# The History Usage and Type
# Of
# Concrete



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# THE HISTORY USAGE AND TYPE OF CONCRETE

- ## introduction

**Concrete** is a mixture of sand, stones, water and cement. It is a liquid that can be poured into almost any shape and in time turns into a Cement is mainly used as a binder in concrete, which is a basic material for all types of construction, including housing, roads, schools, hospitals, dams and ports, as well as for decorative applications (for patios, floors, staircases, driveways, pool decks) and items like tables, sculptures or bookcases. Rock-like material.

Throughout history, the usage of concrete and its benefits are innumerous its invention brought mankind a new era for life such as building floors, houses, large buildings and to modern day skyscrapers

# FIRST USED CONCRETE

- ## History

The first concrete-like structures were built by the Nabataea traders or Bedouins who occupied and controlled a series of oases and developed a small empire in the regions of southern Syria and northern Jordan in around 6500BC.

then the usage of it were flowed from different regions to other, In making concrete, the Nabataea understood the need to keep the mix as dry or low-slump as possible, as excess water introduces voids and weaknesses into the concrete. Their building practices included tamping the freshly placed concrete with special tools. The tamping process produced more gel, which is the bonding material produced by the chemical reactions that take place during hydration which bond the particulates and aggregate together. Like the Romans had 500 years later, the Nabataea had a locally available material that could be used to make their cement waterproof. Within their territory were major surface deposits of fine silica sand. Groundwater seeping through silica can transform it into a pozzolan material, which is a sandy volcanic ash. To make cement, the Nabataea located the deposits and scooped up this material and combined it with lime, then heated it in the same kilns they used to make their pottery, since the target temperatures lay within the same range.

By about 5600 BC along the Danube River in the area of the former country of Yugoslavia, homes were built using a type of concrete for floors

{This is an illustration of an ancient building that the Nabataea used concrete to build it }

The listed points below  shows the period in which concrete was used in different regions of the world:

- CHINA
  Around 3000BC

About this same time, the northern Chinese used a form of cement in boat-building and in building the Great Wall. Spectrometer testing has confirmed that a key ingredient in the mortar used in the Great Wall and other ancient Chinese structures was glutenous, sticky rice. Some of these structures have withstood the test of time and have resisted even modern efforts at demolition.

- ROME
  Around 600BC

By 600 BC, the Greeks had discovered a natural pozzolan material that developed hydraulic properties when mixed with lime, but the Greeks were nowhere near as prolific in building with concrete as the Romans. By 200 BC, the Romans were building very successfully using concrete, but it wasn't like the concrete we use today. It was not a plastic, flowing material poured into forms, but more like cemented rubble. The Romans built most of their structures by stacking stones of different sizes and hand-filling the spaces between the stones with mortar. Above ground, walls were clad both inside and out with clay bricks that also served as forms for the concrete. The brick had little or no structural value and their use was mainly cosmetic. Before this time, and in most places at that time (including 95% of Rome), the mortars commonly used were a simple limestone cement that hardened slowly from reacting with airborne carbon dioxide. True chemical hydration did not take place. These mortars were weak.

For the Romans' grander and more artful structures, as well as their land-based infrastructure requiring more durability, they made cement from a naturally reactive volcanic sand called harena fossicia. For marine structures and those exposed to fresh water, such as bridges, docks, storm drains and aqueducts, they used a volcanic sand called pozzuolana. These two materials probably represent the first large-scale use of a truly cementicious binding agent. Pozzuolana and harena fossicia react chemically with lime and water to hydrate and solidify into a rock-like mass that can be used underwater. The Romans also used these materials to build large structures, such as the Roman Baths, the Pantheon, and the Colosseum, and these structures still stand today. As admixtures, they used animal fat, milk and blood -- materials that reflect very rudimentary methods. On the other hand, in addition to using natural pozzolans, the Romans learned to manufacture two types of artificial pozzolans -- calcined kaolinitic clay and calcined volcanic stones -- which, along with the Romans' spectacular building accomplishments, are

evidence of a high level of technical sophistication for that time.


