IJCRT.ORG ISSN : 2320-2882
INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)
An International Open Access, Peer-reviewed, Refereed Journal

BEHAVIOUR OF STREGNTH AND DURABILITY CHARACTERISTICS OF FOAM CONCRETE WITH VARYING DENSITIES

[1]Shashank P, [2]Srivathsa H U
[1,2]Assistant Professor
[1,2]Civil Engineering Department
[1,2]ATME College of Engineering, Mysuru, India

Abstract: With growing population, industrialization, and urbanization, there is corresponding growth in the demand for infrastructure**.** Foam concrete is a mixture of cement, fine sand (substituted by fly ash), water and pre-determined volume of foam. The major difference between the foam and conventional concrete is the use of coarse aggregate has been replaced by the air pores inside the concrete. The foam is generated by diluting the foam in agent with water and aerated to create foam. The cement paste can stick around the foam and hardens. In the present work, an attempt has been made to study strength and durability characteristics of foam concrete with varying densities of foam

Index Terms **– Foam concrete, durability, Foaming agent, Foam density**

I. INTRODUCTION

With growing population, industrialization, and urbanization, there is corresponding growth in the demand for infrastructure. Almost all concretes rely critically on being fully compacted. Insufficient compaction dramatically lowers ultimate performance of concrete in spite of good mix design.

Concrete is a composite construction material. It is mainly composed of cement (usually Portland cement), aggregate (coarse aggregate made of gravel, crushed stone and fine aggregate as sand) water and other chemical agents to get desired properties. The adverse development in the field of concrete has led to the development of light weight concrete with good characteristics. There is also a possibility of usage of some other materials for the replacement of cement. This reduces usage of cement and ultimately reduces the emission of CO_2 during the manufacturing of cement.

Foam concrete is a mixture of cement, fine sand (substituted by fly ash), water and predetermined volume of foam. The foam concrete has both fire resistance and thermal insulation properties. The major difference between the foam and conventional concrete is the use of coarse aggregate has been replaced by the air pores inside the concrete. It is called cellular concrete because of its embedded air pores inside the concrete. The foam is generated by diluting the foam in agent with water and aerated to create foam. The cement paste can stick around the foam and hardens. After hardening the foam has sufficient strength to maintain the shape around the voids. Its construction applications as lightweight nonstructural and semi-structural material are increasing in the last few years. It has several advantages because of its porous nature: it provides thermal insulation, considerable saving in materials, lower haulage handling costs and faster rates of construction.

Sharma et al., (2017) studied cellular lightweight concrete which is influenced by foam density. Properties of foam concrete with the fly ash as full replacement of fine aggregate were determined for a density of 1200kN/m3 and 1500kN/m3. As the age and density increases, compressive & specific strength increases considerably and properties decreases because of voids and absence of coarse aggregates.

Kanagalakshmi et al., (2015) studied the usage of quarry dust varying from 10% to 50% in foam concrete. Strength was nearly 43% more than the control foam concrete. On account of experimental investigation; it was proposed that burnt clay bricks can be effectively replaced with the foam concrete blocks.

II. MATERIALS

2.1 Cement- In the present study, OPC 43 grade cement is used.

2.2 Water- Water free from impurities is used for preparing concrete mixes

2.3 Manufactured Sand – M Sand as an aggregate is used for preparing concrete mix as per IS383 code.

2.4 Synthetic Foaming Agent - CETYL TRYMETHYLAMMONIUM BROMIDE (CTAB) is used as Synthetic foaming agent to manufacture foam concrete.

III. METHODOLOGY

3.1 Test on materials

Table 1 Physical properties of Cement

Elements	Contents
Specific gravity	3.16
Fineness	9.33%
Standard Consistency	32%
Initial setting time	40min
Final setting time	285min

Table 2 Physical properties of Manufacture Sand

Particulars	Values
Specific gravity	2.62
Fineness modulus	4.42
Water absorption	1.0%

Table 3 Properties of CTAB

Properties	
Molecular formula	$C_{19}H_{42}BrN$
Molecular mass	364.45g/mol
Appearance	White powder
Melting point	237°C - 243°C
Density	1g/cm^3

3.2 Mixing of materials

A mixture of cement, sand and water is prepared separately on a non-absorbent platform. Foam is added to the prepared mixture and mixed well by using hand mixer in order to obtain a uniform mix which can be place into the mould.

