AN EXPERIMENTAL STUDY ON HYBRID FOAM CONCRETE USING MINERAL ADMIXTURES AND ALKALINE SOLUTIONS

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Abstract - *In this research, foamed concrete with a density of 1200 and 1400 kg/m^3 was prepared by replacement of fully sand by Fly ash and ground granulated blast furnace slag (GGBS) in foam concrete with addition to different percentage of Basalt and glass fiber (0%, 0.1%, 0.3%) and also add the alkaline solution like sodium hydroxide and sodium silicate were used, to study the behavior of mechanical properties of foam concrete. According to the test result indicated that the using Basalt and glass fiber gives a optimum result by certain percentage of fiber dosage by increase in the Compressive strength, Split tensile strength, and Flexural strength , there is marginally effect on the water absorption by adding of different percentage of fiber*

Key Words: Mix proportion, Mineral admixtures, Alkaline solutions, Basalt fiber, Glass fiber, Foam

1.INTRODUCTION

This chapter deals with the history and introduction of foam concrete, which includes the definition of foam, concrete, properties of foam concrete, a factor that affects foam concrete, applications and procedures for the manufacture of foam concrete. Introduction of fiber reinforced concrete and its importance.

1.1 Introduction of foam concrete

Concrete is a building material that has been around for a relatively long time, and has been widely used in the development of different structures since ancient times. The constant and innovative work of concrete has led to the creation of many types of concrete. Each industry has its own unique demand for concrete with different characteristics.

Nowadays, the popularity of concrete is very high and foamed concrete. Foamed concrete is also called Foamed cement, low density concrete and also lightweight concrete. The type of aerated concrete depends on the density of the concrete. The density of lightweight concrete ranges between 400 and 1800 Kg / m3. The composition of lightweight foamed concrete is cement, sand, water, stable foam and without coarse aggregate. AddFoamed concrete generally contains at least 25% air void that distinguishes it from normal concrete. Due to the advantages that lightweight concrete has over conventional concrete in terms of properties, economy and design freedom, it finds many applications in construction. Hence, the demand and additional experimentation that incorporates various ingredients to successfully produce lightweight concrete are happening all over the world. The use of low density concrete significantly reduces the weight of the concrete structure with the consequence of the reduction of the column, the beams and the size of the foundation, which reduces the cost of construction. Other advantages of lightweight concrete include good thermal insulation and better fire resistance. There is a bigger advantage in terms of concrete management. Since delivery mass is reduced, the efficiency of labor also increases, thereby increasing on-site productivity.

2. Procedure for mixing

•The target volume and density (1400,1600 kg / m3) of the expanded concrete was determined and the amount of material required was prepared (cement, GGBS).

• Add cement, GGBS mixing ratio (1: 1) into the pan and mix well to ensure mixing is well done.

• The dry mix is poured into the drum mix for 10 minutes to ensure that the mixture is more effective.

• Add the calculated amount of water to the drum mix for 8 to 10 min until it is thoroughly mixed with cement and GGBS.

•add the 1% weight of the water for super plasticizer.

• Then stop the mixing drum to manually mix for about 30 seconds and then turn it on again for 30 seconds.

• Then adding the alkaline solution like sodium hydroxide and sodium silicate

• While the mixture is in motion, the necessary amount of foam is added to the mix

• The mixture was continued for 5-6 min and confirm that the foam is thoroughly mixed with the raw material to avoid segregation.

• After that, the drum mix is turned off for hand mixing for about 30 seconds and the mixer is turned on again for 30 seconds. Manual mixing is to ensure that the mixture of all materials is homogeneous before adding foam.

• The foam and concrete mix is then stopped and the foam concrete is ready for pouring the cubic beam and the cylinder

Fig No 1 Procedure For Making Of Light Weight Foam Concrete

3. TEST RESULTS AND DISCUSSIONS

This section presents the results of the various tests carried out on foam concrete with fibers (Basalt and Glass) and without fiber specimens in the laboratory. The results include a summary of water absorption and mechanical properties such as compressive strength, split strength and flexural strength. We also performed a regression analysis to compare the compressive strength and flexural strength for 28 days, as well as the test is performed to compare the compressive strength and tensile strength of rupture for 28 days.