An ancient building in rome

Great wall of china

Concrete was used in these building the great wall of china which is infact one of the 7 wanders of the world

❖ Egypt
Araound 3000 BC

Around 3000 BC, the ancient Egyptians used mud mixed with straw to form bricks. Mud with straw is more similar to adobe than concrete. However, they also used gypsum and lime mortars in building the pyramids, although most of us think of mortar and concrete as two different materials. The Great Pyramid at Giza required about 500,000 tons of mortar, which was used as a bedding material for the casing stones that formed the visible surface of the finished pyramid. This allowed stone masons to carve and set casing stones with joints open no wider than 1/50-inch.

*A pyramid casing stone*

# MODERN DAY CONRETE:

Today's concrete is made using Portland cement, coarse and fine aggregates of stone and sand, and water. Admixtures are chemicals added to the concrete mix to control its setting properties and are used primarily when placing concrete during environmental extremes, such as high or low temperatures, windy conditions, etc

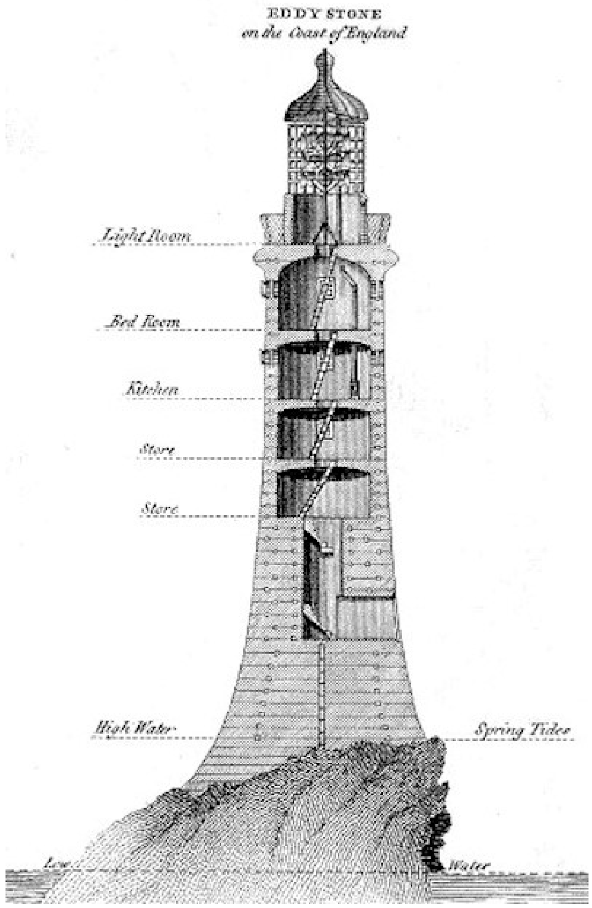
in 1824, an Englishman named Joseph Aspdin invented Portland cement by burning finely ground chalk and clay in a kiln until the carbon dioxide was removed. It was named "Portland" cement because it resembled the high-quality building stones found in Portland, England.

{Ordinary Portland Cement is the most common form Modern concrete consists of Portland cement, stone aggregates, and sand mixed with fresh water. The main advantage of modern concrete is that it sets and dries quickly compared to Roman concrete }

Technological Milestones:

During the Middle Ages, concrete technology crept backward. After the fall of the Roman Empire in 476 AD, the techniques for making pozzolan cement were lost until the discovery in 1414 of manuscripts describing those techniques rekindled interest in building with concrete.

It wasn't until 1793 that the technology took a big leap forward when John Smeaton discovered a more modern method for producing hydraulic lime for cement. He used limestone containing clay that was fired until it turned into clinker, which was then ground it into powder. He used this material in the historic rebuilding of the Eddystone Lighthouse in Cornwall, England.




