

Q.1) Describe various cement concrete products used in low cost housing:

Concrete:

The cement concrete is a mixture of sand, cement, pebbles or crushed rock and water. which when placed in the skeleton of humps and allowed to cure becomes hard like stones. So cement concrete has attained the status of measure building materials in modern construction.

Low cost housing:

The low cost housing or affordable housing refers to housing units that are affordable by the section of society whose income is below the median household income.

How the low cost house is constructed:

- ① First prepare the geometry of low cost house.
- ② Consider the construction method and material carefully.
- ③ Take the labour cost to be added along with construction material.
- ④ Be careful with floor area.

In this low cost housing the concrete plays an important role because it has a high compressive strength and it is free from corrosion. Therefore when the water cement ratio is between 0.5 to 0.6 and strength is around 15 kg/cm^2 , then the cement concrete show its good properties.

The mixing machine, quality of chips can make the concrete very useful in low cost housing.

Therefore its strength is more, so that it can face the natural calamities.

The concrete can harden the low cost housing with a sufficient strength. When the iron ~~bar~~ beam are added, it can be more stronger with moderate cost.

Under the initial shrinkage and proper curing, this low cost housing product can be more proper and it lasts for more longer than the other house.

concrete products like beam, roof, lintel, slabs, floor all can be useful for low cost housing. But when the under surface is come with water, then it can be also prepared with lower slabs above the water surface.

Various types of ferrocement products

As we know the steel reinforcement is generally in the form of round bar of mild steel. But ferrocement is a composite material composed of mortar reinforced with light steel.

Light steel means fabric or ^{meshed} reinforced product used for in the form of thin section.

Therefore ferrocement should be composed with ferroc-concrete.

The various ferro cement products which are used in different environment are normally composite materials in which cement and some kind of cement filler material called matrix is reinforced with fiber. The fiber should be dispersed through the composite material and its result is a greater performance to the original material. The composite material should have unique property like better resistance to cracking, higher compressive strength, higher tensile strength, and good durability therefore the ferro cement product include water storage tank, grain storage bins, boats, small sieves, pipes, elements for roofing houses, keral lining elements and other utility products.

Procedure

Prepare the ferro cement product mini of 2 layer of wareness which is provided and depending upon the design of the element is properly fixed. cement, sand, additives which are combinely mixed and combined with water and apply on the frame work then the plastering carried out if 1.5 mm.

Then without any kind of interruption the ferrous cement must be cure with a minimum of 14 days just like the procedure of concrete construction.

The different ferro-cement products houses and rafters generally clay type ~~roof~~ roofing is adopted for houses with the help of timber crushes or rafters as the supporting structure when the secondary member can be timber ~~rafters~~ rafters. Such products are free from hazards and attacked from termite, and it is also cheaper than the timber.

Ferrocement Rafters

When the tile roofing materials generally rafters are spaced at the distance of 750 to 1000 mm the calculated steel as reinforcement should be provided in the body of the rafter in addition to providing a normal wellness. So the performance is improved when the welded mesh element have prepared for this purpose. Because it affectively prevents the ~~so~~ crack.

Ferrocement Lattice

It is the requirements for some small housing scheme with lean to roof then monolithic ferrocement can be made in any desired shape. So that there will be match the leading requirement.

Forcement roofs:

This can be made with the help of pre-cast technology which is appropriate for the modular and repeatedly construction. This can be made with large span areas without any supporting structures.

The frame forcement roofs, the attic tile, forcement ~~and~~ core units are also the products of the ferro-cement.

All these are coming under ferro-cement product. Therefore ferro-cement product can be utilise with a higher strength and resistance capability.

Mosaic Tiles:

Traditionally mosaic is a decorative design or work of art made up of small materials such as pieces of stone or glass arrange to create pattern or image. So in the tile work mosaic is defined as inlay design line pattern with smaller than 2x2 inch.

