

Making a miniature concrete girder

Safety

Cement is an alkali, which can cause skin burns.

Wear eye protection and a plastic glove.

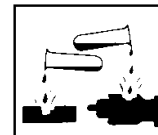
Take great care when mixing to avoid producing a dust.



EYE PROTECTION
MUST BE WORN



HARMFUL



CORROSIVE

Aims

To make small blocks of concrete with different compositions, and then to test their properties later.

Apparatus

goggles

cardboard mould

plastic glove

yoghurt pot and teaspoon

newspaper

water, sand, cement, fine gravel

Methods

1. Put on your eye protection.
Cover your bench with newspaper, then collect all your other apparatus.
2. Put on your glove. Take your yoghurt pot to the front bench to collect the ingredients.
Using the teaspoons in each container, put 3 level teaspoons of cement, 3 level teaspoons of sand, and 3 level teaspoons of fine gravel into the yoghurt pot. Return to your bench.
3. Using your teaspoon, stir carefully to mix the cement, sand and gravel together.
Add a little water, and carefully stir the mixture. Keep adding water until the mixture is sloppy.
Remember you can always add a little more water, but you can't take it out!
When the mixture is right, your teaspoon should push easily into the mixture, leaving a hole when it is taken out.
4. Scrape the mixture into a mould (10cm x 1cm x 1cm).
Mark the mould so that you will know that it is yours, and what mixture is on it.
5. If you have time, make at least one other bar of concrete.
You must use 9 level teaspoons of material in total, but you should vary the proportions of the mixtures, e.g. 4 of cement, 3 of sand, 2 of gravel, and so on. Label the bars carefully, and record exactly what you have put into each.
6. **Do not wash any concrete down the sink.**
Put the yoghurt pots (and any waste mixture) in the bin provided.
Put your teaspoon in the container of cold water provided.
Pull your glove off inside out, and put that in the bin with the used yoghurt pots.
7. Tidy your bench, then wash your hands. Remove your eye protection when told to.

Notes on concrete mixes

Introduction

Making concrete is similar in principle to baking a cake: selected ingredients are mixed together, heated, and allowed to set. Just as cakes vary according to the type of ingredients and the method used to add them together, so the texture, strength, resilience and colour of concrete can vary.

Concrete is a mixture of three ingredients:

- cement (the bonding agent)
- aggregate (the filler or bulk of the concrete – usually sand and gravel)
- water (the catalyst for the cement).

Cement

The **quality** and **quantity** of the cement will affect the strength of the bond between the particles of aggregate.

Aggregate

The **shape** of the aggregate will affect the overall strength of the concrete mix. Angular (pointed) particles lock together, whereas rounded particles only butt up against each other.

Water

The **amount** of water added to the mix is very important:

- if too much water is added, the bonding effect of the cement is lost;
- if too little water is added, the bonding action will not be complete.

Two other main factors affect the quality of concrete. These are density and curing time.

Density

The denser the concrete, the more particles are interlocked and the stronger it will be.

A dense concrete mix is shaken thoroughly in moulds, and more concrete is added to the space as the mix settles down (just as cornflakes settle in the packet).

Commercially dense concrete has other properties apart from strength. These include good resistance to sound and water penetration, and low shrinkage as it dries out.

Curing time

Concrete can take up to 20 years to gain maximum strength.

Commercially, curing is helped by heating, steam and pressure.

Best quality concrete is steamed at 160°C at 6 times atmospheric pressure for 24 hours.