Fig.1 Mixing of materials

Table 4 Mix Proportions of Foam concrete

Mixes	Cement	Water	Fine aggregate	Vol. of Foam	S/C ratio	W/C ratio
Mix 1	266.67	133.35	800.01	-	-	0.5
Mix 2	266.67	133.35	800.01	0.48	3	0.5
Mix 3	311.11	155.35	933.33	0.39	3	0.5
Mix 4	355.55	177.77	1067.67	0.31	3	0.5
Mix 5	400	200	1200	0.22	3	0.5

M1: Normal concrete M2: Foam concrete of 1200kg/m^3 M3: Foam concrete of 1400kg/m^3 M4: Foam concrete of 1600kg/m^3 M5: Foam concrete of 1800kg/m^3

IV. RESULTS AND DISCUSSIONS

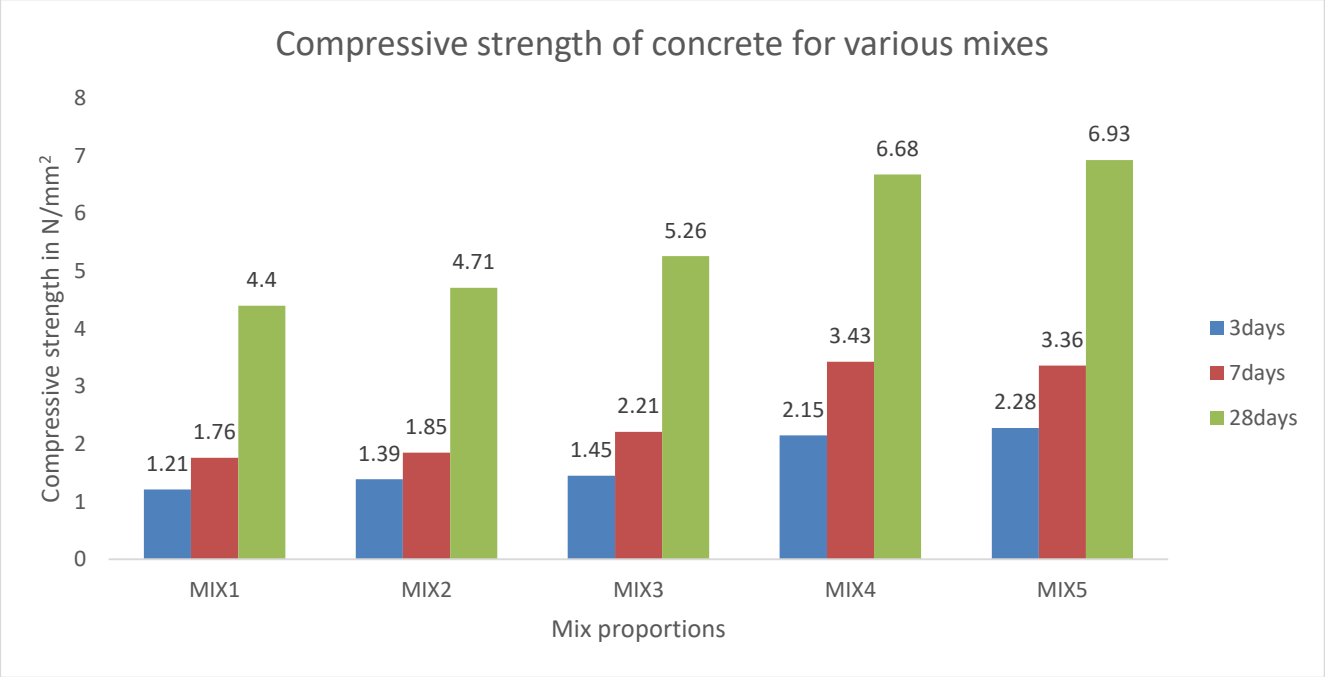

Fig 2 shows the variation of compressive strength results after 3,7 & 28days of curing for normal concrete and foam concrete with varying densities

The above graph indicates that the variation of compressive strength results after 3, 7 & 28days of curing for Normal and foam concrete with varying densities. It was observed that, as the density of foam increases, compressive strength of foam concrete after 28days of curing increases about 1.07, 1.19, 1.51, 1.57 times for densities of 120kg/m^3, 1400kg/m^3, 1600kg/m^3 & 1800kg/m^3 than compared to normal concrete.

