



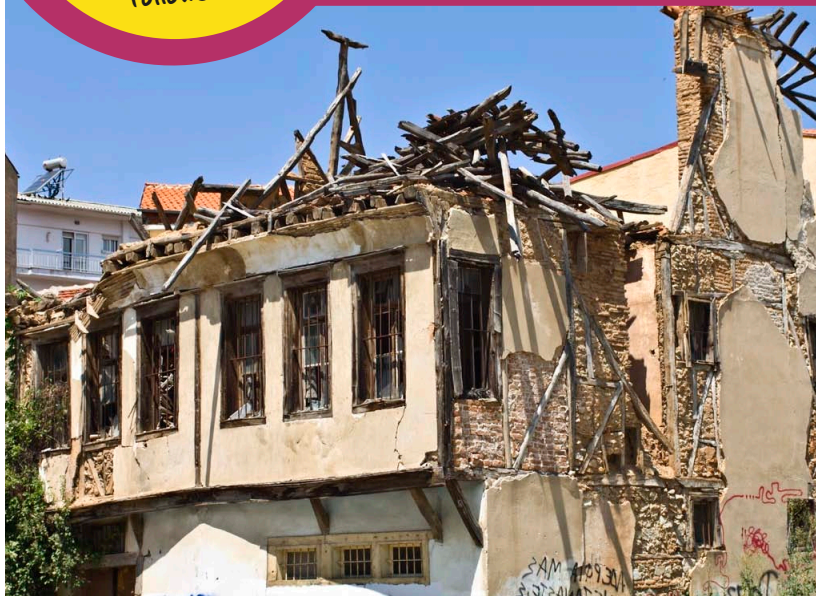
Moving House



This session should fill two club timeslots as a short project (or it can be used as part of a longer project if the extras are followed).

Did you know that buildings move? What happens to buildings if there is an earthquake or strong wind? Try this new spin on an old favourite.

During the activity your students will be able to demonstrate the idea of reinforced materials and conclude which is the best to choose.



As a force pushes on a building it will deform:

Force



The building has been deformed but it should return to its normal position once the force has been removed.

This poses a problem; if our building materials are too stiff they will break when a force pushes on them, but if they are not stiff enough they will wobble and will not be able to hold up the building.

What You Need

- ✓ Jelly
- ✓ Hot water
- ✓ Jug (or beaker to make jelly in)
- ✓ Polystyrene cups
- ✓ A variety of materials e.g. wooden splints, string, wool, pasta etc
- ✓ Old Newspaper (to cover the table!)
- ✓ Stopwatch
- ✓ Vibration (try the Jitterbug at www.mindsetsonline.co.uk product code BUG001 as a cost effective method for vibration, you will need to stick the jitterbug to the table using plasticine, you will also need an AA battery)



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What To Do

Imagine that you need to build in a possible earthquake area. This task looks at making the strongest jelly, that will move but not break under vibration. Remember we do not want too much wobble.

Follow the instructions for your particular jelly, but use approximately a quarter less water than the instructions state, then pour into a cup, only filling halfway.

Make another batch, but before pouring arrange one of the other materials in the cup. Remember not to overfill the jelly with material. Repeat for the number of jellies/materials you have available. Perhaps each group could try a different material?

Leave the jellies to set until your next Club Meeting before testing, they may need refrigeration. Whilst you wait make your jitterbug (follow the instructions given).

Are your jelly buildings able to move just the right amount? Carefully place your jelly on the jitterbug (removing the cup, break the polystyrene carefully if the jelly wont come out. Try to get as much of the jelly out whole as possible).

Time each jelly on the jitterbug for three minutes. Remember to cover the table and surrounding area in old newspaper.

Which is the best jelly? What effects can your group observe? Does the jelly wobble or break?
Look for small surface damage as well as big breaks.



Some Extras...

Try putting structures into the jelly e.g. assemblies of drinking straws. You could also try different types of jelly and different water quantities.

Another test, often done by STEM Clubs, is to see how strong your reinforced jellies are.

Place your jellies on (a covered) level surface. Put a block or mat on top of your jelly, then place masses on top to see how much weight the jelly can take before it breaks.

Remember to follow usual experiment health and safety procedures. Which reinforcements are most effective; making the jelly stronger?

You could always create your own moulds by vacuum forming!

Curriculum Links

Using this activity you could discuss:

England

Science: Unit 7K: Forces and their effects, Unit 9J: Gravity and space

PSHE: looking at real life situations, personal preferences and priorities

D&T: Unit 09a:ii: Selecting materials Focus: resistant materials

Scotland

Science: Forces 2-07a, 3-07a, 3-08a

Explanation

This experiment provides a good opportunity to discuss waves, vibration, natural frequency, simple harmonic motion and even earthquakes with your group.

