





- Nelson Mandela

Building Materials

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CEMENT

Learning Objectives

At the end of this lesson you shall be able to

- Know the types of cement.
- Explain artificial cement and its types.
- Know the field tests for cement.
- State the properties of Portland cement.
- Understand the storage of cement and grades of cement.

4.1.1 Introduction

Cement is the most important material in building construction. To a layman the term cement means Portland cement. Cement is manufactured from lime stone and clay. It is available in powder form, when mixed with water can set to a hard mass even under water.

Cement | Building Materials





4.1.2 Types of Cement

Generally cement is classified into two categories. They are,

- 1) Natural Cement
- 2) Artificial Cement

4.1.2.1 Natural Cement

Natural cement is obtained by burning, crushing and powdering the molecular stones of natural silica and lime. This stone contains 20% to 40% of clay alias silica. It is also known as **"Roman cement"**.

4.1.2.2 Artificial Cement

Artificial cement is obtained by adding lime and clay in correct proportion and burning it at high temperature. This burnt mixture is called "**Clinker**". Gypsum is added to clinker and grinded in powdered form. This grinded powder is known as "**Cement**". Colour of artificial cement is alike the stones in Portland of United Kingdom. Hence it is called "**Portland cement**". In the year 1904, artificial cement is manufactured in India. In general, the weight of one cement bag is 50 kg.

4.1.3 Types of Artificial Cement

In addition to ordinary Portland cement, following are the other varieties of cement.

- 1. Hydrophobic cement
- 2. Pozzolana cement
- 3. Quick setting cement
- 4. Rapid hardening cement
- 5. White cement
- 6. Colour cement
- 7. Acid resisting cement
- 8. Blast Furnace slag cement
- 9. High alumina cement
- 10. Low heat cement





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11. Sulphate resisting cement

Hydrophobic Cement



Acidol, Napthalene soap, oxidised petroleum, etc., are used as the additional ingredients to decrease the wetting ability of cement grains. These substances form a thin film around cement grains. The fine pores in concrete are uniformly distributed. Thus frost and water resistance of the concrete are increased considerably.

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Portland cement was invented by an English man named 'Joseph Aspdin' in the year 1824 (19th century).



Pozzolana denotes volcanic powder. It is cheap, attains compressive strength with age, offers great resistance to expansion and possesses lighter tensile strength. It is used to prepare mass concrete of lean mix works and for laying concrete underwater.

Quick Setting Cement



Quick Setting cement is produced by adding a small percentage of aluminium sulphate to the ingredients of cement during

Pozzolana Cement



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grinding. The setting action starts within five minutes after the addition of water. It becomes hard in less than thirty minutes. This cement is used to lay concrete under static water or running water.

Rapid Hardening Cement



Rapid Hardening cement attains high hardness in minimum days. The initial setting time and final setting time of this cement is like ordinary cement. Increase in lime content, very fine grinding and burning at high temperature are the reasons for the quick setting. The cost of this cement is more than Portland cement. Construction work is done quickly due to its quick setting and hardening property.

White Cement

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White Cement is a variety of ordinary cement. It is prepared from raw materials which are practically free from oxides of iron, manganese or chromium. It is white in colour. It is used for floor finish, plaster work, ornamental work, etc. It is more costly than ordinary cement.

Colour Cement





Colour cement is manufactured by mixing 5% to 10% of colouring agents with ordinary cement. Strength of this cement is affected when more than 10% of colouring pigment is added. Green colour is obtained by adding chromium oxide. Blue colour is obtained by adding cobalt. Yellowish brown, red, yellow colours are obtained by adding iron oxide in different proportions. Black colour is obtained by magnesium oxide. This cement is used to make artificial stones, external decoration, coloured cement flooring, etc.

4.1.4 Field Tests For Cement

To know the quality of cement, the following tests are conducted in cement.

- 1. Manufacturing date and Colour test.
- 2. Physical properties
- 3. Presence of lumps
- 4. Block test
- 5. Glass plate test

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4.1.4.1 Manufacturing Date and **Colour** Test

If the cement bags stocked for long period it loses its strength. Hence, the manufacturing date of the cement bag should be checked. The colour of cement should be uniform. It is light green mixed with grey colour.

