© Adobe Stock

12,000-10,000 BCE –
Gobekli Tepe,
Anatolia, Turkey

First cementitious material

Earliest known use of a cementitious material in a general sense – lime, obtained from burning limestone.

Ancient city of Kameiros, Rhodes.
© Shutterstock

~500 BCE –
Rhodes, Greece

Volcanic ash improves the durability

The Ancient Greeks were the first to use natural pozzolan (volcanic ash) as an additive to lime. This innovation significantly improved the durability and water resistance of the lime mortars widely used in their constructions.

Enduring Roman structures

The Romans used lime and volcanic ash to make cement, building many enduring structures across their empire. Vitruvius first described concrete making in *De Architectura* around 20 BCE.

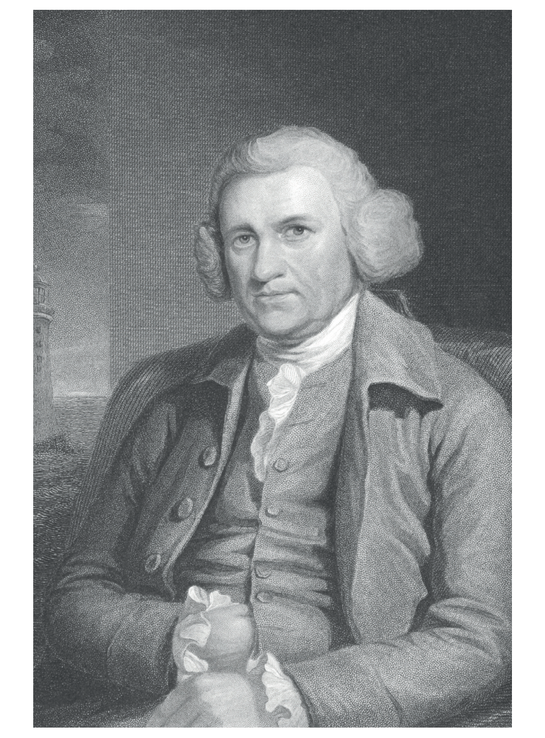
27 BCE – 1453 AD
Roman Empire

Pantheon in Rome, Italy.
© Adobe Stock

Steps towards modern cement

British engineer John Smeaton developed a new hydraulic lime for the construction of the Eddystone Lighthouse. He used argillaceous (clay-containing) limestone, advancing developments towards modern cement.

1756 –
John Smeaton



© Adobe Stock

Louis Vicat bridge or Pont de Souillac in France, one of the first structures in the world made with artificial cement.
© Adobe Stock

1818 –
Louis Vicat

Invention of modern cement

French engineer Louis Vicat researched artificial hydraulic lime, demonstrating that calcining a mixture of limestone and clay produced superior results. He identified the correct proportions needed to create a binder that sets underwater, crucial for durable construction, and showed that this artificial lime had better properties than natural hydraulic limes.

Invention of Portland cement

English inventor Joseph Aspdin patented "Portland Cement" named for its grey color resembling Portland stone from the Isle of Portland. The production of Portland cement involves the calcination of a mixture of limestone and argillaceous earth (or clay). Joseph Aspdin was the first to achieve the high temperatures necessary for this process in a beehive kiln, a technique known as «clinkering.» The result was a type of cement closely resembling the Portland cement we use today.

1824 –
Joseph Aspdin

Remains of an ancient disused quarry at Portland Bill, England, UK.
© Adobe Stock

The gypsum quarry of Toconao, Chile.
© Adobe Stock

1830s

Use of gypsum

It was discovered that co-grinding clinker with a small quantity of gypsum increased the strength of cement and enabled to control the setting time.

First reinforced concrete bridge

A Parisian gardener, Monier patented the idea for reinforced concrete in 1866 and built the first known reinforced concrete bridge, 4m wide by 16.5m length, in 1875.

