



Use of foundations with **rubber layers** allows buildings to easily move by up to several inches and absorb sideways movement. These are called **base isolators** .

Cross bracing. This allows buildings to twist on their foundations and not collapse.

Computers control moveable roof weights to counter the shock waves.

Automatic sprinkler system and gas shut-off to prevent fires.

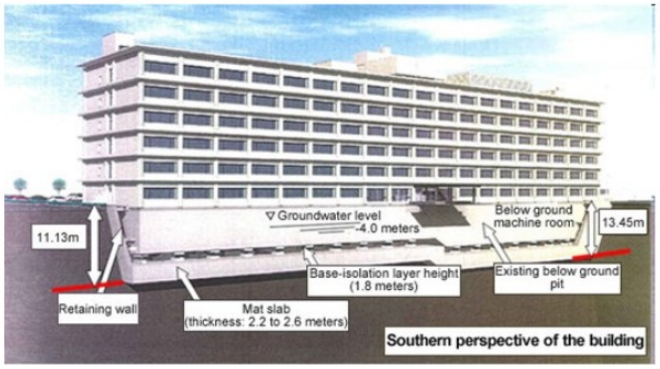
A core of reinforced (layered for strength) concrete and cables with tension.

Automatic window shutters to prevent falling glass.

Activity 2) Design an earthquake-proof building

Buildings designed and constructed in **regular patterns** – square, rectangular, cuboid or even triangular – have the ability reduce seismic forces spreading the shaking equally through the whole building.

Irregular-shaped buildings distribute earthquake forces in such a completely random and uneven fashion that building collapse is virtually inevitable.

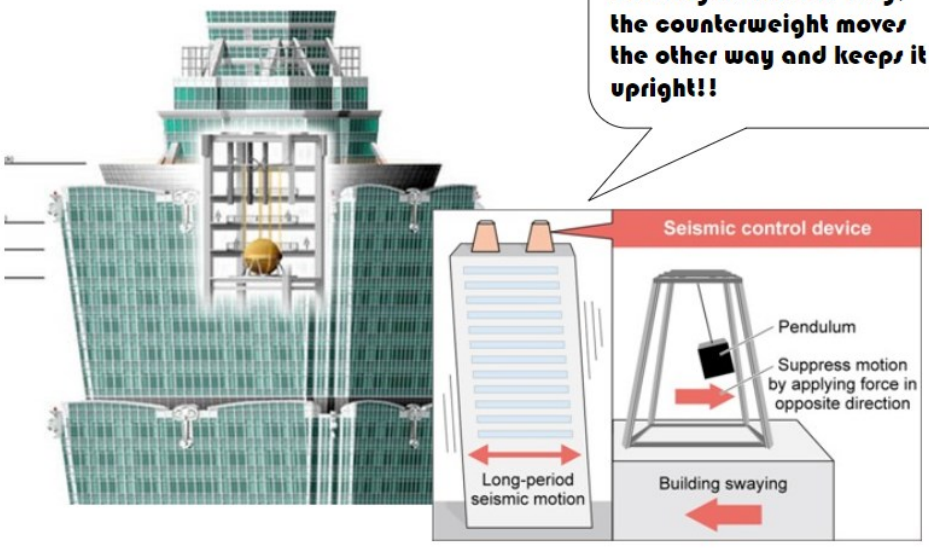


Base isolators

When a building is built away (isolated) from the ground

It will only move a little or not at all during an earthquake instead of moving with the ground

Use a roof counterweight on the building. When the building moves one way, the counterweight moves the other way and keeps it upright!!



Activity 2) Design an earthquake-proof building

How much did you understand? Complete the sentences below, suing the words provide, to see.

