

# CHAPTER - 1

## CONCRETE AS A CONSTRUCTION MATERIAL

2015

JANUARY | FRIDAY

02

WK 01 • 002-363

### concrete :-

→ concrete is obtained by mixing cementing materials, water, aggregates and sometimes admixtures in required proportions.

or concrete is a mixture of cement or lime, sand, coarse aggregate and water.

i.e concrete = cement or lime + (fine aggregate) + coarse aggregate + water.

→ When the concrete is placed in forms and allowed to cure, it becomes hard like a stone.

→ It is the most widely used man-made construction material in the world.

→ The hardened concrete is also considered as an artificial stone in which the voids of larger particles (coarse aggregate) are filled by the smaller particles (fine aggregate) and the voids of fine aggregates are filled with cement.

## CHAPTER-2

### CEMENT

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2015

SATURDAY | JANUARY

01

#### cement :-

- cement is an engineering material or building material or material of construction, which is used for binding.
  - The natural cement is obtained by burning and crushing the stones containing clay, carbonate of lime and some amount of carbonate of magnesia.
  - The natural cement is brown in colour.
  - The artificial cement is obtained by burning at a very high temperature a mixture of calcareous and argillaceous materials.  
(lime)  
(clay)
  - A mixture of cement and sand when mixed with water to form a paste is known as cement mortar.
- 11 SUNDAY
- cement is a fine powder and delicate link in concrete construction.
  - The cement commonly used is portland cement and the fine



oxide composition of ordinary portland cement.

oxide (ingredients)	percentage	Average
Lime (CaO)	60-65	63
Silica (SiO <sub>2</sub> )	17-25	20
Alumina (Al <sub>2</sub> O <sub>3</sub> )	3.5-9	6.3
Iron oxide (Fe <sub>2</sub> O <sub>3</sub> )	0.5-6	3.3
Magnesia (MgO)	0.5-4	2.4
Sulphur trioxide (SO <sub>3</sub> )	1-2	1.5
Alkalis i.e soda / Potash (Na <sub>2</sub> O / K <sub>2</sub> O)	0.5-1.3	1.0

08

Ingredients	percent	Range
Lime (CaO)	62	62 to 67
Silica (SiO <sub>2</sub> )	22	17 to 25
Alumina (Al <sub>2</sub> O <sub>3</sub> )	5	3 to 8
Calcium Sulphate (CaSO <sub>4</sub> )	4	3 to 4
Iron oxide (Fe <sub>2</sub> O <sub>3</sub> )	3	3 to 4
Magnesia (MgO)	@ 2	0.1 to 3
Sulphur (S)	1	1 to 3
Alkalies	1	0.2 to 1
Total = 100		



## chapter-3

# AGGREGATE

2015

FEBRUARY | TUESDAY

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WK 07 • 041-324

## Aggregate :-

- Aggregates are the chemically inactive materials which form the bulk of cement concrete.
- Aggregates are bound together by cement.
- Aggregates are generally cheaper than cement and impart greater volume stability and durability to concrete.
- The aggregate is used for the purpose of providing bulk to the concrete.
- The aggregates provide about 75 percent of the body of the concrete and hence its influence is extremely important.
- The aggregate must be of proper shape (either rounded or approximately cubical), clean, hard, strong and well graded.

## Classification of aggregates :-

- Aggregate can be classified according to their
- (1) geological origin
  - (2) size
  - (3) shape
  - (4) unit weight



# CHAPTER-4

## WATER

2015

04

2015

MARCH • MONDAY

16

WK 12 • 075-290

### Water :-

- Water is the most important and least expensive ingredient of concrete.
- A part of mining water is utilized in the hydration of cement to form the binding matrix in which the inert aggregates are held in suspension until the matrix has hardened.
- The remaining water serves as a lubricant between the fine and coarse aggregates and makes concrete workable i.e. readily placeable in forms.
- Example :- cement requires about three-tenth of its weight of water for hydration. So minimum water-cement ratio is 0.30.  
But <sup>the</sup> concrete containing water in this proportion will be very harsh and difficult to place. Additional water is required to lubricant the mix, which makes the concrete workable.
- The water-cement-ratio is influenced by  
i- grade of concrete.  
ii- nature and type of aggregates



Admixtures :-

→ Admixtures are the chemical compounds in concrete other than hydraulic cement (OPC), water and aggregates.

→ These are mineral additives that are added to the concrete mix immediately before or during mixing to modify one or more of the specific properties of concrete in the fresh or hardened state.

→ The use of admixture should offer an improvement not economically attainable by adjusting the proportions of water, cement and aggregates. and should not adversely affect the performance of the concrete.

→ Admixtures are no substitute for good concreting practice.

→ The admixtures have formulated chemical composition and special chemical action and are used to modify certain properties of concrete.

→ They are used primarily to reduce the cost of concrete construction.



## Functions of admixtures :-

The functions of admixtures are as follows:

1- To accelerate the initial set of concrete i.e. to speed up the rate of development of strength at early ages.

2- To retard the initial set i.e. to keep concrete workable for a longer time for placement.

3- To enhance the workability.

4- To improve the penetration (flowability) and pumpability of concrete.

