

The History of Concrete

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Cement has been around for at least 12 million years. When the earth itself was undergoing intense geologic changes natural, cement was being created. It was this natural cement that humans first put to use. Eventually, they discovered how to make cement from other materials.

12,000,000 BC	Reactions between limestone and oil shale during spontaneous combustion occurred in Israel to form a natural deposit of cement compounds. The deposits were characterized by Israeli geologists in the 1960's and 70's.
3000 BC Egyptians	Used mud mixed with straw to bind dried bricks. They also used gypsum mortars and mortars of lime in the pyramids.
Chinese	Used cementitious materials to hold bamboo together in their boats and in the Great Wall.
800 BC Greeks, Crete & Cyprus	Used lime mortars which were much harder than later Roman mortars.
300 BC Babylonians & As Syrians	Used bitumen to bind stones and bricks.
300 BC - 476 AD Romans	Used pozzolana cement from Pozzuoli, Italy near Mt. Vesuvius to build the Appian Way, Roman baths, the Coliseum and Pantheon in Rome, and the Pont du Gard aqueduct in south France. They used lime as a cementitious material. Pliny reported a mortar mixture of 1 part lime to 4 parts sand. Vitruvius reported a 2 parts pozzolana to 1 part lime. Animal fat, milk, and blood were used as admixtures (substances added to cement to increase the properties.) <i>These structures still exist today!</i>
1200 - 1500 The Middle Ages	The quality of cementing materials deteriorated. The use of burning lime and pozzolan (admixture) was lost, but reintroduced in the 1300's.
1678	Joseph Moxon wrote about a hidden fire in heated lime that appears upon the addition of water.
1779	Bry Higgins was issued a patent for hydraulic cement (stucco) for exterior plastering use.
1780	Bry Higgins published "Experiments and Observations Made With the View of Improving the Art of Composing and Applying Calcereous Cements and of Preparing Quicklime."
1793	John Smeaton found that the calcination of limestone containing clay gave a lime which hardened under water (hydraulic lime). He used hydraulic lime to rebuild Eddystone Lighthouse in Cornwall, England which he had been

	commissioned to build in 1756, but had to first invent a material that would not be affected by water. He wrote a book about his work.
1796	James Parker from England patented a natural hydraulic cement by calcining nodules of impure limestone containing clay, called Parker's Cement or Roman Cement.
1802	In France, a similar Roman Cement process was used.
1810	Edgar Dobbs received a patent for hydraulic mortars, stucco, and plaster, although they were of poor quality due to lack of kiln precautions.
1812 -1813	Louis Vicat of France prepared artificial hydraulic lime by calcining synthetic mixtures of limestone and clay.
1818	Maurice St. Leger was issued patents for hydraulic cement. Natural Cement was produced in the USA. Natural cement is limestone that naturally has the appropriate amounts of clay to make the same type of concrete as John Smeaton discovered.
1820 - 1821	John Tickell and Abraham Chambers were issued more hydraulic cement patents.
1822	James Frost of England prepared artificial hydraulic lime like Vicat's and called it British Cement.
1824	Joseph Aspdin of England invented portland cement by burning finely ground chalk with finely divided clay in a lime kiln until carbon dioxide was driven off. The sintered product was then ground and he called it portland cement named after the high quality building stones quarried at Portland, England.
1828	I. K. Brunel is credited with the first engineering application of portland cement, which was used to fill a breach in the Thames Tunnel.
1830	The first production of lime and hydraulic cement took place in Canada.
1836	The first systematic tests of tensile and compressive strength took place in Germany.
1843	J. M. Mauder, Son & Co. were licensed to produce patented portland cement.
1845	Isaac Johnson claims to have burned the raw materials of portland cement to clinkering temperatures.
1849	Pettenkofer & Fuches performed the first accurate chemical analysis of portland cement.
1860	The beginning of the era of portland cements of modern composition.
1862	Blake Stonebreaker of England introduced the jaw breakers to crush clinkers.
1867	Joseph Monier of France reinforced William Wand's (USA) flower pots with wire ushering in the idea of iron reinforcing bars (re-bar).
1871	David Saylor was issued the first American patent for portland cement. He showed the importance of true clinkering.
1880	J. Grant of England show the importance of using the hardest and densest portions of the clinker. Key ingredients were being chemically analyzed.

1886	The first rotary kiln was introduced in England to replace the vertical shaft kilns.
1887	Henri Le Chatelier of France established oxide ratios to prepare the proper amount of lime to produce portland cement. He named the components: Alite (tricalcium silicate), Belite (dicalcium silicate), and Celite (tetracalcium aluminoferrite). He proposed that hardening is caused by the formation of crystalline products of the reaction between cement and water.
1889	The first concrete reinforced bridge is built.
1890	The addition of gypsum when grinding clinker to act as a retardant to the setting of concrete was introduced in the USA. Vertical shaft kilns were replaced with rotary kilns and ball mills were used for grinding cement.
1891	George Bartholomew placed the first concrete street in the USA in Bellefontaine, OH. <i>It still exists today!</i>
1893	William Michaelis claimed that hydrated metasilicates form a gelatinous mass (gel) that dehydrates over time to harden.
1900	Basic cement tests were standardized.
1903	The first concrete high rise was built in Cincinnati, OH.
1908	Thomas Edison built cheap, cozy concrete houses in Union, NJ. <i>They still exist today!</i>
1909	Thomas Edison was issued a patent for rotary kilns.
1929	Dr. Linus Pauling of the USA formulated a set of principles for the structures of complex silicates.
1930	Air entraining agents were introduced to improve concrete's resistance to freeze/thaw damage.
1936	The first major concrete dams, Hoover Dam and Grand Coulee Dam, were built. <i>They still exist today!</i>
1956	U.S. Congress annexed the Federal Interstate Highway Act.
1967	First concrete domed sport structure, the Assembly Hall, was constructed at The University of Illinois, at Urbana-Champaign.
1970's	Fiber reinforcement in concrete was introduced.
1975	CN Tower in Toronto, Canada, the tallest slip-form building, was constructed. Water Tower Place in Chicago, Illinois, the tallest building was constructed.
1980's	Superplasticizers were introduced as admixtures.
1985	Silica fume was introduced as a pozzolanic additive. The "highest strength" concrete was used in building the Union Plaza constructed in Seattle, Washington.
1992	The tallest reinforced concrete building in the world was constructed at 311 S. Wacker Dr., Chicago, Illinois.