The mosaic tiles which are used in beautiful and original appearance of house use for different purpose. The basic type of mosaic art are classical, pebble, industrial, hand cut and custom ceramics. This can be combined with mosaic and tiles, where mosaic is anything resembles a with beautiful or it is a piece of size usually coloured with stone, glass, pictures

and other types of materials. Where as tiles means piece of materials that can be used for decoration as well as strengthening purpose.

When the mosaic tiles are prepared, this can be made with different steps -

- ① That can be either made with pressing, hand pressing, ground with mosaic sheets etc
- ② or it can also made by mosaic tile making machines.

The raw materials as we know, for ceramic tiles clay, feldspar, pottery stones, silica sand and talc are used. Like that the mosaic tile are made up of ocean side glass along with sand and they are prepared by hand pressing and along with machine pressing. The different manufactures like J.K. Cement and other types of manufacturer they can preparing this mosaic tiles with portland cement, marble powders, glass powders, superior white ~~powder~~ and foreign impurities. They are first mixing all these material thoroughly along with sand and water. After that it is pressed in a hydraulic press. Then the vibration is given on the tiles. Then it is dried and fired sometimes.

In this way the mosaic tile is prepared for decoration purpose.

Questions

- ① what do you mean by ferro cement ?
- ② write the different types of ferro cement products
- ③ what are the advantage of ferro cement products ?
- ④ what is mosaic tiles ?
- ⑤ write the preparation of mosaic tiles.

Describe making of cement concrete (RCC) pipes and railway sleeper :

The different material which are required for RCC are :

- (I) Cement
- (II) Aggregate
- (III) Steel
- (IV) Water
- (V) Sand

So that the steel reinforced is placed in cement concrete are suitable place to take off the tensile stress. So this is simply called RCC or Reinforced cement concrete.

Cement concrete pipes is a pipe made up of cement concrete when placed skeleton of formed and allow to cure becomes hard like a stone. cement concrete has attained the status of a major building materials due to durable structure and practically no considerable labour expenditure.

So basic material are portland cement aggregate and water. There are 4 basic method for producing pipe :

- (I) centrifugal
- (II) Dry cast
- (III) Packer head
- (IV) Dry concrete mix

So that the different size pipes can be prepared through different machine or that is called pipe making machine.

When the different raw material are mixed together ~~by~~ they are put inside the mould. After the mould is filled up with the raw material then the pipe is removed from the mould. So that the hardening continues for a long time and this becomes a special class of materials.

As we know this is more economical than steel pipes. This is due to the fact that sand and pebbles are crushed rock forming the bulk of cement concrete. This is moderately changed to the new shape with minor water & cement ratio and it hardens the surface and suitable for resisting abrasion.

So this is normally used in different sewage system, transportation of water, transportation of different types of liquid along with the removal of sewage product.

Railway Slipper:

The cement concrete pipe when made up of railway slipper then the strength of the slipper is increase and the cost is reduced. As we know previously the railway slipper is made up of wooden materials but now-a-days these are replaced with RCC. But in circumstances like bridges wooden slipper are use.

- (i) Normally this can withstand the unfavourable climatic condition.
- (ii) It is economical and low maintenance.
- (iii) It is high resistance to lateral movement.
- (iv) It is suitable for holding shapes at high speed because this slipper are a lot heavier and have a corrugated bottom.

A concrete slipper normally made up of steel reinforced concrete. This are the advantage that they do not rot like timber & extra weight make the track more suitable than the other slippers.

They give more retaintivity to the track they have longer life than wooden slipper. Therefore environmental friendly.

This advantage include that when trains derail at wheel it the timber slipper tend to absorb the blow and remain in track while concrete slipper tend to shatter & have to replace.

Initial cost are greater and they are unsuitable for change of gauge. Normally this is manufactured with preparation of concrete and they are placed inside the mould & it is pressed normally. This types of production are based on the size and the requirement of industry.