5- To reduce the segregation in grout and concrete mixtures.

6- To increase the strength of concrete by reducing the water content and by densification of concrete.

7- To increase the durability of concrete, i.e. to enhance its resistance to special conditions of exposure.



# CHAPTER-6

## 05 PROPERTIES OF FRESH CONCRETE 2015

APRIL • THURSDAY

16

WK 16 • 106-259

### Fresh concrete :-

Fresh concrete is defined as the concrete having a suitable composition in terms of quality and quantity of cement, aggregate and admixtures should satisfy a number of requirements from the mixing stage till it is transported, placed in formwork and compacted.

### Workability :-

Workability is defined as the property of freshly mixed concrete or mortar which determines the ease and homogeneity with which it can be mixed, placed, compacted, and finished.

### Homogeneity :-

→ Homogeneity means uniform and stable distribution of cement, aggregate and water and resistance to segregation. Segregation is a critical physical property of plastic concrete.

→ The presence of excess mixing water, under-mixing and overmixing are



# CHAPTER-7

## 05 PROPERTIES OF HARDENED CONCRETE

2015

28

APRIL TUESDAY

WK 18 • 118-247

### Introduction :-

The properties of hardened concrete are

i - strength

ii - stress-strain characteristics

iii - shrinkage and creep deformations

(iv) - response to temperature variation

(v) - permeability and durability.

The voids present in concrete mass have been found to influence greatly the strength of concrete.

### Strengths of concrete :-

The strength of concrete can be classified into three types such as:

1- compressive strength

2- Flexural strength

3- Tensile strength.

### 1- compressive strength :-

→ compressive strength comes from compressive stresses. cubes, cylinders, and prisms are the three types of



PRODUCTION OF CONCRETEIntroduction :-

- The design of a satisfactory mix proportion is by itself no guarantee of having achieved the objective of quality concrete work.
- The batching, mixing, transportation, placing, compaction, finishing and curing are very complimentary operations to obtain desired good quality concrete.
- Good quality concrete is a homogeneous mixture of water, cement, aggregates and other admixtures.
- The aim of quality control is to ensure the production of concrete of uniform strength in such a way that there is a continuous supply of concrete delivered to the place of deposition, each batch of which is as nearly like the other batches as possible.

→ The production of concrete of uniform quality involves the following five definable phases.

1- Batching or measurement of materials.



- 2- Mixing of concrete
- 3- Transportation
- 4- Placing, compaction and finishing of concrete
- 5- curing.

### 1- Batching of materials :-

→ A proper and accurate measurement of all the materials used in the production of concrete is essential to ensure uniformity of proportions and aggregate grading in successive batches.

→ For most of the large and important jobs the batching of materials is usually done by weighing.

The factors affecting the choice of proper batching system are

- i- Size of job
- ii- required production rate
- iii- required standards of batching performance.

→ The batching equipment can be classified into three categories



## CHAPTER - 10

the locality  
available  
materials of  
variable  
characteristics.

# INSPECTION AND QUALITY CONTROL OF CONCRETE

17

WK 29 • 198-167

2015

JULY, FRIDAY

Quality control of concrete:—

concrete is generally produced in batches at the site with,

\* So the aim of quality control is to reduce the above variations and produce uniform material providing the characteristics desirable for the job envisaged to required.

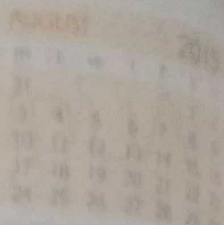
\* quality control is a corporate, dynamic programme to assure that all aspects of materials, equipment and workmanship are well looked after. The tasks and goals in these areas are properly set and defined in the specifications and control requirements.

\* quality control is conformity to the specifications, no more or no less. The most practical method of effective quality control is to check what is done in totality to conform to the specifications.

Factors causing variations in the quality of concrete.

The factors causing variations in the quality of concrete are:  
1- personnel





## Introduction :-

\* cement concrete suffers from several drawbacks such as low tensile strength, permeability to liquids and consequent corrosion of reinforcement, susceptibility to chemical attack and low durability.

\* Recent developments in the material and construction technology have led to significant changes resulting in improved performance, wider and more economical use.

\* The improvements in performance can be grouped as:

1- Better mechanical properties than that of conventional concrete such as compressive, tensile strength, impact toughness etc.

2- Better durability attained by means of increased chemical and freeze-thaw resistances.

3- Improvements in selected properties of interest such as impermeability.



adhesion, thermal insulation, lightness, abrasion and skid resistance etc.

### 10 SHOTCRETE OR GUNTING :-

11 \* Shotcrete is mortar or very fine concrete  
12 deposited by setting it with high velocity on to a prepared surface.

1 \* It has different proprietary names in different countries such as  
2 Blastcrete, Blowcrete, Guncrete,  
3 jet-crete, Nucrete, Pneukrete,  
4 Spraycrete, Tokrete etc. through the principle is essentially the same.

5 \* Shotcrete offers advantages over conventional concrete in a variety  
6 of new construction and repair works.

7 \* Shotcrete is frequently more economical than conventional concrete because of less formwork requirements requiring only a small portable plants for manufacture and placement.

\* Shotcrete is very useful for the restoration and repair of concrete