4.1.4.2 Physical Properties

When cement felt between fingers is rough, and is warm when hand is inserted in a bag of cement, it indicates adulteration.

4.1.4.3 Presence of Lumps

Cement inside the bag should not be harden due to moisture. If it is hard, such cement should be rejected.

4.1.4.4 Block Test

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A cement block of size 200 mm \times 25mm $\times 25$ mm is made and it is immersed in water for 7 days. It is then placed 150 mm apart between supports. The cement is good, if this block shows no sign of failure when 34kg weight is loaded on it.

4.1.4.5 Glass Plate Test

A thick paste of cement with water is made on a piece of glass plate and keep it in water for 24 hours. The paste should set hard with the glass plate when it is taken out.

Required Properties of 4.1.5 **Portland Cement**

- Initial setting time should not be less than 30 minutes.
- Final setting time should not be more than 10 hours.
- After 3 days, compressive strength should not be less than 16 N/mm².
- After 7 days, compressive strength should not be less than 22 N/mm².
- After 3 days, tensile strength should be 2 N/mm^2 .



The first bridge built using artificial cement is Souillac Bridge over Dordogne River in 1824 at France.



ACTIVITY 1

Do the block test and glass plate test conducted in cement in your class room.

- After 7 days, tensile strength should be 2.5N/mm^2 .
- The residue should not be more than 10% when sieved in I.S 90 micron sieve.
- Should not expand more than 19 mm in Le-Chatlier test.

4.1.6 Grades of Cement

There are three grades of cement.

- 1) Grade 33 as per IS 269 (1989).
- 2) Grade 43 as per IS 8112 (1989).
- 3) Grade 53 as per IS 12269 (1987).



Now a days the cement of grade 43 is easily available.

The grades 43 and 53 in cement mainly corresponds to the average compressive strength attained after 28 days in mega Pascals (Mpa) of at least 3 mortar cubes (area of the face 50cm²) composed of one part of cement with three parts of standard sand.

4.1.7 Storage of Cement



- Cement packed in bags should be stored in a place that it may not come into contact with water, moisture and even with moist air.
- Cement bags are stored in storage sheds on damp proof raised floors.



ver two billion tons of cement is produced each year. Ancient Chinese used cement to hold bamboo together in boats and in the Great Wall of China.

Building Materials | Cement

- The bags should be kept 60cm away from the walls.
- Not more than 10 bags should be stacked on one stock.
- Cement should not be stored for more than one year.
- In case of long storage for a period more than a year it should be covered with "tarpaulin" which renders water proof.



- If different brands of cement are stacked they should be stacked separately.
- For mass storage, cement should be stored in silos in loose form.



Silos

ACTIVITY 2

Visit any loose cement storage plant nearby your town and submit a report with photos.

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Model Questions

PART I (1 Mark)

Choose the correct answer

- 1. The artificial cement is manufactured in India in the year ...
 - a. 1900
 - b. 1940
 - c. 1904
 - d. 1914
- 2. The other name of natural cement is ...
 - a. Roman cement
 - b. Sand
 - c. M- sand
 - d. Artificial cement
- 3. The weight of cement bag is...
 - a. 10kg
 - b. 50kg

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- c. 100kg
- d. 75kg
- 4. Colour cement is manufactured by mixing of colouring agents with ordinary cement.
 - a. 25% to 50%
 - b. 50% to 100%
 - c. 1% to 60%
 - d. 5% to 10%
- 5. While storage the cement bags should be stored away from the wall.
 - a. 120cm
 - b. 60cm
 - c. 15cm
 - d. 90cm



PART II (3 Marks)

Answer in on or two sentence

- 6. What are the general types of cement?
- 7. What are the field tests conducted in cement?
- 8. Brief about the block test conducted on cement.
- 9. List any five types of artificial cement.
- 10. List the grades of cement.

