Chocolate bar bridges

An ICE do-at-home activity for ages 4-18

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Chocolate bar bridges

Bridges are part of our everyday lives and we may take them for granted, but they allow us to cross major obstacles (like rivers!) and our world would be very different without them. Civil engineers make sure our bridges are strong and safe to travel across – even in stormy weather.

Bridges are made out of all kinds of materials, wood, stone, steel, bamboo, concrete, and in this experiment – chocolate! A simple bridge can be made of one plank that spans the distance to be crossed. In this activity we will be using Twirl chocolate bars (or another type with enough chocolate on them to melt and 'weld' together) to build a bridge across a 20cm gap.

In real life bridges that carry cars have to be strong so it won't fall down with the weight of the traffic, in our challenge you will test the weight of the bridge by seeing how many coins in yogurt pots it can hold before breaking.

There are many different types of bridges that are built by civil engineers, one shape that you will see often is a triangle as this is the strongest shape (a top tip for your design process!).

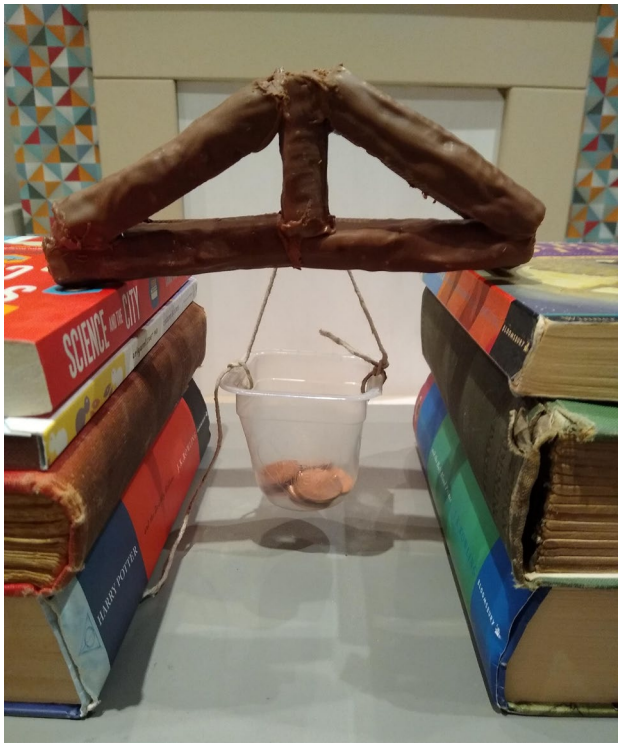
Materials needed

- Approximately 16 long thin chocolate bars – Twirls are ideal
- A ruler
- A glass bottle with a tightly fitting lid
- Kettle filled with hot (not boiling) water
- 1-2 small yoghurt pots (the kind you get Petit Filous or Munch Bunch in are ideal)
- Lots of 1p or 2p coins or a mix, or other small heavy weights like pebbles
- Several short lengths of string (15-20cm approximately)

Activity instructions

1. Before civil engineers build anything, they draw out plans first, so on a piece of paper draw out a plan of your bridge structure.
2. For welding the bars together, fill a glass bottle with hot water (you might want to get an adult to help you with this)
3. Press the end of two Twirls against the glass and wait for the chocolate to start to melt. Once this has happened you can attach them together and leave to set hard for a few minutes (or put in the fridge if it's hot where you're

building). Continue to build your bridge in this way. **Top tip**: create your bridge in sections rather than trying to add single bars to the main structure in one go – this will mean you can let many smaller sections set properly before assembling them into the finished bridge. Use this process to build a bridge that has a 20cm plus span.



4. Raise up your bridge (after checking the chocolate 'welding' has set firmly) across a 20cm gap. You can use two upturned items like books or shoeboxes.

5. Testing the bridge with weights. Use an empty yogurt pot filled with coins to test the bridge once it is complete. Pierce two small holes in your yogurt pot near the lid and thread through some string to make a loop that goes over the bottom middle of your bridge span. Fill it with coins, starting with a small number and slowly increasing it one coin at a time until your bridge breaks. Hang an additional weight pot if needed.

6. Optional but recommended: eat your bridge sharing equally between your whole engineering team!

Don't forget to tweet us at twitter.com/ICE_schools with your bridge pictures and your record for weights. Ours held over 35 1 pennies but we're sure you can do better!

For 11-16 year olds

Test the **tensile strength** (this is a term civil engineers use when describing the strength of something like a steel beam) of a single stick of Twirl (or whatever chocolate you're using). Do this by placing the bar across a gap and hanging a yogurt pot from it in the middle and keep adding coins until it snaps. Compare how many coins it takes to snap one single chocolate bar and the whole bridge. You can calculate how much stronger the bars are when welded into a larger structure by dividing the breaking weight of the bridge by the number of chocolate bars in the structure, and comparing this to the breaking weight of one bar (this should be more!).

For 16-18 year olds

Now that you know the factor of strength increase from one chocolate bar to the number in your bridge structure, can you calculate how strong a bridge made of 50 bars would be across a 40cm gap?

If you're feeling very creative and you have a variety of chocolate bars available you could try building other types of structures – perhaps a famous one like this chocolate model of Tower Bridge by ICE Ambassador John Brownlie.

Tell us what you thought!

Email us at **careers@ice.org.uk** or write a comment or post on the ICE@schools Twitter.

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