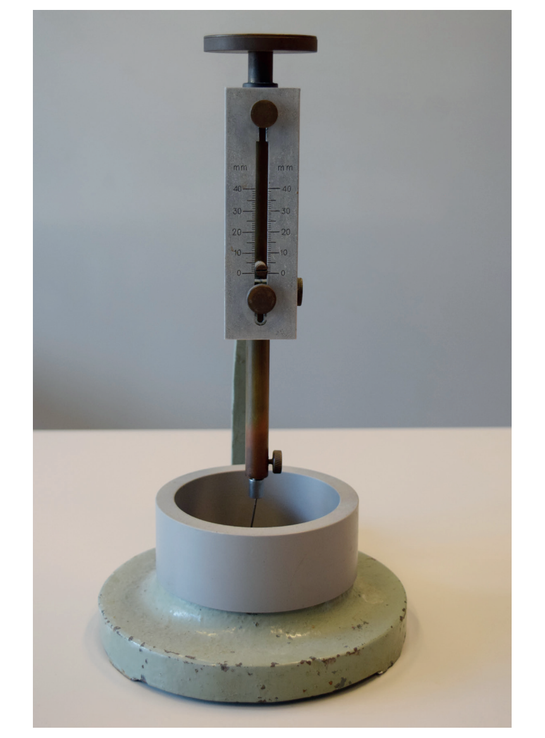
1875 –
Joseph Monier

Reinforced concrete in modern days, pouring concrete into prepared place with reinforced steel bars.
© Adobe Stock

Standardizing performance testing

The development of testing methods and scientific research played an important role in establishing a common understanding among scientists and engineers for quantitatively comparing cement performance.

Mid-Late 19th Century



Vicat needle apparatus, used for determining the setting time of mortar and cement paste.
© EPFL / LC3 Project

© Alamy Images

1903 –
The Ingalls Building

First concrete 'skyscraper'

James W. McLaughlin designed the world's first concrete 'skyscraper' which was built in Cincinnati, USA, reaching 16 storeys and 64 metres tall. It is still in use today, now as a hotel.

Advancements in production

The wider availability of coal during the Industrial Revolution enabled the development of Portland cement in the early 19th century. The introduction of the rotary kiln made cement production more efficient, and the widespread use of reinforced concrete transformed construction practices globally.

1900s –
Industrial revolution

An example of a rotrary klin today.
© Adobe Stock

Bolomey's formulas

Jean Bolomey, a professor at EPFL Switzerland, published an article on determining the compressive strength of mortars and concrete, introducing the well-known Bolomey's formulas, which are widely used in civil engineering.

1925 –
Jean Bolomey

© EPFL

Supplementary Cementitious Materials (SCM)

The initial use of various supplementary cementitious materials (SCMs) as additives to Portland cement occurred in different countries. These SCMs included fly ash, slag, and silica fume, which are by-products of the coal and metal industries.

Early-mid 20th Century

Blast furnace slag.
© Adobe Stock

The Golden Gate Bridge in San Francisco.
© Stutterstock

1930s

Calcined clays

Calcined clays were used in the USA in the 1930s in several dams and bridges, including in the anchorage blocks of the Golden Gate bridge.

Innovative work in reinforced concrete

Swiss engineer Robert Maillart designed the masterpiece Salginatobel Bridge using reinforced concrete.
It is one of the first modern bridges to utilize reinforced concrete.

1930

Salginatobel bridge in Schiers, Switzerland.
© Shutterstock

© Adobe Stock

1930 – 1940s

Precast Concrete

Introduction and popularization of precast concrete, leading to new architectural possibilities and efficiency in building processes.

Grande Dixence Dam in Swiss Alps, construction completed in 1961.
The tallest gravity dam in the world.
© Adobe Stock

1930s – 1960s

First large-scale dams

The first large-scale dams made of concrete begin construction and operations.

Start of extensive use of concrete

After World War II, there was a significant construction boom, particularly in the United States and Europe. The need to rebuild war-torn cities and accommodate growing populations led to extensive use of concrete. This period saw the rise of high-rise buildings, highways, and large public works projects.