3.1 Result of Water Absorption Test

Table 3.1 Water Absorption Test Result At 28 Days For Density 1400 Kg/m3

Sl. no	Density in Kg/m³	Fiber in %age	Saturated weight(w_1) in Kg	Owen dry weight (w_3) in Kg	Water absorption (w) in %
1	1400	0	4.76	4.20	13.33
		0.1	4.82	4.30	12.10
		0.2	4.93	4.42	11.50
		0.3	4.98	4.51	10.42

Table 3.2 Water Absorption Test Result At 28 Days For Density 1600 Kg/m3

SL. NO	DENSITY IN Kg/m³	FIBER IN %age	SATURATED WEIGHT(W_1) in Kg	OWEN DRY WEIGHT(W_3) in Kg	WATER ABSORPTION (w) in %
1	1600	0	5.53	5.02	10.16
		0.1	5.66	5.17	9.50
		0.2	5.68	5.24	8.40
		0.3	5.70	5.30	7.54

3.3 Result of Compressive Strength Test

Table 4.3 Compressive Strength for Different Percentage Of Basalt and Glass Fiber Test Result At Days

SL.NO	TRAGET DRY DENSITY in KN/m³	FIBER IN%age	COMPRESSIVE LOAD in KN	COMPRESSIVE STRENGTH	AVERAGE COMPRESSIVES STRNG
1	1400	0	165	7.33	7.84
			175	7.77	
			190	8.44	
		0.1	170	7.55	7.92
			175	7.77	
			190	8.44	
		0.2	185	8.22	8.73
			195	8.66	
			210	9.33	
		0.3	185	8.22	8.51
			190	8.44	
			200	8.88	
2	1600	0	220	9.7	12.19
			280	12.44	
			325	14.44	
		0.1	315	14	13.77
			280	12.4	
			335	14.88	

		0.2	290	12.88	14.58
			320	14.22	
			375	16.66	
		0.3	260	11.55	13.77
			305	13.55	
			375	16.22	

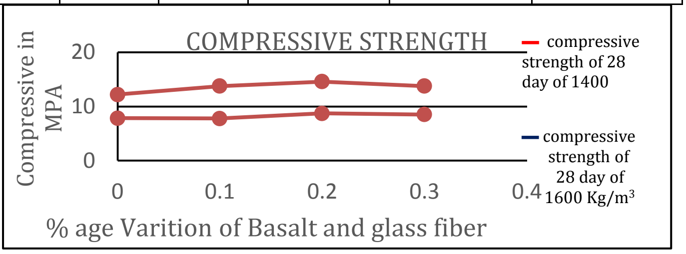

Figure 4.3 Variation of Compressive Strength and Fiber Content for Density 1400and 1600 Kg/m³

3.3 Result of Flexural Strength Test

Table 4.3 Flexural Strength for Different Percentage of Basalt and Glass Fiber Test Result at 28 Days

SL.NO	TRAGET DRY DENSITY IN Kg/m³	FIBER IN %	LOAD IN KN	FLEXURALSTRENGTH In N/mm	AVERAGE FLEXURAL STRENGTH IN N/mm²
1	1400	0	2	0.8	1.06
			2.5	1	
			3	1.2	
		0.1	2.5	1	1.2
			3	1.2	
			3.5	1.4	
		0.2	5.5	2.2	2.2
			6	2.4	
			5	2	
		0.3	3	1.2	1.46
			3.5	1.4	
			4.5	1.8	
2	1600	0	2.5	1	1.33
			3	1.2	
			4.5	1.8	
		0.1	4	1.4	1.6

			4.5	1.6	
			5	1.8	
		0.2	6	2.4	2.8
			6.5	2.6	
			8.5	3.4	
		0.3	3.5	1.4	1.6
			4	1.6	
			4.5	1.8	

