

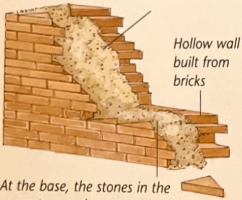
BUILDERS AND ENGINEERS

All over the empire, Roman builders and engineers constructed vast public buildings, bridges and water systems. These magnificent structures were certainly built to last - many Roman buildings are still standing today.

INCREDIBLE CONCRETE

In the 2nd century BC, the Romans invented concrete - an amazing new building material that was strong, light and easy to use. It was made by mixing volcanic ash with water, and then adding stones to give it extra strength.

Cutaway picture of a Roman wall filled with concrete



At the top, the concrete was mixed with small, light stones.

At the base, the stones in the concrete were larger and heavier.

By filling the walls of their buildings with concrete, the Romans could build tall, strong structures that were light enough not to collapse under their own weight. These buildings were often faced with stone or marble to make them look beautiful.

ROUNDED ARCHES

Roman buildings are famous for their rounded arches - a feature that was copied from the Etruscans. These arches are surprisingly strong because each stone in an archway pushes hard against the stones next to it, which helps to hold the arch together.

Here you can see how a Roman arch was built around a wooden frame.

The keystone was put in place last.



The frame was removed once the arch was completed.

BUILDING BRIDGES

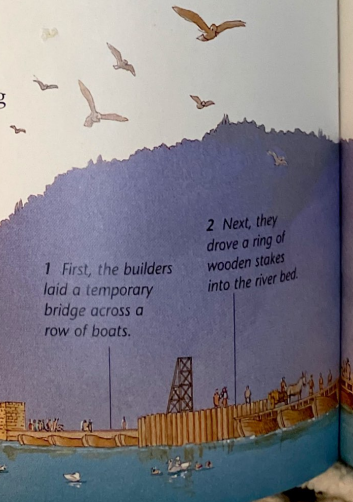
The Romans used arches to build huge public buildings and to construct bridges that spanned wide valleys. Building a bridge was an engineering challenge that required very careful planning.

This picture shows a simple Roman bridge being built.

VIADUCTS AND AQUEDUCTS

Some of the most stunning achievements of the Roman engineers were their multi-layered bridges, known as viaducts and aqueducts. Viaducts carried roads high above the ground, while aqueducts carried water in raised stone channels. Amazingly, some of these structures are still being used today.

Roman aqueducts formed part of a complex system of pipes and channels that delivered water from mountain springs direct to the towns and cities. Some of the Roman water systems were over 40km (25 miles) long. Because they relied entirely on gravity, the water in them had to flow downhill all the way. This is why aqueducts were needed, to keep the water high up so that it could get over hills.



1 First, the builders laid a temporary bridge across a row of boats.

2 Next, they drove a ring of wooden stakes into the river bed.