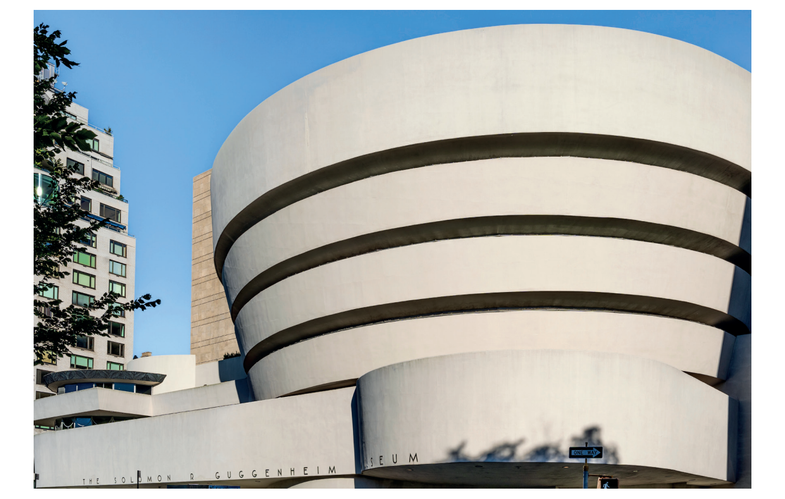
1945 - 1960

Piccadilly Circus in central London, England, UK, 1959.
Concrete used for roads and pavements, shops and buildings.
© iStock

Concrete in design

Design prominently featured concrete, often combined with steel and glass. This approach emphasized clean lines and functional forms, showcasing concrete's versatility and aesthetic appeal.

1960s-1970s



Guggenheim Museum, contemporary art museum designed by Frank Lloyd Wright, in the Fifth Avenue, New York City, USA.
© Adobe Stock

© Adobe Stock

1960 – 1980

Rise of concrete in urban infrastructure

The mid-20th century concrete is used more and more for its durability, versatility, and cost-effectiveness in building the urban infrastructure we have today, roads, bridges, buildings, airports, marinas, etc.

© iStock

1990s

Ready-mix concrete

The concept of delivering pre-mixed concrete to construction sites improves the efficiency and quality of concrete construction. Improvements in mixing and transportation technology helped to increase its adoption and brings flexibility in use of concrete.

© Adobe Stock

1990s

Environmental considerations

Awareness of environmental impacts prompts research to begin on reducing its carbon footprint.

Alternative Materials

Increased use of supplementary cementitious materials (SCMs). SCMs help improve cement's environmental impact by substituting part of the carbon-intensive clinker in Ordinary Portland Cement (OPC) all while improving concrete properties.

1990s

Stacks of fly ash piled up next to a coal power plant in Germany.
© Shutterstock

Limestone Calcined Clay Cement, the use of clay gives a slighter warmer reddish brown colour to the cement.
© EPFL / LC³ Project

2000s

LC³ - Low-carbon cement

Development of low-carbon cement LC³ (Limestone Calcined Clay Cement) by Karen Scrivener, professor at EPFL in Switzerland, as an SCM to reduce CO_2 emissions, by replacing about half of the clinker with calcined clay and ground limestone.

Burj Khalifa

The world's tallest building, standing at 828m, utilized high-performance concrete for its strength. During construction, a record was set by pumping concrete up to 601m. Achieving this height required a substantial amount of concrete per unit floor.

2009 –
Burj Khalifa, Dubai, UAE

© Adobe Stock

© Adobe Stock

2020s

Global cement production reaches a new threshold

Cement is a victim of its success, and it is essential for building the societies we live in. While it is an extremely reliable material and cheap to manufacture all over the world, due to the huge volumes of cement produced on earth – 4 billion tonnes every year – the manufacture of cement represents about 8% of all CO_2 emissions, contributing to climate change.

Sustainable innovations

Continued advancements in cement technology focus on sustainability.
The Global Cement and Concrete Association 2050 roadmap to reach net zero emissions in cement and concrete manufacture tackles numerous ways to eliminate carbon emissions like the use of alternative cleaner fuels and reducing the amount of clinker in cement.

2020s

© Adobe Stock

Concrete future

In the next 25 years, the world will produce every year around 4,5 billion tons of cement, to make around 35 billion tonnes of concrete. Strong population growth in the Global South and the need for housing and infrastructure will drive a huge demand for cement in the next 3 decades in these regions.

2025 – 2050