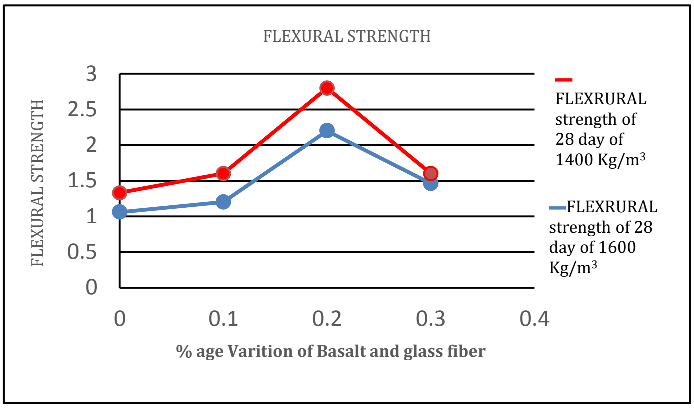

Figure 4.4 Variations in the Flexural Strength and Fiber Content

4.5 Result of Split tensile Strength Test

Table 4.5 Split Tensile Strength For Different Percentage Of basalt and Glass Fiber Test Result At 28 Days

SL.NO	TRAGET DRY DENSITY INKG/m⁴	FIBER IN %	LOAD IN KN	SPLIT TENSILE STRENGTH	AVERAGE SPILT TENSILE STRENGTH
1	1400	0	75	1.06	1.17
			85	1.2	
			90	1.27	
		0.1	90	1.27	1.36
			95	1.34	
			105	1.48	
		0.2	95	1.34	1.43

			100	1.41	
			110	1.55	
			95	1.34	
		0.3	100	1.41	1.41
			105	1.48	
			95	1.34	
		0	110	1.69	1.52
			120	1.55	
			110	1.55	
		0.1	115	1.56	1.57
2	1600		125	1.62	
			125	1.76	
		0.2	130	1.83	1.79
			140	1.98	
			115	1.62	
		0.3	120	1.69	1.71
			130	1.83	

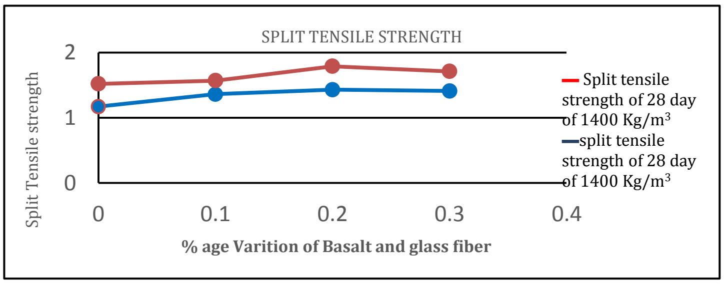

Figure 4.5 Variation Of Split Tensile Strength and Fiber Content For Density 1400and 1600 Kg/m³

5. CONCLUSIONS

This thesis is carried out to determine the effect of the inclusion of basalt and glass fibers on the properties of lightweight foam concrete. There are some significant conclusions are obtained from the experimental work:

• Addition of basalt and glass fibers increases compressive strength and division tensile strength, up to 0.3% of the fiber content by weight of cement, after increasing the fiber content causes a decrease in strength.

• For a density of 1400 kg / m3 and 1600 kg / m3, the compressive strength obtained after 28 days of hardening was respectively 3.15 Mpa and 5 Mpa with 0.3% of the fiber content of Basalt and Glass .

• The flexural strength obtained after 28 days of hardening was 2.23 Mpa and 2.3 Mpa respectively with 0.3% of the fiber content of Basalt and Glass. It is observed that the addition of Basalt and Glass will decrease the respective strength of the concrete.

• The tensile strength obtained after 28 days of hardening was 0.45 MPa and 0.5 MPa respectively with 0.3% of the fiber content of Basalt and Glass. It is observed that the addition of Basalt and Glass will decrease the respective strength of the concrete.

• The maximum water absorption observed after the addition of Basalt and Glass fiber was 18.16% per 1400 kg / m3, and 11.19% for 1600 kg / m3.

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