*Smeaton's version (the third ) of the Eddystone Lighthouse, completed in 1759. After 126 years, it failed due to erosion of the rock upon which it stood.*

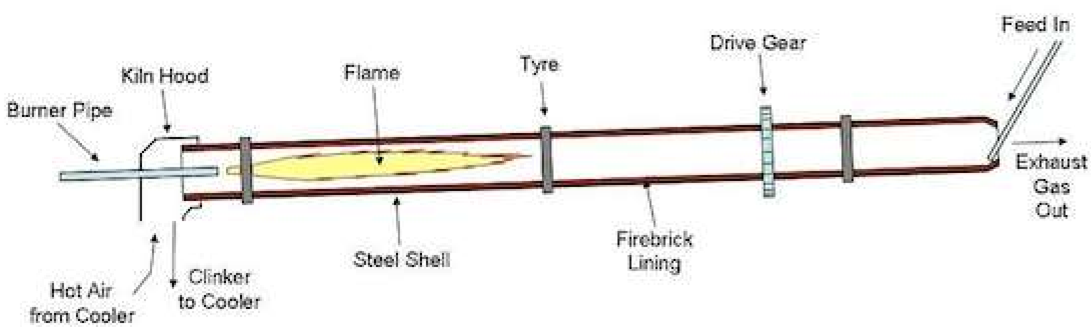
Finally, in 1824, an Englishman named Joseph Aspdin invented Portland cement by burning finely ground chalk and clay in a kiln until the carbon dioxide was removed. It was named "Portland" cement because it resembled the high-quality building stones found in Portland, England. It's widely believed that Aspdin was the first to heat alumina and silica materials to the point of vitrification, resulting in fusion. During vitrification, materials become glass-like. Aspdin refined his method by carefully proportioning limestone and clay, pulverizing them, and then burning the mixture into clinker, which was then ground into finished cement.

## Composition of Modern Portland Cement

Before Portland cement was discovered, and for some years afterward, large quantities of natural cement were used, which were produced by burning a naturally occurring mixture of lime and clay. Because the ingredients of natural cement are mixed by nature, its properties vary widely. Modern Portland cement is manufactured to detailed standards. Some of the many compounds found in it are important to the hydration process and the chemical characteristics of cement. It's manufactured by heating a mixture of limestone and clay in a kiln to temperatures between 1,300° F and 1,500° F. Up to 30% of the mix becomes molten but the remainder stays in a solid state, undergoing chemical reactions that can be slow. Eventually, the mix forms a clinker, which is then ground into powder. A small proportion of gypsum is added to slow the rate of hydration and keep the concrete workable longer. Between 1835 and 1850, systematic tests to determine the compressive and tensile strength of cement were first performed, along with the first accurate chemical analyses. It wasn't until about 1860 that Portland cements of modern composition were first produced.

Kilns

In the early days of Portland cement production, kilns were vertical and stationary. In 1885, an English engineer developed a more efficient kiln that was horizontal, slightly tilted, and could rotate. The rotary kiln provided better temperature control and did a better job of mixing materials. By 1890, rotary kilns dominated the market. In 1909, Thomas Edison received a patent for the first long kiln. This kiln, installed at the Edison Portland Cement Works in New Village, New Jersey, was 150 feet long. This was about 70 feet longer than the kilns in use at the time. Industrial kilns today may be as long as 500 feet.

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# The 26 Types of Concrete

## 1- Normal Strength Concrete

Normal strength concrete is made up of a combination of several fundamental ingredients — aggregate, concrete and sand — in a 1:2:4 ratios. This mixture produces normal strength concrete that can be used for many applications. It takes about 30 to 90 minutes to set, but this is dependent on the weather conditions at the concrete site and the cement's properties.

It's normally used for pavements or buildings that don't need high tensile strength. It is not very good for many other structures since it doesn't withstand the stresses created by wind loading or vibrations very well.

## 2 - Reinforced Concrete

This form of concrete is widely used in industry and modern construction. Reinforced concrete gets its strength through the help of wires, steel rods or cables that are placed in the concrete before it sets. A more familiar name for these items is rebar. Lately, people have used fibers to reinforce this concrete.

These reinforcements resist tensile forces to avoid cracking or breaking. Meanwhile, the concrete itself resists compressive forces to withstand heavy weight. Together, the two materials create a strong bond against many applied forces, such as vehicles. In essence, they become a single structural element.

Invented in the 19th century, it dramatically changed the construction industry. Roadways, buildings and bridges require reinforced concrete. Next time you visit a construction site, you'll likely see reinforced concrete with rebar.

