



# What is Concrete?

**ARMCON**  
CERTAINTY: IN CONCRETE

## Overview:

Concrete is a material composed primarily of aggregate, cement, and water. There are many formulations, which provide varied properties. The aggregate is generally coarse gravel or crushed rocks such as limestone, or granite, along with a fine aggregate such as sand. The cement, commonly Portland cement, and other cementitious materials such as fly ash and slag cement, serve as a binder for the aggregate. Various chemical admixtures are also added to achieve varied properties. Water is then mixed with this dry composite, which enables it to be shaped (typically poured) and then solidified and hardened into rock-hard strength through a chemical process called hydration. The water reacts with the cement, which bonds the other components together, eventually creating a robust stone-like material. Concrete has relatively high compressive strength, but much lower tensile strength. For this reason it is usually reinforced with materials that are strong in tension (often steel). Concrete can be damaged by many processes, such as the freezing of trapped water.

Concrete is widely used for making architectural structures, foundations, brick/block walls, pavements, bridges/overpasses, motorways/roads, runways, parking structures, dams, pools/reservoirs, pipes, footings for gates, fences and poles and even boats. Famous concrete structures include the Burj Khalifa (world's tallest building), the Hoover Dam, the Panama Canal and the Roman Pantheon.

Concrete technology was known by the Ancient Romans and was widely used within the Roman Empire—the Colosseum is largely built of concrete. After the Empire passed, use of concrete became scarce until the technology was re-pioneered in the mid-18th century.

The environmental impact of concrete is a complex mixture of not entirely negative effects; while concrete is a major contributor to greenhouse gas emissions, recycling of concrete is increasingly common in structures that have reached the end of their life. Structures made of concrete can have a long service life. As concrete has a high thermal mass and very low permeability, it can make for energy efficient housing.

## Components:

### Cement:

Cement is made by heating limestone (calcium carbonate) with small quantities of other materials (such as clay) to 1450 °C in a kiln, in a process known as calcination, whereby a molecule of carbon dioxide is liberated from the calcium carbonate to form calcium oxide, or quicklime, which is then blended with the other materials that have been included in the mix. The resulting hard substance, called 'clinker', is then ground with a small amount of gypsum into a powder to make 'Ordinary

Portland Cement', the most commonly used type of cement (often referred to as OPC). Portland cement is a basic ingredient of concrete, mortar and most non-specialty grout. This is the ingredient to the concrete that ensures the concrete 'sticks' together, without this ingredient, the materials that make the concrete would be separate.

#### **Water:**

Water starts the hydration process needed to bond the concrete together, it also ensures your mix can be flowable.

Too much water can cause your concrete to be weak and sloppy, and too little and the cement is not able to hydrate as well and the mix is stiff and difficult to use. Getting the right balance can be tricky, and that's where admixtures come in.

#### **Course Aggregate:**

Course aggregate is the larger material found in concrete, and it is the job of this element to bulk out the concrete whilst providing strength and making the concrete cheaper (than if you were to only use cement).

#### **Small Aggregate:**

This is usually sand, and is used to fill the gaps between the larger particles, this is basically a filler aggregate.

#### **Admixtures:**

Admixtures need to be mentioned, often called the 5<sup>th</sup> ingredient in concrete, there are many different types, plasticisers, accelerators, pigments and so on, there is an admixture for almost anything you can think of, and each has its own place. Most good concretes will include some sort of plasticiser, it not only makes the concrete wetter, but by default makes it stronger. See our booklet on plasticiser.

Concrete is the second most used product in the world, after water. With an estimated 20 – 30 billion tons used worldwide, with many variants. The key is to experiment to get the right mix for your purpose.