PART III (5 Marks)

Answer shortly

- 11. Write briefly about artificial cement.
- 12. Write about any two types of artificial cement in brief.

PART IV (10 Marks)

Answer in detail

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- 13. What are the required properties of portland cement?
- 14. Explain about storage of cement.

(d) . c (b) . 4 . (d) . c (b) . 4 . (d) . 5 . (b)

Part – I Answers

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MORTAR

Learning Objectives

4.2 MORTAR

4.2

At the end of this lesson you shall be able to

- Know mortar and its types.
- Understand the properties of good mortar.
- Understand the preparation of cement mortar.
- Know the precaution in using mortar.
- Know the uses of mortar.

4.2.1 Introduction

Mortars are used in masonry for joining stones, bricks, blocks, etc., and are designated by the mix used.

4.2.2 Definition

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The term mortar is used to indicate a paste prepared by adding required quantity of water to a mixture of binding material like cement or lime and fine aggregate like sand.



4.2.3 **Properties of Good Mortar**

- i) It must have the required strength.
- ii) It must be workable.
- iii) It must be durable.

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iv) Compatible with the types of painting work.
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- v) It should stiffen early.
- vi) It must have good bond with bricks and stones.
- vii) It should prevent seepage of rain water.
- viii) It should be cheap.
- ix) It should have water retentivity.

4.2.4 Types of Mortar

Based on the kind of binding material used, the mortar is classified into 4 types. The binding material is chosen based on the expected working condition, hardening temperature, moisture condition, etc.

They are,

- 1. Lime Mortar
- 2. Cement mortar
- 3. Combination or gauged mortar
- 4. Mud mortar

4.2.4.1 Lime Mortar

In lime mortar, lime is used as binding material and it may be fat lime, hydraulic

Building Materials | Mortar

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lime or lime with surkhi in different proportions. Lime mortar has the properties like high plasticity, can be placed easily, good cohesiveness, durability and hardens slowly. It is generally used in lightly loaded parts of building above ground level.

4.2.4.2 **Cement Mortar**

In cement mortar, cement is used as binding material. Proportion of cement to sand varies from 1:2 to 1:6 or more. Cement mortar is used where a mortar of high strength and water resisting property are required such as underground construction, water saturated soil, etc.

4.2.4.3 **Combination** Mortar or **Gauged Mortar**

To improve the quality of lime mortar, cement is sometimes added to it. This is known as gauging. It makes lime mortar more strong and dense.

4.2.4.4 **Mud Mortar**

In this type of mortar clay and sand are mixed together and used in the construction of temporary sheds.



have already been used 10,000 years ago.

Lime came into operation in 6000 BC but it had been used first by romans as a constituent to produce mortar.

4.2.5 **Preparation of Cement** Mortar

Cement Mortar needed for small works is mixed by hand and for large works is mixed by mixer machine.

4.2.5.1 Hand Mixing



Cement and Sand



Dry Mixing



Wet Mixing



Prepared Mortar

Sand is measured by boxes and cement by weight of bags. The specified quantity of sand is spread first and then cement is spread over it. They are dry mixed again and again

by a shovel or spade till the mix is of uniform in colour. Then water is added and the whole mass is mixed for ten to fifteen minutes.

4.2.5.2 Machine Mixing



In machine mixing, cement and sand are just mixed in a concrete mixer and then water is added gradually. Mixing is carried out for more than one minute till the mixture is brought to a plastic condition.

Mortars within two hours can be used after retempering by adding water to restore the consistency. After two hours the mix should not be used.

ACTIVITY 3

Visit a construction site near by your school and collect details about mixing of mortar.

4.2.6 Uses of Mortar

- 1. To bind the building units such as bricks, stones, etc.
- 2. To carry pointing and plaster work on exposed surface of masonry.
- 3. To form an even bedding layer for building units.
- 4. To form joints of pipes.
- 5. To improve the appearance of structure.
- 6. To prepare moulds.
- 7. To serve as a matrix to hold coarse aggregates, etc.

Building Materials | Mortar

4.2.7 Precautions to be taken in Using Mortar

The following precautions are to be taken while making use of mortar.