By adding material to the jelly we have reinforced it, just like reinforced concrete.

To make reinforced concrete; the concrete mixture is poured into the mould, over metal bars that are held in tension. When the tension is removed the metal bars 'push' on the concrete forcing it into compression. So, the concrete is in compression and the metal bars have some residual tension. When a load is applied the reinforced concrete will be much stronger.

Heston Blumenthal's Fairy Tale feast shows a great example of reinforced chocolate concrete, available at Channel 4's website www.channel4.com (but do watch BEFORE showing to your group, so that you can edit the clip and ensure its suitability).

Handy Hints



If possible link this activity to represent recent world news events e.g. In February 2011 we used Cyclone Yasi (Australia) to provide context.

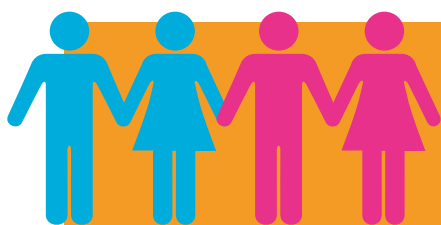
Students were asked to think about building houses that could withstand a cyclone. You could also use Angela's profile to help set the scene.

However Earthquakes do occur in the UK. The strongest earthquake in recent times occurred in Dudley (West Midlands) in 2002. This measured 5 on the European Macroseismic (98) scale which measures the effect felt from an earthquake. 5 indicates a strong earthquake:

- ♥ the vibration is strong causing top heavy objects to topple over
- ♥ felt indoors by most, outdoors by few
- ♥ many sleeping people awake
- ♥ a few run outdoors
- ♥ buildings tremble throughout
- ♥ hanging objects swing considerably
- ♥ china and glasses clatter together

Visit www.earthquakes.bgs.ac.uk for more information.





Profile: Who Uses These Ideas?

Angela Crowther

Structural Engineer/Built Environment Designer

Industry sector	Building Sector
What I do on an average day	Working at Expedition Engineering I get a lot of variety in my job. They are a very exciting company and since I joined I have been helping to work out how environmentally-friendly the 2012 London Olympic Velodrome is. It turns out it is a fantastically sustainable project that is becoming really famous as an example of how we should all be designing in the future!
How I got here 	I studied a Masters in Civil and Architectural Engineering at the University of Bath. I was supported throughout my degree by scholarships from the Royal Academy of Engineering and Institution of Civil Engineers. This paid for me to travel and learn about all the different exciting jobs engineers can do.
My favourite part of my job 	I spent a year working for a charity in Indonesia. There I got to design and build a school for 200 pupils. It was part of the rebuilding after the 2004 Boxing Day Tsunami. Now living in London I still get involved in these types of projects by giving design advice to a charity called Architects for Humanity. At the moment we are designing an Eco Lodge in Ghana for AfriKids. I love this part of my job because I get to see first-hand all the great things that engineers can do to help people.
Likes	Learning! Designers need lots of inspiration so you can never have enough knowledge!
Dislikes	Being told something is impossible! There's always a solution – an engineer can probably help you find the answer!
The future	I really want to be designing but I don't mind what. Buildings, furniture, new ways of working ... anything society needs!
What is engineering?	To engineer means to make things happen. I believe engineers have the skills to make the future a better place for all of us.



This Is Engineering

Civil engineers have to ensure that buildings, roads and structures are built strong enough; being able to understand forces and materials is essential for engineering of this type.

Civil Engineering can be taken at many universities, with entry requirements covering A Levels, Advanced Diplomas and Scottish Advanced Highers (www.ucas.com).

Related fields: Construction and Architectural Engineering.

Why not try an apprenticeship in Engineering Construction (www.apprenticeships.org.uk)? The Engineering Construction industry plays an important role in the UK economy through the design, construction and maintenance of industrial processing and energy production facilities that are essential to the country's prosperity and way of life.



Extra Maths

If the frequency of your jitterbug (vibration) is 5Hz (i.e. 5 cycles per second) how many cycles will have been completed in 3 hours

If your jitterbug lasted for 200,000 cycles, how many hours could it last?

Next Steps

Perhaps a STEM Ambassador could help support this session? Speak to your local contract holder (www.stemnet.org.uk/regions)

or visit *STEMNetworking* (networking.stemnet.org.uk)

There are more useful ideas at: www.stemclubs.net

For more information on support for Engineers and Engineering from The Royal Academy of Engineering visit: www.raeng.org.uk



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