## 3 - Plain or Ordinary Concrete

This is another concrete that uses the common mix design of 1:2:4 with its components of cement, sand and aggregates. You can employ it to make pavement or buildings where there is not a high demand for tensile strength. It faces the same challenges as normal strength concrete — it doesn't stand up very well to vibrations or wind loading. Plain or ordinary concrete is also used in dam construction. The durability rating of this kind of concrete is very satisfactory.

## 4 -  Pre-stressed Concrete

Pre-stressed concrete units are used for many large concrete projects. To create pre-stressed concrete, you must use a special technique. Like reinforced concrete, it includes bars or tendons. But these bars or tendons are stressed before the actual application of the concrete.

When the concrete is mixed and placed, these bars are placed at each end of the structural unit where they are used. When the concrete sets, this unit is put into compression.

This compression enhances the strength of the lower section of the unit and improves its resistance against tensile forces. However, this process requires skilled labor and heavy equipment. Normally, pre-stressed units are created and assembled on-site. Pre-stressed concrete is used to build bridges, heavy-loaded structures or roofs that have long spans.

## 5 - Precast Concrete

As with most classes of concrete, precast concrete must be made and cast according to specific measurements. These concrete units are eventually transported to the application site and assembled for use.

You frequently see these units transported to worksites as you drive on highways. Precast concrete is used for:

Concrete blocks

Precast walls

Staircase units

Poles

The advantage of using precast concrete is its speedy assembly. Since the units are manufactured in a factory, they are of very high quality.

# 6 - Lightweight Concrete

Lightweight concrete is any kind of concrete that has a density of less than 1920kg/m3. Lightweight concrete is created by using lightweight aggregates. Aggregates are ingredients that add to the density of the style of concrete. These lightweight aggregates are made up of various natural, artificial and processed materials, which include:

Clays

Expanded shales

Scoria

Pumice

Perlite

Vermiculite

The most important property of lightweight concrete is that it has very low thermal conductivity. Common uses for lightweight concrete include creating long-spanning bridge decks and building blocks. It can also be used to protect steel structures.

# 7 - High-Density Concrete

High-density concrete has a very specific purpose. It is frequently used in the construction of atomic power plants. The heavyweight aggregates used in the creation of high-density concrete help the structure resist radiation.

Crushed rocks are normally used. Barytes, a colorless or white material that consists of barium sulfate and is the principal ingredient in barium, is the crushed rock most often employed.

## 8 - Volumetric Concrete

This concrete was created as an alternative to ready-mix concrete to address the problem of long distances between the concrete plant and construction sites. It requires specialized trucks known as volumetric mobile mixers. They carry the concrete ingredients and the water that will be mixed at the construction site.

Volumetric concrete is extremely useful when a builder requires two different kinds of concrete mix at a single site. Since the concrete can be mixed and delivered as needed, it allows one truck to produce two different mixes of concrete. It is very useful on large sites, basement constructions and multi-projects where you need different types of concrete.

## 9 - Stamped Concrete

Also known as imprinted or textured concrete, stamped concrete is designed to realistically replicate the look and pattern of natural stones, tiles, brick and granites. Stamped concrete is often used to construct patios, pool decks, interior floors and driveways.

This style is achieved by using professional stamping pads to create an impression on the surface of the concrete. To get a natural finish, you can also use various texture work and coloring stains.

Some of the advantages of stamped concrete include:

Affordability compared to natural pavers and stone

Easy maintenance once sealed

Becomes slip-resistant with a non-skid additive

Enhances outdoor space and adds value

Durable and long-lasting

Extensive pattern and color choices

# 10 - Air-Entrained Concrete

Some types of concrete hold billions of microscopic air cells in every cubic foot. These tiny air pockets relieve the internal pressure on the concrete. They provide tiny chambers where water can expand when it freezes.

The air is entrained in the concrete by adding several foaming agents during the mixing process, including:

- Fatty acids
- Resins

Alcohols

Because this concrete is mixed at the site of application, the mixing and entraining process requires careful engineering supervision. The entrained air adds up to about 3% to 6% of the volume of the concrete. Almost all concrete used in a freezing environment or where there are freeze-thaw cycles is air-entrained.