- i) After preparation, it should be consumed as early as possible.
- ii) The cement mortar should be consumed before its initial setting time starts.
- iii) It is advisable to prepare mortar of one bag of cement at a time.
- iv) It is advisable to stop the work in frosty weather.
- v) The building units should be soaked in water before mortar is applied.
- vi) The construction work should be cured by sprinkling water to avoid rapid drying.
- vii) The mortar should not contain excess water and it should be as stiff as it can be conveniently used.

4.2.8 Required Strength of Mortars In Masonry

Strength of mortars to be used for joining bricks, stones, blocks, etc., should depend on the strength of the materials. There is no advantage in using over strong mortar. It should be sufficiently strong to resist erosion, abrasion and other factors affecting durability. The following list gives the ratio of common cement – sand mortars used in practice in Tamilnadu.

- 1. Damp proof course CM 1 : 2
- 2. General Brick work CM 1 : 6
- 3. Stone masonry CM 1:6
- 4. Arch work CM 1:3
- 5. Pointing work- CM 1:1 to 1:3
- 6. Brick work plaster CM 1:5
- 7. RC Plasterwork (like ceiling) CM 1:3 to 1:4

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Model Questions

PART I (1 Mark)

Choose the correct answer

- 1. is used in masonry for binding stones and bricks together.
 - a. Mortar
 - b. Concrete
 - c. Adhesives
 - d. Chemicals
- 2. The mortar is mixed for minutes in hand mixing.
 - a. 30 to 45
 - b. 10 to 15
 - c. 5 to 10
 - d. 20 to 25
- 3. It is advisable to prepare cement mortar for at a time.
 - a. 5 bags
 - b. 2 bags

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- c. 3 bags
- d. 1 bag



PART II (3 Marks)

Answer in one or two sentences

- 4. Define mortar.
- 5. List the types of mortar.
- 6. Define mud mortar.
- 7. List any three ratios of cement mortars used in practice.

PART III (5 Marks)

Answer shortly

- 8. Write about any two types of mortar.
- 9. What are the uses of mortar?

PART IV (10 Marks)

Answer in detail

- 10. What are the properties of a good mortar?
- 11. Explain the preparation of cement mortar.
- 12. What are the precautions to be taken in using mortar?



Part – I Answers

Mortar | Building Materials |

CONCRETE

Learning Objectives

At the end of this lesson you shall be able to

- Know concrete and its ingrediants.
- Understand about water cement ratio.
- List the types of concrete, its uses and properties.
- Know the preparation of cement concrete.
- Understand the precautions to be taken while transportation and placing of concrete.
- Know the grades of concrete.

4.3.1 Introduction

4.3

Cement concrete is a major building material used in modern building constructions. It is used in all parts of a building like foundations, superstructure and roofs. It is prepared at site by hand mixing or machine mixing. Nowadays it is also available as a factory made product known as **"Ready Mix Concrete" (RMC)**.

4.3.2 Definition

Concrete is a composition of coarse aggregate, fine aggregate, binding material and water in such proportions that the whole sets into a monolithic mass.

When cement concrete is used without reinforcement, it is called "Plain Cement Concrete" (PCC). If it is reinforced with steel, it is called "Reinforced Cement Concrete" (RCC).

4.3.3 Ingredients of Concrete



The ingredients of concrete are,

- 1. Binding material (cement or lime)
- 2. Fine aggregate (river sand or M-sand)
- 3. Coarse aggregate (broken bricks or broken stone)
- 4. Water
- 5. Admixtures in cement

4.3.3.1 Binding Material

Cement or lime are used as the binding material. They bind the individual units of fine aggregate and coarse aggregate by virtue of its properties of setting or hardening in combination with water. It helps to fill the voids and imparts density to concrete.

4.3.3.2 **Fine Aggregate**

Sand or crushed stone sand (M sand) are used as fine aggregate to fill the voids leaved between coarse aggregates and thereby reduce the quantity of cement.