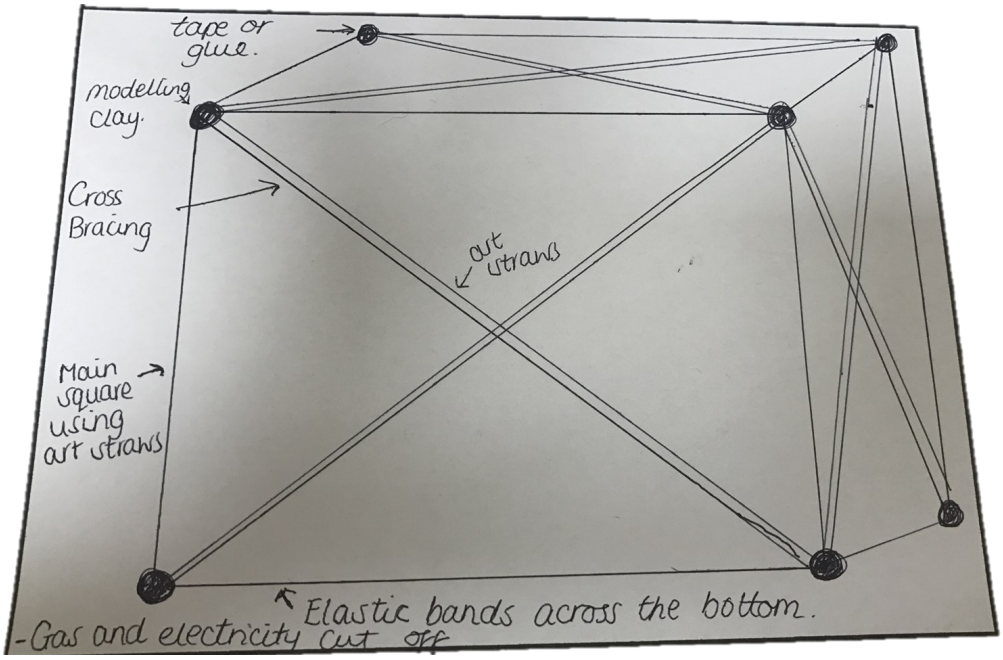
1. _____ help the building to turn without collapsing.
2. Base isolators use _____ to separate it from the shaking ground.
3. _____ patterns evenly spread the force of an earthquake throughout a building, resulting in less damage.
4. _____ patterns unevenly spreads the force of an earthquake, causing greater damage and regularly, the collapse of buildings.
5. Using _____ roofs helps the building to stay _____.
6. _____, soil or weak rock creates an unstable foundation to build on.

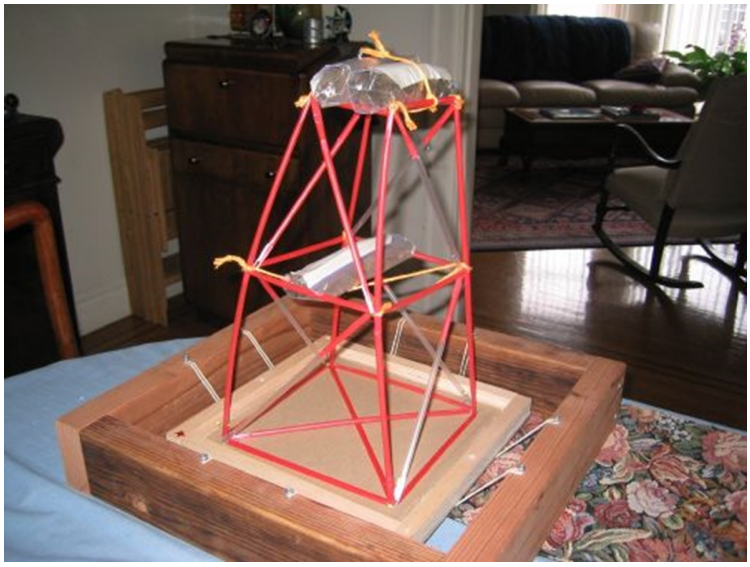
irregular **counterweight** **rubber** **soft** **cross bracing** **regular** **upright**

