

Experimental study on strength of foamed concrete by varying foam content

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Abstract - This paper summarizes the research work on the the production of foamed concrete by varying the foam content from 1%, 2%, 3% and 4% by weight of cement. For this purpose, sample cubes and cylinders are casted for determining strength in terms of compressive strength and splitting tensile strength. In addition to this, fresh state characteristics of foamed concrete are also determined. The final mix proportions were established by laboratory trials to achieve a target density of 1800 kg/m³.

Key Words: foamed concrete, foam content, compressive strength, splitting tensile strength, fresh state characteristics.

1. INTRODUCTION

By substitution for the cementitious and aggregate phases, the finished product can be tailored to its application with varying strength, density, or chemical and thermal resistance properties. The adverse development in the field of concrete has led to the innovation of lightweight concrete materials. The development of lightweight concrete is made with a good achievement of performance in their characteristics. Foam concrete is produced when foam is added to cement-based slurry. The foaming agent is diluted with water and aerated to create the foam. The cement paste or slurry sets around the foam bubbles and when the foam being to degenerate, the paste has sufficient strength to maintain its shape around the voids. Foamed concrete is a type of lightweight concrete that is mainly produced by the incorporation of preformed foam into cement paste or mortar. The major advantage of this material is the ease of production that makes it possible to produce lightweight concrete at any location with relatively simple and inexpensive materials and equipment. The material has attracted considerable research effort worldwide, particularly in the last two decades. The research has led to a better understanding of the material and enhancement of its properties. The important applications of foamed concrete include structural elements, non-structural partitions and thermal insulating materials. Foamed concrete can be utilised as cast-in-place beams and columns, load bearing walls, sandwich panels, prestressed structures and

refractories. The density of foam concrete is determined by the ratio of foam to slurry and densities range typically between 300 and 1600 kg/m³

1.1 Objective

1. To find out the fresh state characteristics of foamed concrete.
2. To find out the strength of foamed concrete in terms of compressive strength and splitting tensile strength.
3. To find out the optimum percentage of foam to be added in terms of weight of cement.

2. EXPERIMENTAL METHODOLOGY

Foamed concrete is prepared by trial mixing in the ratio of 1:2 with a water cement ratio of 0.5. Foaming reagent is added by weight of cement as 1%, 2%, 3% and 4%. Fresh state characteristics of foamed concrete are determined by using flow table test. Mechanical properties of foamed concrete are determined in terms of compressive strength and splitting tensile strength in cubes and cylinders respectively.

2.1 Materials Used

- a) Ordinary Portland cement (OPC) which is grey in colour. OPC of 53 grades is used in this experiment.
- b) Sand is naturally available granular material composed of finely divided rock and mineral particles.
- c) Water which is used for drinking is satisfactory for usage in concrete
- d) Foaming reagent used in this work is sodium lauryl ether sulphate. It is an anionic detergent and surfactant widely used in foamed concrete production which is inexpensive and effective

2.2 Specimen Preparation

For this work, prefoaming method is adopted. Foam is added to the concrete by 1%, 2%, 3%, 4% by weight of cement and mixing is done in the ratio of 1:10. Mould of size 150mm×150mm×150mm were used to prepare the cube specimens and moulds of size 150mm×300mm were used to

prepare cylinder specimens for determining the compressive strength, split tensile strength of foamed concrete.



Fig -1: Foam preparation and mixing of it by prefoaming method



Fig- 2: Casting of specimens



Fig- 3: Air curing of specimen

3. RESULT AND DISCUSSION

3.1 Fresh state characteristics

Fresh state characteristics of foamed concrete are determined by using flow table test. The fresh foamed concrete produced was first poured into an inverted slump flow cone without any compaction and vibration is then given. The flowability of foamed concrete mixes was

measured by the diameter of the slump. As foam content increases flow value of foamed concrete also increases.