4.3.3.3 **Coarse Aggregate**

Broken stone or broken brick acts as main filler and forms the main bulk of concrete. The aggregates should be clean, dense, hard, strong and durable.

Water 4.3.3.4

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Water facilitates the spreading of cement over the aggregates and regulates the consistency. Water used should be clean. Sea water should not be used as it retards setting of concrete.

Admixtures in cement 4.3.3.5

There are also certain other additives known as "Admixtures" added to improve the quality of concrete required for various constructions. Some of them are,

- i) Plasticizers.
- Superplasticizers. ii)
- iii) Accelerators.
- iv) Retarders.
- Pozzolanic material. v)
- vi) Air entraining agents.
- vii) Fibres.
- viii) Polymers.
- ix) Silica fume.









Accelerators

Retarders





Pozzolanic material

Air entraining agents



Fibres



Polymers



Silica fume

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4.3.4 Water – Cement Ratio

"Water-cement ratio" is defined as the ratio of the weight of mixing water to the weight of cement used in the concrete. The strength of concrete increases with decrease in water-cement ratio.

Water reacts with cement chemically and causes setting and hardening of concrete. It is found theoretically that water required is about 0.50 to 0.60 time the weight of cement.

4.3.5 **Preparation of Cement** Concrete

Cement concrete is prepared either by hand mixing or machine mixing depending on the requirement. The materials are mixed thoroughly, so that a uniform distribution of materials is obtained. The thorough mixing ensures that cement in the form of a film completely covers the surface of aggregate.

4.3.5.1 Hand Mixing



Mixing by hand is done either in a steel pan or on a pucca water tight platform. First, the sand and cement in the specified proportions are mixed thoroughly. Then, this mixture is spread evenly on a stack of coarse aggregate. It is turned over twice in dry state. Then the measured quantity of



Tn India the buildings made out of white concrete is Bhai lotus temple (constructed in1986) located in Delhi.

Search link: http://en.m.wikipedia.org> wiki>lotustemple



water is added and the mixture is mixed thoroughly to get a uniform mix. The prepared mix shall be consumed in 30 minutes after adding water. Hand mixing is best for small works.

Machine Mixing 4.3.5.2





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Machine mixing is useful in large works. It is cheaper in the long run. The mixing is done in concrete mixer either of tilting drum type or non-tilting drum type. Water should be added in the mixer at the same time or before the other materials are placed. The mixing time should be at least one minute and preferably two minutes. The concrete discharged from the mixer should be consumed before the setting time starts. The mixer should be cleaned well after every use.



Typical ione bag) tilting druns construct indust



Visit a construction site in your town during the process of concreting by machine mixing and prepare a report with picture.

4.3.5.3 Ready Mix Concrete





Batching Plant

When construction is to be carried out in congested places, it is difficult to find space for storing aggregates and mixing concrete at the site. Hence, ready mix concrete are used at such sites. The ready mix plants are located away from the centre of city where concrete can be mixed by using batching plants.



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ACTIVITY 5 Visit ready mix plant nearby and prepare a report.

In case of where it is difficult to lift the concrete to large heights by employing manual labour, concrete is pumped up through



specially designed pumps. These `pump concrete mix should be designed in such a way that they do not allow segregation.



The ready mix concrete while being transported in rotating drums which keep the concrete in agitated condition as well a dose of retarding agents (additives) are added to the concrete.

4.3.6 Compaction of Concrete



The thoroughly mixed concrete should be placed continuously and compacted rapidly. The main aim of compaction is to remove air bubbles and

Building Materials | Concrete

thus give a maximum density to concrete. Compaction can be done in 2 ways.

- 1. Hand Compaction
- 2. Mechanical Compaction

4.3.6.1 Hand Compaction



This is done with the help of steel tamping rods or timber screeds. Narrow and deep members are compacted with tamping rods. The slabs and floors are tamped with screeds. Compaction should be done in layers of 300mm for mass concrete and 150 mm for reinforced concrete.

4.3.6.2 Mechanical Compaction



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Reinforced concrete:

n 1848, Jean-Louis-Lambot was the first

person to use reinforced concrete by using iron bars and wire mesh.



