EXPERIMENT AND CASE STUDY ON FOAMED CONCRETE

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Abstract: This is the experimental and study on foamed concrete or light weight concrete. It is the concrete which has air voids present in it. That makes the concrete less in weight with more strength. Here, we make foamed concrete of four types with difference in mixture. It composed of foaming chemicals or admixtures like Sodium bicarbonate, Dried N, N- Di-methyl formamide, Polyethylene glycol, #6000. By using we have prepared three cubes and a cylinder. With these specimens we have calculated the weight and compressive strength of concrete.

Key Words: *Polyethylene glycol*, *Di-methyl formamide*, *Dried N*, *foaming chemicals*.

1. INTRODUCTION

Foamed concrete, it has a unique property and characteristics. It is the type of concrete which is aerated and lightweight. This type of concrete does not needany compaction. In this the cement slurry is added with pre-prepared foamed solution. The function of the solution is to create the bubbles or air voids in that cement slurry. The solution is added as a resultit produced air voids in the concrete. Foamed concrete is designed with density, and the range is of 300-1850 Kg/m3 (dry density). In this we have prepared three cubes and one cylinder with different ratio of foamed agents and some replacement of fine aggregate.The properties of the foaming solution are also defined in this.

2. FOAMED CONCRETE

It is one of the methods of decreasing the concrete density. This is done by introduction of stable air voids inside the hardened cement or mortar. The foaming agents introduced the air voids in the concrete, so it is called foamed concrete. Foamed concrete does not contain coarse aggregate; it contains only the fine aggregate that is nothing but the sand or m-sand, some light weight agents like thermocol beats, water and foaming solution.

When compared to normal concrete, it is considerably homogeneous. However, its properties depend on the microstructure and composition of concrete. Lightweight is one of the main advantages of the foamed concrete.

3. MATERIALS USED

- Cement

It is a binding agent. It is used in the construction works that binds all the materials used. Cement mixed with the fine aggregate and water produces mortar, and it mixed with coarse and fine aggregate and with water produces concrete. In this fly ash is added as a replacement of cement in percentage.

- Fine aggregate

M-Sand (Manufactured Sand) it is used as a substitute of river sand. It is manufactured by crushing of hard granite stone. The M-Sand is in the form of cubical in shape with edges grounded. It is less than 4.75mm in size. The M-Sand is used instead of river sand due to the depletion and transporting cost and non availability of river sand. M-Sand is used because of its availability, economy and manufactured in large quantity than river sand. We used M-Sand and some light weight material thermocol which is used as replacement for m-sand in percentage.

- Foaming Agent

The foaming agent is added to the mixtures which produce the bubbles or air voids in the concrete. The agents we used here is eco-friendly. The foaming agent we used here is,

1. Polyethylene glycol, #6000
2. Dried N,N- Dimethylformamide
3. Sodium bicarbonate

- Water

The water is added to the mixture of cement and fine aggregate to get the homogeneous texture of concrete. The water used for construction should not be less than or more than 7 in pH. The water is neutral in nature.

The demineralised water is preferable while adding the chemical composition or chemical solution. The mineral in water react with the chemical compounds and becomes inactive.

- **Polyethylene Glycol, #6000**

Polyethylene glycol (PEG), it is generally considered as biologically inert and safe. PEG is also a non-toxic material. It is in irregular shape, in the form of pellets. When it exposed to the atmosphere, it changes its phase from solid to gas.

- **Dried N, N-Dimethyleformamide**

It is a liquid with water-white which is colourless. It is faint fishy in odour. The density of dimethylformamide is lesser than water. It react with atmosphere and turns into pale yellow in colour. It may causes irritation to eyes. When it combines with polyethylene glycol it acts as a foaming agent. Its solubility is miscible in water.

- **Sodium Bicarbonate**

Sodium bicarbonate is a white crystalline powder. It produce buffer because of excess of hydrogen ions. Odourless in nature. When it combines with water and mixed in high speed it will produce the foam in the form of bubbles.

4. PREPARATION OF FOAMED CONCRETE

The concrete we prepared is in the grade of M-20. The mix ratio of M-20 grade is one part of cement and one and a half parts of fine aggregate (1:1.5). The water-cement ratio is of 0.5. As per the IS code book of mix design, the ratio of cement and fine aggregate is calculated in corrected amount.