# 11 - Ready-Mix Concrete

Concrete prepared and bathed in a centrally located plant is known as ready-mix concrete. This concrete is mixed as it is transported to the site in the familiar cement trucks seen often on roads and highways. Once the trucks reach the worksite, the cement can be used immediately because it does not need further treatment. Ready-mix concrete is a specialty concrete that is mixed based on specifications developed with great precision.

Creating ready-mix concrete requires a centralized location where the concrete can be prepared. These locations need to be placed at an adjustable distance from the worksite. If the concrete takes too long to reach the worksite, it will be of no use. In most cases, the worksite to far from the preparation plant. Retarding agents are sometimes used to delay how long the concrete takes to set.

Ready-mix concrete is preferred to concrete mixed on-site because the mixture has higher precision and having the concrete ready to pour reduces confusion on the worksite. Ready-mix concrete can be used for buildings, roadways, walls and more.

## 12 - Self-Consolidated Concrete

Self-consolidating concrete will compact on its own due to its weight when put in place. This non-segregating, highly flow able concrete will fill the formwork and spread easily into place to encapsulate the reinforcement without the need for vibration or mechanical consolidation. This highly workable concrete is best used for applications and areas where there is thick reinforcement.

Some benefits of self-consolidated concrete include the following:

- Self-leveling
- Enhanced hardened properties
- Improved consolidation in congested areas
- Safer work environment
- Reduced equipment and labor
- Increased detailing flexibility
- Smoother surfaces
- Reduced noise

## 13 - Decorative Concrete

Decorative concrete creates visually and aesthetically appealing concrete mixes. Decorative concrete can go through several processes, such as:

Coloring

Molding

Polishing

Etching

Applying decorative toppings

It is ideal for any project in which you want to make an aesthetic statement. It's also a great way to add a bit of "personality" to dull surfaces or structures. For instance, swimming pools and flooring can make great use of decorative concrete.

## 14 - Polymer Concrete

Polymer concrete aggregates, compared to those in other concrete types, are bound together in a matrix with polymer instead of cement. This type of concrete is made of limestone gravels, silica, quartz, granite pebbles and other high-compressive strength materials. If these materials are not dry, clean and dust-free, it can have a negative impact on the concrete's binding ability.

The polymer resin serves as the binder and the aggregate is the compressive stress material. Polymer concrete composites contain a distinct combination of properties in their formulation. Some of these properties include:

Rapid curing ambient temperatures

Good adhesion to surfaces

Long-term durability

High flexural, tensile and compressive strengths

Low permeability to water and some solution

Lightweight formula

Strong chemical resistance

Polymer concrete also has a few distinct categories, including:

Polymer impregnated concrete

Polymer cement concrete

Partially impregnated

## 15 - Rapid-Set Concrete

In a hurry? Then you need rapid-set concrete. It's ideal when you're short on time to complete a project. It has faster set times and is very resistant to low temperatures, so it can be used any time of the year. It's especially useful in winters when the cold weather does not allow you to use many other kinds of concrete.

## 16 - Smart Concrete

As the name suggests, smart concrete is the concrete technology of the future. The creation of this type of concrete makes it easier to monitor the condition of reinforced concrete structures. Smart concrete contains short carbon fibers that are added with a conventional concrete mixer. This process affects the concrete's electrical resistance when under strain or stress. This kind of concrete can be used to detect possible problems before the failure of the concrete.

It is very good at sensing tiny structural flaws. While not widely available yet, it promises to be the building material of the future for cities that face repeated earthquake risk. Smart concrete allows engineers in those cities to check the health of structures after earthquakes, providing a far better assessment of their condition than a visual inspection.

## 17 - Pervious Concrete

This is one of the most common kinds of concrete used to build roads and pavements. It is designed to deal with the problems of stormwater runoff and pools of water and puddles on roadways or airport runways.

Other concrete absorbs water. Roadways that use pervious concrete have fewer problems with hydroplaning, tire spray and snow buildup. It also reduces the need for curbing and storm sewers.

It is composed of a mixture of cement, water and coarse aggregates. It contains no sand, which creates an open-scale, porous structure. This allows water to pass through the layers more easily. Some kinds of pervious concrete will pass several gallons of water through its surface per minute.