Vibrators are used for this way of compaction. The vibrators permits the use of a lower water- cement ratio as the compaction is very thorough even for drier mixes. The advantages of this type of compaction are,

- i. A good surface finish can easily be obtained.
- ii. Formworks can be removed early.
- iii. A leaner mix with high strength can be obtained.
- iv. Concrete can be deposited also in small openings and in the places where it will be difficult to deposit by hand methods.

4.3.7 Curing of Concrete

After concrete is set, it should be continuously cured for a specific period. For the chemical reaction (Hydration) to take place between the constituent of cement, there should be a humidity of 95% in the mix. Hence, it is necessary to keep the concrete wet for a specific period. If the concrete is not cured properly then cracks appear on the top and the full strength also not attained.

4.3.7.1 Methods of Curing

- I. Ponding with water.
- ii. Covering the concrete with wet sand, jute bags, etc.
- iii. Intermittent spraying and covering concrete with polythene bags.
- iv. Completely immersing in water tanks as in the case of precast elements.
- v. By steam curing.
- vi. Vertical surfaces like columns are cured by covering with wet sack or by spraying.



Ponding with water



Intermittent spraying

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Covering concrete with polythene bags



Steam curing



Immersing in water tank



Cured by covering with wet sack

Building Materials | Concrete



Covering the concrete with wet sand



Covering the concrete with, jute bags

4.3.8 Properties of Concrete

Cement concrete possesses the following important desirable properties:

- i. It has high compressive strength.
- ii. It is free from corrosion and there is no appreciable effect of atmospheric agents on it.
- iii. It can be moulded into any form.
- iv. It hardens with age.
- v. It is proved to be more economical than steel.
- vi. It binds rapidly with steel.
- vii. It forms a hard surface, capable of resisting abrasion.

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The main undesirable properties of cement concrete are as follows:

- i. It undergoes shrinkage while setting and hardening.
- ii. It requires careful attention in preparation, placing and curing.
- iii. Concrete structure will be bigger and heavier than steel structures.
- iv. If it is not compacted thoroughly, porous holes may formed on the surface.

4.3.9 Uses of Concrete

Concrete is used for variety of purposes such as:

- i. Foundations of masonry works, especially in damp soil or under water.
- ii. Terrace roofs and floors.
- iii. Walls, retaining walls.

- iv. Arches, dams and bridges, etc.
 - The use of concrete can be traced back to ancient Egypt, where it was used as an infill material for the pyramids.
 - First concrete highway was built in 1909 in Greenfield Township, which is now northwest Detroit, Michigan, USA.

4.3.10 Types of Concrete

There are many types of concrete that can be made as per requirement. In the ordinary concrete, the following distinctions are usually made.

- (1) No fines concrete.
- (2) High slump or self-compacting concrete.
- (3) High strength concrete.
- (4) High performance concrete.

4.1.10.1 No Fines Concrete



It is designed with cement, coarse aggregate and water without fine aggregates. This is generally used in mass concrete work in foundation where we want to prevent capillary rise of water.

4.1.10.2 High Slump or Self Compacting Concrete



In situations like concreting of piles, we cannot compact the concrete by external means. Similarly, in places where there is congestion of steel, we need this type of concrete. These are produced by

increasing the workability of concrete by the aid of plasticizers and super plasticizers.

4.1.10.3 High Strength Concrete

Concrete which is designed to have strength 40 N/mm² (Grade 40) and above is called high strength concrete.



4.1.10.4 High Performance Concrete

Concrete which is designed to have strength more than 60N/mm² is called high performance concrete. Also these concrete have special characters like high workability, high resistance to corrosion, etc.





Precasted concrete construction is the modern type of construction now-a-days.

Search link: Http://en.m.wikipedi. org>wiki>precastedconcreteconstruction.



4.3.11 Other Types of Concrete

In addition to the above concretes, a large number of special types of concretes are made for special purposes. They are:

- i. Fibre reinforced concrete.
- ii. Light weight concrete.
- iii. Fly ash concrete.
- iv. Silica fumes concrete.
- v. Polymer concrete.
- vi. Ferro cement concrete.
- vii. Pre packed concrete.