(CODE BOOK: IS 10262: 2009 – MIX DESIGN

MIX RATIO FOR M 20 GRADE CONCRETE CUBE

Volume of cube = (0.15x0.15x0.15)x2500

=8.4375

=8.375 x (10/100)

=0.8375+8.375

=9.28125

=9.3/(1+1.5)

Total amount of cement = 3.778 kg Amount of fine aggregate

= 3.778 x 1.5

=6.417 kg

Water content = weight of cement x 0.5

(cube -1)=2.09 litres

(cube-2)=2.04 litres

(cube - 3)=2.024 litres

Foaming agent

(cube-1) = 0.055 litres

(cube-2) = 007 litres

(cube-3) = 0.085 litres

CYLINDER

Volume of cube = (3.14x 0.15x0.15x0.3x2500)/4

=13.24

=13.24x (10/100)

=1.324+13.24

=14.560

=14.560(1+1.5)

Total amount of cement = 5.245 kg Amount of fine aggregate

= 5.245 x 1.5

=8.742 kg

Water content = weight of cement x 0.5

=2.532 litres Foaming agent

= 0.1 liters

CUBE-1:

The cube mould of size 150mm X 150mm X 150mm is prepared. The lubricant oil is applied on the sides of the cube. The ratio of cement and fineaggregate is measured with 15% wastage.

Total amount of cement- 3.778 kg

Fly ash (10% of cement)- 0.500 kg

Fine aggregate - 6.417 kg

Water - 2.094 litres

Foaming agent solution

N, N – dimethylformamide- 25 ml

Polyethylene glycol- 15 g in 20 ml of water

CUBE-2:

The second cube is also in the same size. In this the aggregate is replaced with 25% of thermocol and with additional amount of foaming solution.

Total amount of cement- 3.772 kg

Fly ash (10% cement)- 0.500 kg

Fine aggregate - 4.880 kg

Thermocol (25% of fine aggregate) - 1.604 kg

Water - 2.049 litres

Foaming agent solution

N, N –Dimethylformamide- 30 ml

Polyethylene glycol- 25 g in 30 ml of water

CUBE-3:

The third cube is also made with same sized mould. In this the aggregate is reduced to 25% and 15% of thermocol is replaced instead of fine aggregate. The foaming solution is same as the same used for 2nd cube. Sodium bicarbonate is added to the previous foaming solution.

Total amount of cement- 3.772 kg

Fly ash (10% of cement)- 0.5 kg

Fine aggregate (25% of total)- 4.880 kg

Thermocol (15% of fine aggregate)- 0.732 kg

Water- 2.024 litres

Foaming agent solution

N, N – Dimethylformamide- 30 ml

Polyethylene glycol- 25 g in 30 ml of water

Sodium bicarbonate-10 g in 10 ml of water

CYLINDER:

The cylinder mould of size 150 mm in diameter and 300 mm in length is prepared. The lubricant oil is applied on the sides of the mould.

Total amount of cement- 5.245 kg

Fly ash (10% of cement)- 0.5 kg

Fine aggregate - 8.742 kg

Water - 2.532 litres

Foaming agent solution

N, N – Dimethylformamide- 15 ml

Polyethylene glycol- 35 g in 40 ml of water

Sodium bicarbonate- 30 g in 30 ml of water

5. WEIGTH AND COMPRESSION STRENGTHVALUE

WEIGHT OF THE SPECIMEN:

S.NO	SPECIMEN	WEIGHT (KG)
1.	CUBE 1	7.04 kg
2.	CUBE 2	6.90 kg
3.	CUBE 3	6.78 kg
4.	CYLINDER	11.54 kg

COMPRESSION TEST VALUE:

S.NO	SPECIMEN	COMPRESSIVE STRENGTH (N/ mm^2)
1.	CUBE 1	1.689 N/ mm^2
2.	CUBE 2	1.42 N/ mm^2
3.	CUBE 3	1.6 N/ mm2
4.	CYLINDER	2.09 N/ mm^2

6. ADVANTAGES

1. Settlement of concrete will not occur. Hence compaction is not required.
2. Reduction in its death weight.
3. It has high resistance to thawing and freezing.
4. Foam concrete is easily produced, thus quality control is easily done.
5. It has capability of excellent load spreading and distributing aspect.
6. Water absorption.
7. The completion of work is fast and non-hazardous
8. It need only less maintenance, cost effective.

7. DISADVANTAGES

1. It will take more time to mix the materials.
2. Finishing of concrete is little difficult.
3. Due to the presence of water the foam concrete will become very sensitive.
4. Flexural strength and Compressive strength will decrease with increase in density.

8. APPLICATION

1. Some of the application of foam concrete is as follows;
2. Panels or elements for pre-cast wall.
3. Bridge approaches.
4. Sub-base in highways.
5. Pre-cast blocks.
6. Insulation on roof.
7. Insulation floor screeds.
8. Used for embankments.
9. Abandonments of pipelines.
10. Reinstatements of trenches
11. Filling of hollow blocks.

9. CONCLUSION

In the industrialized building system, foam concrete has a desirable strength and used as an alternative for construction materials. For lower density mixture cause low strength concrete. It has significant reduction of weight.

It is used in many construction fields. Increased air voids cause reduction in density. Hence compressive strength is reduced. Foam concrete does not require any compaction or vibration.

Foam concrete has many advantages and it is new technology in the construction fields. Time consumption andcost-efficient techniques so it is widely used. It has good thermal resistant and properties of freezing and thawing effect. It is also fire resistance because of the air voids present inside the concrete.

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