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CONCRETE TECHNOLOGY

MODULE (1)

CEMENT :-

Portland cement :- In 1824, Joseph Aspdin, a brick layer and mason in Leeds, England, took out a patent on hydraulic cement that he called Portland cement. because its colour resembled the stone quarried on the Isle of Portland, off the British coast.

Cement is a key ingredient of concrete and the world's most widely used building material.

The most common type of cement used is ordinary Portland cement. It is manufactured by intimately mixing in definite proportions of argillaceous (containing silica) and calcareous (containing lime) and/or other silica, alumina or iron-oxide-bearing compounds to a partial fusion at a temperature of about 1400°C . As a result, a product called clinker is formed which is cooled and then ground to required fineness.

No material is added after burning, other than gypsum (Natural or chemical) or water or both and not more than one percent of air-entraining agents or other agents. The fine ground material is called cement.

TYPES OF CEMENT :-

- Ordinary Portland cement - 33 grade, 43 grade & 53 grade
- Rapid hardening Portland cement
- Portland slag cement
- Portland Pozzolana cement

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- High-alumina cement
- Hydrophobic cement
- Super-sulphated cement
- Sulphate resisting portland cement.

Ingredients of Portland cement :-

Ingredients	Percentage
Lime (CaO)	60% - 65%
Silica (SiO ₂)	20% - 25%
Alumina (Al ₂ O ₃)	4% - 8%
Iron Oxide (Fe ₂ O ₃)	2% - 4%
Magnesium Oxide (MgO)	1% - 3%
Sulphur trioxide (SO ₃)	1% - 2%
Alkalies	0.3% - 1%

SPECIAL CEMENT :-

1. White Portland cement
2. Expansive cement
3. Masonry "

Different tests For Cements :- (a) Field testing
(b) Laboratory testing.

1. Determination of fineness
 - (a) By dry sieving
 - (b) By blaine Air permeability Method
2. Determination of consistency of standard cement paste
3. Determination of initial and final setting times
 - (a) Initial setting time.

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(b) Final setting time

4. Determination of compressive strength of cement.

Setting time:- The setting time is influenced by the percentage of water and its temperature and by the temperature and humidity of air.

1. Initial setting time:-

- Take 300gm of cement. Prepare a neat cement paste by gauging the cement with 0.85 times the water required to give a paste of std. consistency.
- Pour the paste in Vicat mould completely. The mould resting on the non porous plate.
- Level the surface of the paste.
- The needle (1mm square) is lowered gently until it comes in contact with surface of the test block. and released quickly to penetrate into the test block.
- The penetration of the needle is read on the scale.

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2. Final Setting Time:-





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2. Final Setting Time:-

- Replace the needle of the Vicat apparatus used for setting time by the needle with an annular attachment.
- The cement should be considered finally set when upon applying the needle gently to the surface of the test block, the needle makes an impression thereon, while the attachment fails to do so.
- The period elapsing between the time when the water added to the cement and the time at which the needle makes an impression on the surface of the test block while the attachment fails to do so shall be the final setting time.

HYDRATION:- Cement gets its strength from chemical reactions between the cement and water. The process is known as hydration.

Chemical composition of clinker:-

Following ^{are the} typical composition for clinker.

Compound	Formula	Shorthand form	% by weight.
Tricalcium aluminate	$\text{Ca}_3\text{Al}_2\text{O}_6$	C_3A	10
Tetra calcium aluminoferrite	$\text{Ca}_4\text{Al}_2\text{Fe}_2\text{O}_{10}$	C_4AF	8
Belite or dicalcium silicate	Ca_2SiO_5	C_2S	20
Alite or tricalcium silicate	Ca_3SiO_4	C_3S	55
Sodium Oxide	Na_2O	N	upto 2
Potassium Oxide	K_2O	K	"
Gypsum	$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	C_2H_2	5