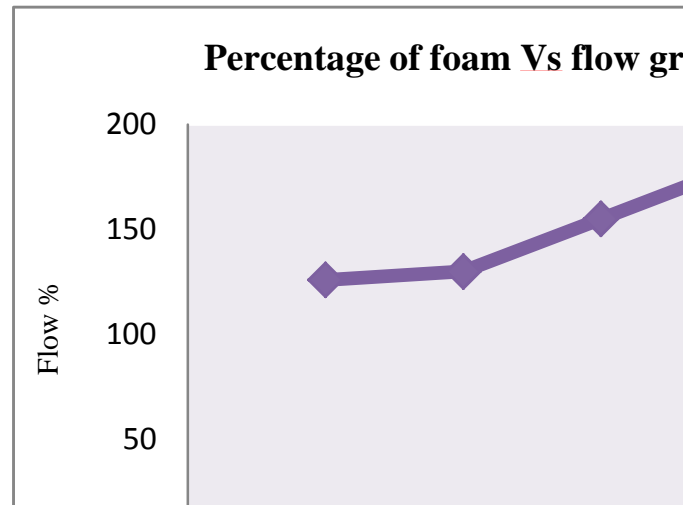


Fig - 4: Percentage of silica fume Vs flow percentage graph

3.2 Compressive strength

Compressive strength on concrete cubes are determined. As foam content increases compressive strength decreases. Optimum value of compressive strength is obtained for 2% of foam content and thereafter value decreases.

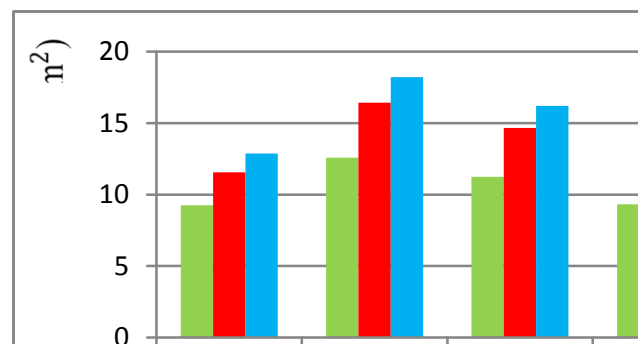


Fig - 5: Compressive strength of foamed concrete after 7, 14, 28 days of air curing

3.3 Splitting tensile strength

Splitting tensile strength is determined on concrete cylinders. As foam content increases split tensile strength decreases.

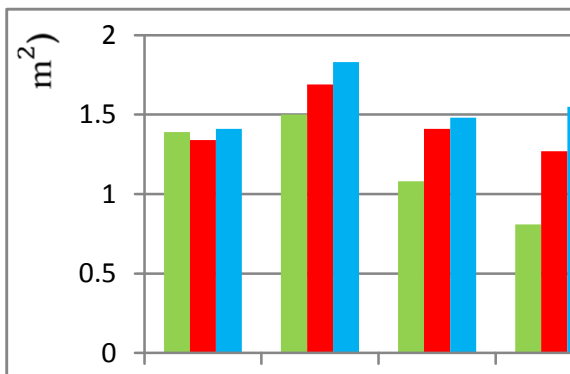


Fig - 6: Splitting strength of foamed concrete after 7, 14, 28 days of air curing

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4. CONCLUSIONS

Effect of foam content on both fresh state characteristics and mechanical properties of foamed concrete are studied. The following conclusions are drawn from this study:

- In flow table test, as foam content increases flow value increases that is fluidity value increases.
- Compressive strength of foamed concrete decreases as foam content increases. Optimum value of compressive strength is obtained for 2% foam content
- Splitting tensile strength of foamed concrete also decreases as foam content increases. Optimum value of compressive strength is obtained for 2% foam content

ACKNOWLEDGEMENT

The Author(s) wish to express their special gratitude to **Dr. P. G. Bhaskaran Nair**, PG Dean, Sree Narayana Institute of Technology, Adoor, Er. Henna Salam, structural Engineer, SAFE, Kochi. Above all the author(s) thank **GOD** almighty for his grace throughout the work

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