Building Materials | Concrete

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NOV A 10- storey precasted structure was erected in 48 hours in Mohali, Chandigarh by involving 200 workers including technicians.



4.3.12 Precautions to Be taken During Transportation and Placing of Concrete

During Transportation

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- There should be no segregation or spilling of concrete.
- Water should not be added in any circumstances.
- Concrete should be placed and compacted before its setting starts.

During Placing

- The form work should be properly cleaned and prepared well to receive fresh concrete.
- It should be deposited as nearly as possible to its final position.
- The position of form work and reinforcement should not be disturbed.
- It should not be dropped from height more than a metre to avoid segregation.

- It should be laid continuously.
- The thickness should not be more than 30-45cm in case of mass concrete and 15
 - 30 cm in case of RCC Works.
- It should be consolidated or compacted well.
- Walking on freshly laid concrete should be avoided.
- Concrete should not be laid during rain.



Stephen Stepanian:

An American An American inventor and owner of numerous patents including the elevator and conveyor, compound tool and the wrench. He is also the inventor of self-discharging motorized transit mixer that was the predecessor of the concrete mixer truck. Stepanian is often called the 'father of the readymix concrete' industry



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4.3.13 Grades of Concrete

Concrete grades are denoted by M_{10} , M_{20} , M_{30} according to their compressive strength. The 'M' denotes mix design of concrete followed by the compressive strength number in N/mm².

'Mix' is the respective ingredient proportions which are cement, fine aggregate and coarse aggregate.

If we mention M_{10} concrete, it means that, the concrete has 10 N/mm² characteristic compressive strength after 28 days.



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ACTIVITY 6

Collect pictures of coloured concrete buildings and various concrete construction and prepare an album.

Note: The minimum grade of concrete for plain cement concrete (PCC) is M_{15} and for reinforced cement concrete (RCC) is M_{20} .

Grade	Proportion of concrete	Characteristic Compressive Strength (N/mm ²)
M ₅	1:5:10	5 N/mm ²
M _{7.5}	1:4:8	7.5 N/mm ²
M ₁₀	1:3:6	10 N/mm ²
M ₁₅	1:2:4	15 N/mm ²
M ₂₀	1:1 1/2 : 3	20 N/mm ²
M ₂₅	1: 1: 2	25 N/mm ²
M ₃₀	1: 1: 3	30 N/mm ²

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Model Questions

PART I (1 Mark)

Choose the correct answer

- 1. concrete is adopted for concreting in congested areas.
 - a. Ready mix
 - b. Reinforced cement
 - c. Plain cement
 - d. Lime
- 2. The materials used to improve the quality of concrete is
 - a. Fine aggregate
 - b. Binding material
 - c. Admixture
 - d. Cement
- 3. water should not be used in concrete.
 - a. Pond

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- b. Lake
- c. River
- d. Sea
- 4. The strength of high strength concrete is
 - ••••
 - a. 20 N/mm^2
 - b. 40 N/mm^2
 - c. 30 N/mm^2
 - d. 10 N/mm^2



PART II (3 Marks)

Answer in one or two sentences

- 5. Define RCC and PCC.
- 6. List the ingredients of concrete.
- 7. List any four admixtures used in concrete.
- 8. What is water-cement ratio?
- 9. Write shortly about grade of concrete.

PART III (5 Marks)

Answer shortly

- 10. Write about any two ingredients of concrete.
- 11. Explain hand mixing of concrete.
- 12. Write about ready mix concrete.
- 13. What is compaction of concrete?
- 14. Write the uses of concrete.
- 15. What are the advantages of mechanical compaction of concrete?

PART IV (10 Marks)

Answer in detail

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- 16. Explain machine mixing of concrete with sketch.
- 17. Explain about compaction of concrete.
- 18. Define curing and list the methods of curing.

(d) .4 (b) .5 (c) .1 (b) .1

Part – I Answers

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