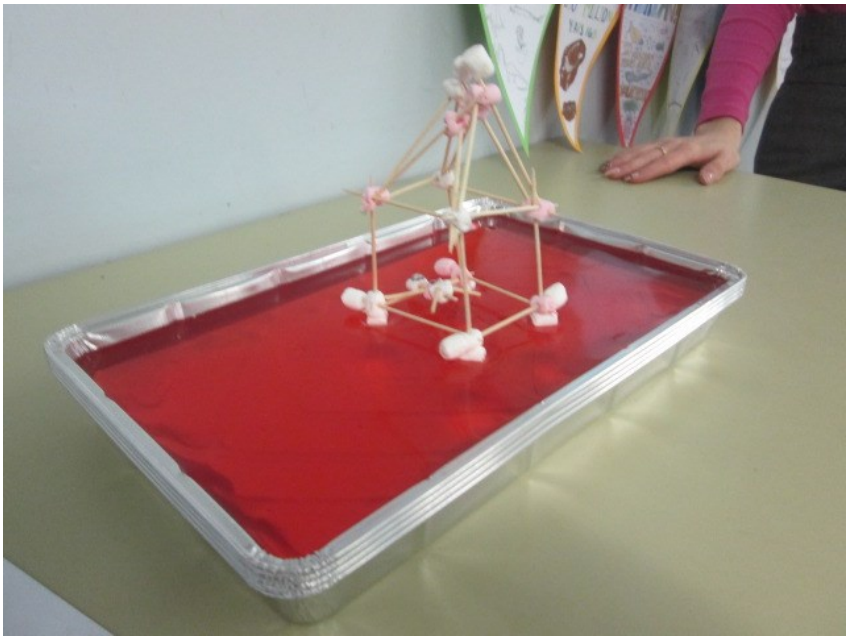
Your task) Pick at least 3 of the characteristics below to include in your design. Draw and label your earthquake-proof (jelly-proof) building ready for tomorrow.

x-shape cross bracing	regular patterns (squares, rectangles, triangles)	a reinforced (layered) core
rubber base isolator to separate the building from the ground	building on strong ground	counter-weights
small building	tall building	fixed-based

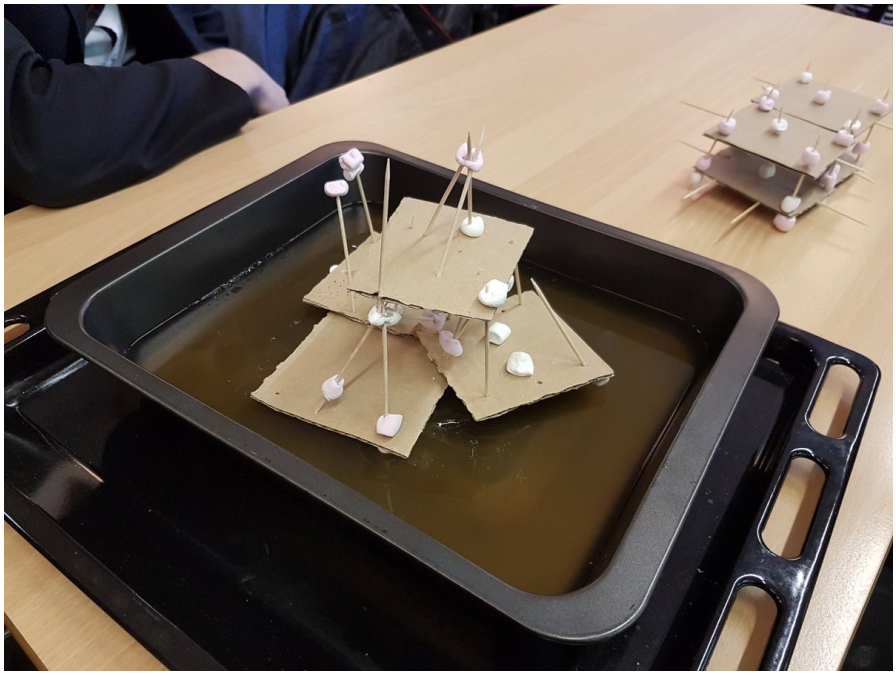
Activity 3 WAGOLLS







Activity 3 WAGOLLS



Activity 4) Evaluation

	Tick			
Design Characteristic	**Fully Meets**	**Partially Meets**	**Does Not Meet**	**Comments (How easy or difficult was constructing this? How impactful was it on the building's stability? How could you improve it?**
1				
2				
3				

1. Does your building have all the characteristics you wanted? If not, what is missing or lacking?

2. Thinking about how long your building remained upright, explain when and how it toppled over if it did. If it didn't, then why do you think this was?

3. Describe whether your building remained whole. Did parts of it crumble separately or did it crumble all together? Why was or wasn't this the case?

4. If you were to build another earthquake-proof building then what changes would you make for next time? How would these changed improve your building?