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Commentary on Concrete

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Cementitious materials have been used by civilizations over the past 5,000 years. The Egyptians used mud mixed with straw to bind dried bricks, and gypsum mortars and mortars of lime are evident in the pyramids. In the same period, 5,000 years ago, the Chinese used cementitious materials to bind bamboo in their boats and later rocks in portions of the Great Wall. These cementitious materials evolved with the advancement of science and technology to the concrete mixes of today. In the modern era, as in past civilizations, concrete is the single most widely used material in the world.

Milestones

There are milestones in the history of concrete that should not go unnoticed. Between 300 BC and 479 CE the 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).

In 1818, Maurice St. Leger was issued patents for hydraulic cement, and Natural Cement (limestone that naturally has the appropriate amounts of clay) was produced in the USA. Six years later in 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. By 1860 concrete mixes contained Portland cements of modern composition.

It was during the period between the turn of the century and 1840s that concrete pipe entered the American marketplace, and in 1867, Joseph Monier of France reinforced William Wand's (USA) flower pots with wire thereby ushering in the idea of iron reinforcing bars (rebar). In 1889, the first concrete reinforced bridge was built, quickly followed by concrete buildings and roads.

The 20th century was marked by concrete marvels including dams, bridges, skyscrapers, road networks, major underground drainage and collection systems. Concrete had found its place in America as the single most widely used construction material. Materials were standardized and specifications adopted for many applications of concrete mixes. But the story of concrete did not end there and continues to unfold.



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In the 1980s, superplasticizers were introduced as admixtures and silica fume was introduced as a pozzolanic additive resulting in high strength concrete. By the end of the 1990s, a Swedish company introduced concrete polishing to the United States and now the technology is commonplace.

Modern Times

The story of concrete continues, of course into the 21st Century. Age-old Portland cement is now supplied as Portland-Limestone cement to reduce the carbon footprint of kilns and projects within the context of rules and regulations intended to mitigate the effects of climate change. Concrete products and structures such as buildings and small bridges can now be formed using 3D printers instead of centuries-old labor-intensive production and construction techniques. Scientists and manufactures of concrete products have introduced fibers into the concrete mix as an alternative to steel rebar and mesh. Transparent concrete (translucent concrete or light transmitting concrete) is achieved by replacing aggregates with transparent alternate materials to transmit light by using clear resins in the concrete mix. And researchers have developed a bendable concrete that may be stronger and more durable than regular concrete.

Durable Concrete

And this brings us to the characteristic of concrete that transcends time to the palaces of the Egyptian Pharaohs. Concrete is a durable material and when reinforced, can last for centuries in many of the Earth's environments. Durability, or service life of a material is as equally important as its ability to perform intended structural functions. The capability of a structure to continue to perform satisfactorily for an acceptable period is a fundamental engineering consideration. It is exciting times for producers of precast concrete structures. History teaches us that it is a certainty that concrete will continue to be the world's most widely used construction material. With assurance of demand for concrete and a little insight, precasters can look at the history of concrete, the new concrete mixes entering the marketplace, along with advances in modern technology for construction to get a glimpse of new markets and applications of precast.

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