When the different numbers of cement concrete railway slipper are placed on a railway line. Its strength is varied as per the use of the railway department. Therefore the concrete slippers made upside down in mould the pre-stress steel reinforcing bar then concrete is poured. It takes several days for the concrete is cure, after which the slipper are removed from the mould and it cut into individual slipper.

Conclusion +

Any this railways slipper are now days used for their advantage to the railway department.

Describe making of cement concrete block :-

The cement concrete block is a blocks made up of cement concrete normally the portland cement aggregate include sand, fine gravel which can be producing by using autoclave cured concrete.

Questions:

1. How the cement concrete pipes are manufactured?
2. Write the advantage of cement concrete pipes?
3. How the cement concrete can be useful for railway sleeper?
4. Write the advantage and disadvantage of cement concrete used in railway sleeper.
5. How we can prepared the railway sleeper with cement concrete?

The cement concrete block can be prepared by mixing the cement that is portland cement, water and gravel which can produce a light grey block with surface texture and high compressive strength that can be mix with 3 part sand, 3 part stone aggregate, 1 part cement to light part which can be mix thoroughly and pressed in a block making machine so that block is prepared with a high pressure and with the mould then this can be pressed the block and harden slightly the basic mixture for most concrete block project is 4 to 1 or 5 to 1 mixture where 4 to 5 parts of sand is mixed with 1 part of cement. Then water is added to that until achieve the texture.

Now-a-days it can be prepared with

automatic machine. Normally concrete blocks have 1 or more hollow cavities and their sides may be cast or smooth with a design in use. Concrete blocks are stacked and held together with fresh concrete mortar to form the desired length and height of wall.

The concrete mortar or small bone which are developed by Roman in 15th century, the concrete commonly used to make concrete blocks which is a mixture of portland cement. If granulated coal or volcanic cinder dust are used instead of sand and gravel, the resulting block is commonly called cinder block. The light weight concrete block is made by replacing the sand and gravel and the light weight concrete block can be prepared by the crushing raw material and heating upto 1093°C . The shape and size of most common concrete blocks have been

standardize to ensure uniform building construction.

The manufacturing process consists of 4 steps -

- (i) Mixing
- (ii) Moulding
- (iii) Curing
- (iv) Cubing

Afterward this is prepared with quality control testing and packing.

Mixing :

Mix the raw material in mixture.

Moulding :

Mould it inside a mould.

Curing :

The block are put inside the kiln and fired in a central bed.

Cubing :

They are rolled out of the kiln, quality control and tested.

Conclusion :

So the cement concrete block can help the builder to build a new design.

Making of FAL-G brick (Fly ash Lime-Gypsum)

FAL-G brick is an alternative building material to the traditionally bond clay brick and substitute for the traditional bond brick used for the construction.

The FAL-G is the technology used in the design to be practised in lime roof and cement roof. The FAL-G brick and block technology such as the unique technology to make the block in alternative manufacturing process starts with mixing the ingredients, pressing the brick in a machine, curing the brick for stipulated period then this mix

is moulded on the pressure. Drying may be done. Then they are sintered with making eco-friendly but some bricks does not steaming or autoclaving. Here the fly ash is resource material where it is heat treatment on properties and reaction between flyash and lime occurs.

Here the role of gypsum is double in first stage. It acts as a set retarder, 2nd it act as a strength accelerator due to this type of combination the FAL-G brick can be prepared with a new technology and advance machinery.

Questions

- ① What do you mean by cement concrete block?
- ② How cement concrete block are prepared?
- ③ compare between curing and curing of cement concrete block.
- ④ Write the advantage of cement concrete block.
- ⑤ Write the use of cement concrete block.

When this Fal-G bricks used for construction purpose due to its advance technology the less cement is required.

With a strength of 8 to 40 MPa the Fal-G bricks do not find a strong application in construction. But when it can be used for other purposes. The other things like sand, stone dust, cement, blasting sand that can be used the bricks become stronger and it can be used for construction purpose. Fly ash is 35%, quality dust is 50%, sludge lime is 10%, gypsum - 5%. This can be taken for conventional method of preparing that first these raw materials are patented where the environmental friendly cost effective house can be prepared.