## 18 - Vacuum Concrete

In certain applications, such as deck slabs, parking lots and industrial floors, concrete will have a higher water content than necessary when poured into the formwork. In these cases, the excess water must be removed with a vacuum pump before the concrete begins to set. Compared to a normal construction method, the vacuum technique can help make the concrete platform or structure ready to use sooner.

## 19 - Pumped Concrete

If you've ever wondered what types of cement mixtures used in the flooring of a very tall building are, the answer is probably pumped concrete. The secret to pumped concrete is that it is very workable, so it can be conveyed easily via a pipe to an upper floor. This pipe will be a flexible or rigid hose that discharges the concrete to the required area.

Pumped concrete can also be used:

- To create super flat floors on lower structures
- In construction projects like roadways and bridges
- For more personal items, like swimming pools

It is a reliable, efficient and economical way to apply concrete and is often the only way that concrete can be placed in certain locations. Very fine aggregates are used in pumped concrete. The finer the aggregate used in the mix, the freer the concrete flows from the pipe.

## 20 - Lime Crete

This concrete uses lime instead of cement, along with lightweight aggregates like glass fiber or sharp sand. It's mainly used for the construction of floors, vaults and domes. Lime Crete has many environmental benefits because it is so easily cleaned and is renewable. It can also be used with radiant floor heating.

. Roll Compacted Concrete

It's a familiar sight on many American highways — a heavy roller compacting a layer of concrete. Roll-compacted concrete is a strong, dense concrete used on heavily trafficked highways with vehicles that carry large loads. This concrete emits fewer emissions during the production process, which benefits the environment.

Roll compacted concrete can be found in roadworks, airport runways, car parks, pavements and industrial servicing.

## 21 - Glass Concrete

Another, more modern form of concrete, glass concrete features the use of recycled glass. This form of concrete is used when aesthetic appeal is an important element in the design of the concrete.

Commonly used in the large-format slabs found in flooring or on decorative façades, this concrete can have shining or colored glass embedded during the mixing process to give it a distinctive splash of color or sparkle.

## 22 - Asphalt Concrete

More commonly known as "asphalt" or "blacktop," this is a form of concrete often used for constructing sidewalks, roads, parking lots, airport runways and highways— almost anywhere pavement is needed. Asphalt is a dark mineral composed of bitumen, which are a form of hydrocarbons.

The desire for asphalt grew along with the automobile industry. Known for its durability, workability, skid resistance, stability, fatigue resistance, flexibility and permeability, it still requires a properly designed mixture. It is a composite mixture of aggregates and asphalt. The different mixtures of asphalt are used for different purposes.

## 23- Shotcrete Concrete

Shotcrete differs from other forms of concrete primarily in the way it is applied. Shotcrete is shot through a nozzle onto a frame or formwork. Since this application requires higher air pressure, the compaction process takes place at the same time as the placing.

Shotcrete can be used to repair damaged wood, concrete or steel structures. It is also commonly used when access to a work area is difficult or when formwork is impractical or cost-prohibitive.

## 24 - High-Strength Concrete

High-strength concrete is any concrete mix that is greater than 40 mega Pascal (40MPa), which is the tensile strength of concrete. High-strength concrete that meets this determinant can handle much more stress and pressure compared to concrete at 20MPa or 30MPa.

This type of concrete can withstand strenuous conditions before it shears, cracks or breaks. The increased strength in this concrete is accomplished by reducing the water-cement ratio to a low rate.

High-strength concrete above 40MPa is often used for civil and commercial construction, which includes buildings and infrastructure projects, structural beams, columns, loadbearing walls and any other application where increased capacity and durability are required.

## 25 - High-Performance Concrete

Though all high-strength concrete can be labeled as high-performance, not all high-performance concrete (HPC) will be in the high-strength category. HPC meets particular efficiency standards, such as:

- Easy placement
- Heat of hydration

Environmental standards

Longevity and durability

Life-term mechanical properties

Strength gain in early age

Toughness

Permeability and density factors

However, HPC may be limited in strength in some cases, depending on the application you plan to use it in.

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