Earthquake! Year 6 An Engineering Challenge
Control and programming, frame structures

Curriculum Links: Year 3 Geography: Earthquakes and volcanoes
Year 6 Geography: The Himalayas Locating the world's countries, using maps, locating key physical and human characteristics, land use and economic activity
Year 6 ICT Computing: coding and programming

DESIGNING

Understanding contexts, users and purposes

Drawing on learning from Year 3 and Year 6 when pupils studied earthquakes and later the Himalayas, pupils will use programming and electronic control to simulate an earthquake situation. They will design and make a structure to withstand a simulated earthquake.

Watch video footage and explore images to learn about the principles of earthquake proof design. Discuss shapes and features – building such as the Transamerica pyramid, Japanese Pagoda, The Tapei 101 building will be useful. See power point saved in the Design and Technology folder

Engineering Connection:

Because earthquakes can cause walls to crack, foundations to move and even entire buildings to crumple, engineers incorporate into their structural designs techniques that withstand damage from earthquake forces, for example, cross bracing, large bases and tapered geometry. Earthquake-proof buildings are intended to bend and sway with the motion of earthquakes, or are isolated from the movement by sliders. Engineers come up with an idea, test it, and then re-engineer the structure based on its performance.

Generating, developing, modelling and communicating ideas

Pupils will learn about cross-bracing for diagonal support to prevent twisting and to strengthen the structure, large base 'footprint' and tapered geometry.

Present the design brief. Pupils must design and make a structure which will fit on the 'shake tray'; it must be at least 30cm high and withstand shaking for 10 seconds. Pupils should acknowledge in their designs the need to have a mechanism to automatically shut off gas and electricity supplies.

Demonstrate how to construct frame structures using cocktail sticks and marshmallows. Explore the principles that the pupils can draw on following exploration of built structures – images and video.

Pupils collaborate to create prototype models using cocktail sticks and marshmallows to create a structure. Distribute 30 cocktail sticks and 30 marshmallows to each pupil. Explain that the Earth has limited resources, so engineers are typically limited in the resources provided to them when building structures (money, time, materials).

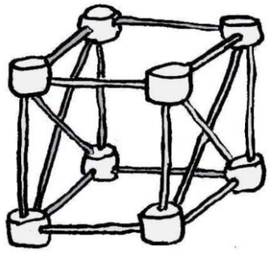
Program a crumble computer to turn on a motor (use 'crumble' software which can be downloaded). Attach a motor to the side of a tray containing set jelly. Use the crumble control system to make the jelly wobble.

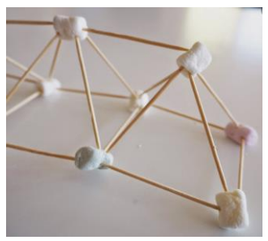
MAKING

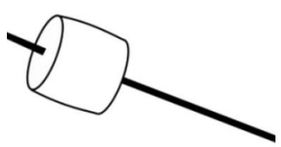
Planning

As pupils design and test, they sketch their designs annotating with the shapes that they have created and labelling the features – triangles, squares, cross-bracing, tapered shapes, cube, pyramid etc. They highlight key features of their designs. Pupils are drawing on their learning and research to refine designs and plans. They share and clarify ideas through discussion.

Practical Skills and techniques





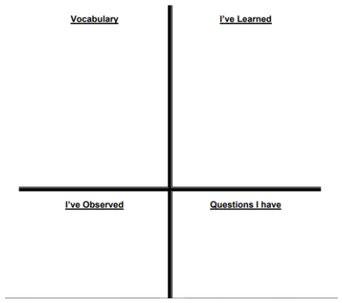


EVALUATING

Existing products

Pupils are evaluating as they watch video footage of building damage and images of earthquake proof buildings.

Own ideas and products



What happens if pupils use two motors? Ask - What would this be modelling? What if the 'building' is taller?

After pupils have tested their structures, they can redesign and rebuild and finally test again.

What can they do to make the structure stronger? More stable?

Which structures worked and which did not? Why was this? Make reflections with reference to the learning about structures.

Key ideas and Individuals

how to make an earthquake-proof building: https://www.youtube.com/watch?v=sxpi9A7_syE

IMAGE and VIDEO RESOURCES

earthquake shockwave images and explanations: https://hamiltontrust-live-b211b12a2ca14cbb94d6-36f68d2.divio-media.net/documents/Earth_Matters_BlkE_Earthquakes_S2_resource.pdf

how to make a marshmallow structure: https://www.youtube.com/watch?v=mMnEXukSmdg

See power point saved in the Design and Technology folder

TECHNICAL KNOWLEDGE

Making products work

Pupils apply their understanding of how to strengthen, stiffen and reinforce more complex structures.

Pupils use the Crumble technology, understanding that they are controlling motion through input, process and output.

Design and technology vocabulary

design brief
consumer
intended user
prototype
labelled drawings
annotate
annotation
model
cross-bracing
diagonal struts
shock waves
rocking motion
absorb
base isolation
concrete
steel
shear walls
shear core
footprint
engineering

https://www.nationalgeographic.com/science/2019/01/earthquakes-priming-himalaya-disaster/