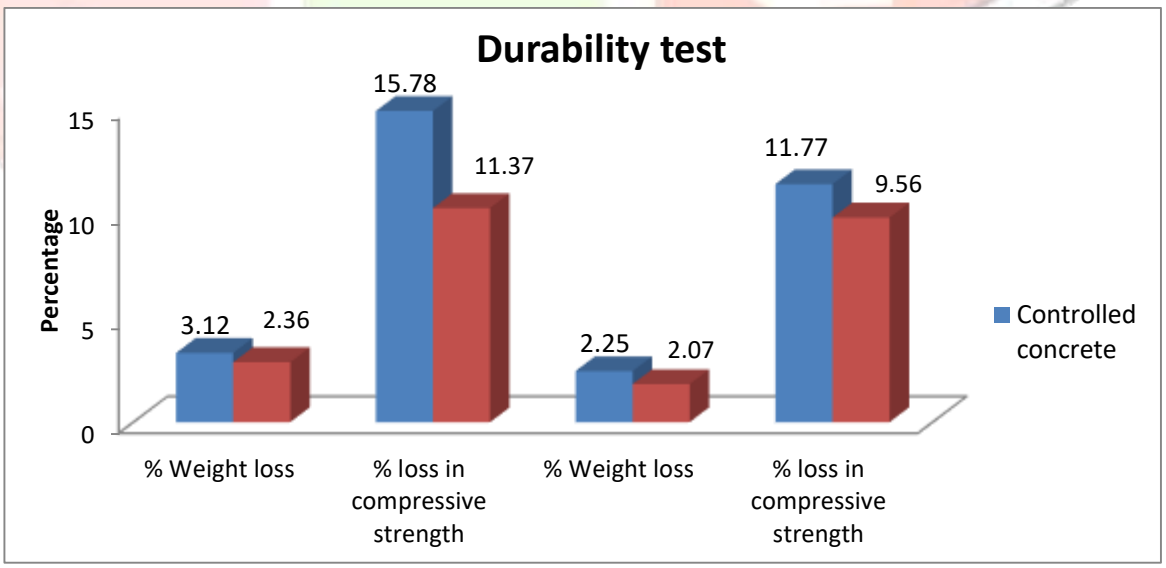

Fig 3 shows the durability test result of normal & optimum mix.

V CONCLUSIONS

1. Compressive strength of foam concrete for an optimum mix was found to be 1.57 times more than that of normal concrete.
2. As the density of foam increases, compressive strength foam concrete also increases linearly.
3. Foam concrete has better resistance against alkaline attack.
4. Foam concrete is also called as self-levelling concrete which can be used in the sections where reinforcements are more.
5. Due to less weight, there is a reduction in dead loads thereby decrease in the size of the members is considered
6. Foam concrete has better resistance to aggressive environment than compared to that of controlled concrete.
7. Amount of surfactant required for manufacturing 1m^3 of foam concrete is less. Therefore, it proves to be cost effective.

REFERENCES

[1] Y.H. Mugahed Amran, Nima Farzadnia, and A.A. Abang Ali "Properties and applications of foamed concrete; a review", Construction and Building Materials 101 (2015), 991-1066.

[2] ZHANG Yinghua, YOU Lunan, HUANG Zhian, GAO Yukun and YAN Jianhao "Experiment development of foam slurry materials" International Symposium on Safety Science and Technology, Procedia Engineering 45 (2012), 768 – 773.

[3] Dr. A. S. Kanagalakshmi, K. Sasikumar and E. Britto Pravin "An investigation on foam concrete with quarry dust replacement for filler in mix design", International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE), Volume 13 Issue 1, March 2015.

[4] A. Sattainathan Sharma1, G. Suhil and L. Visali "Influence of foam densities in cellular lightweight concrete", International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 5 Issue IV, April 2017.

[5] H. Süleyman Gökçe , Daniel Hatungimana and Kambiz Ramyar "Effect of fly ash and silica fume on hardened properties of foam concrete", Construction and Building Materials, 5 November 2018.

[6] Marcin Kozłowski and Marta Kadela "Mechanical Characterization of Lightweight Foamed Concrete", Advances in Materials Science and Engineering Volume 2018.

[7] S. Nandi et al. (2016), "Cellular concrete & its facets of application in Civil Engineering", International Journal of Engineering Research, ISSN: 2319-6890, Volume No.5, Issue-1 pp. 37-43.

[8] IS 2386(Part 1):1963, "Methods of test for aggregates for concrete: Part 1 Particle size and shape".

[9] IS 2386(Part 3):1963, "Methods of test for aggregates for concrete: Part 3 Specific gravity, density, voids, absorption and bulking".

[10] IS 10262:2009, "Guidelines for concrete mix proportioning".

[11] IS 2185(Part 4): 2004, "Concrete masonry unit – specification: Preformed foam cellular concrete blocks".

[12] M. S. Shetty, "Concrete Technology", S. Chand & Company Pvt Ltd, New Delhi, Seventh Edition, Reprint 2013.