The raw materials can be taken to preparation of the different structures with a different technology. The different manufacturing machines which are come to use they are first taken with the proper proportion like - Fly ash, 50%, Slaked lime - 30%, Anhydrous gypsum - 20%, 3 to 4 types of stone dust, then that is thoroughly cleaned and placed inside a pressing machine. Afterward that can be placed with 30 to 35 MPa or sometimes more than that. The loss on ignition is about 1000°C is 5% or less. The fineness should not be more than ~~320~~ $320 \text{ m}^2/\text{kg}$. The CO₂ should be contain more than 10%.

Advantage:

- It reduce the dead load on structure due to light weight.
- It has high fire insulation.
- Due to high strength there will be no breakage occur & they do not require soaking in water.
- Due to uniform size of brick the mortar required is 50%.

This brick do not require soaking in water. so the lower water penetration water through brick is considerably reduced.

Disadvantage:

- Its mechanical strength is low. and it has limitation of size and it is only good for the place like sub-tropical area.

Conclusion:

Anyhow the Fal-G bricks is a advanced material for new generation.

Question:-

1. What do you mean by Fal-G brick.
2. What are the Raw material for Fal-G bricks?
3. How this brick is manufactured?
4. Write the advantage and disadvantage of Fal-G brick.
5. Write the uses of Fal-G brick.

Introduction:

High alumina cement is a special type of cement, which can be also known as calcium aluminate cement which is composed of calcium silicate and it is manufactured from limestone, chalk and bauxite.

High alumina is consist of more than 45% of alumina where the properties of alumina is to protect the temperature on its condition.

When the cement is prepared with high alumina this is also mainly made to protect the thermal condition.

Most of the material like castable, cement bond, mouldable that can be rammed into position either in a wall or in a mould.

Recently the CaO , MgO , Al_2O_3 or BaO , Al_2O_3 are replaced by cement.

The advantage of monolithics, cement, castable have a good thermal shock resistance.

Raw material for high alumina cement.

The different composition of high alumina cement consists of silica, around 3 to 8%, and alumina 37 to 41%, lime 36 to 40%, iron oxide 9 to 10%, Titanium 5 to 6%, magnesium 1%, insoluble residue 1%. The lime stone or chalk

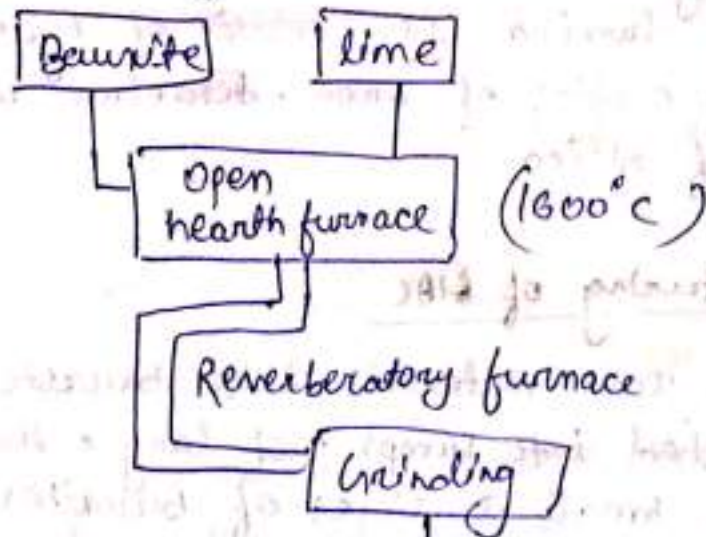
bauxite which is a residual deposit form by weathering under tropical condition of rocks containing alumina. It consists of hydrated alumina, oxides of iron, titanium with small amount of silica.

Manufacturing of HAC

The true raw materials like bauxite and lime are crushed into lumps not larger than 100 mm. Dust and small particles of bauxites form during crushing are cemented into briquettes of smaller size as dust would damp the furnace. The crushed material ~~and~~ of required proportion are fed into the rotary kiln or open hearth furnace which is a combination of cupola furnace and reverberatory furnace and from there the pulverised coal is used about 22% of cement produce.

The moisture & CO_2 in the furnace are driven up & the materials are heated by the hot gas of the furnace at about 1600°C which is the fusion point of the material. The fusion takes place at the lower end of the stack and the molten materials in the reverberatory furnace and from there through a spout into steel plants. Then they are cooled in a cooler but during the grinding which is done after cooling the iron is separated. The fineness of cement is around $2500 \text{ cm}^2/\text{gm}$ to $3200 \text{ cm}^2/\text{gm}$. So the

Material used in the mfg of High alumina cement are fused completely in the kiln.



2500 cm²/gm to 3200 cm²/gm

Hydration Chemistry

When it is reacted with water, there is certain change ~~at~~ occurs in high alumina cement. e.g. a water which is slowly react with high alumina start a reaction with calcium aluminate cement. Normally ordinary portland cement generally used in the construction sector are mainly based on lime, silica mineral phase. When high alumina cement is used the calcium aluminate compound developed a bond where in the first stage a reaction occur due to heat evolution. In 2nd stage the nucleation developed where $Al(OH)_3$ and calcium space is developed and in final stage the growth occurs and the hydration reaction convert the CA phase to CAH_{10} forms at 20°C. C_2AH_8 forms at 21°C, C_3AH_6 at 30°C. So it increase the

porosity and decrease the mechanical strength.

properties of HAC

As we know, high alumina cement is manufactured by grinding of alumina, clinkers and calcareous material such as lime by fusing and sintering process. The chemical property is studied first.

① Composition of high alumina cement:

Al_2O_3 - 37 to 41%.

Lime - 36 to 40%.

Iron oxide - 9 to 10%.

Mg - 1%.

The other properties like physical properties:

① Colour - Black

Due to rapid hydration the rate of gain of strength is very high. The rate of heat development is 9 cal/hour.

Questions:

- ① How we can define HAC?
- ② Write the mfg. process of HAC with a flow chart.
- ③ How we can study the hydration properties of HAC?
- ④ What is the firing temp of HAC?
- ⑤ Why vertical & horizontal furnace is used for firing of HAC?

Setting property

- Normally the initial setting time of HAC is 4 to 5 mins and final setting time is 30 mins later than initial setting time. The setting time of HAC is greatly affected by addition of gypsum.
- Its rate of heat development is 3.5 cal/gm/hr and compressive strength is around 420 kg/cm^2 after 24 hrs. But after 3 days it is 490 kg/cm^2 .
- It is highly resistance to sulphate attack due to the absence of Ca(OH)_2 . Due to the cement free from attack of CO_2 it is dissolved in water.
- The cement is not acid resistance but can withstand well with dilute solution.
- Normally it can be attacked by nitric, hydrofluoric & hydrochloric acid.
- caustic alkalis even in dilute solution attack the cement with great vigour by dissolving the alumina gel.
- This cement stand extremely well to sea water. But sea water is not used for mixing of high alumina cement.

USES of HAC

Normally it is used for repairing of kiln or furnace where this is mixed with some binder and directly applied to the breaking part.

Since it is resist the action of acid and sulphate attack it is sometimes used for chemical discharging pipe. It is not affected by thrust and evolves more heat during the setting. Therefore it can be used for ~~heat~~ setting where the heat evolution is required.

Questions:

- ① What is the chemical properties of HAC?
- ② How we can resist the heat or it can used as a thermal insulating materials in high temp. furnace & kilns?
- ③ What is the strength of the high alumina cement in 3 days and 28 hrs?
- ④ How HAC affects the sea water?
- ⑤ Write the reaction of HAC with CO_2 ?