EXPERIMENTAL INVESTIGATION ON STRENGTH PROPERTIES OF SCC BY REPLACEMENT OF CEMENT BY ESP ADMIXTURES

B.GOPALAKRISHNAN [1], P.CHANDRU. [2]

[1]PG scholar, Department of Civil Engineering, PRIST UNIVERSITY, Trichy-Thanjavur Highway, Vallam, Thanjavur- 613 403

[2]Assistant Professor, Department of Civil Engineering, PRIST UNIVERSITY, Trichy-Thanjavur Highway, Vallam, Thanjavur- 613 403

ABSTRACT

Self Compacting Concrete has a special features that it can be compacted by its own self weight . Such a concrete can be obtained incorporating a new admixture known as Supaflo SPL (Special).

In this study egg shell powder 15, 20, 25, 30% with cement and scc concrete strength parameters are studied.

In Self Compacting Concrete, various testing methods have been carried out on all mix proportions to obtain mechanical properties such as compressive strength, split tensile strength tests from the view point of making it a standard concrete.

INTRODUCTION

Self-Compacting Concrete is a concrete which has a versatile property such as good flowability, compaction by its own self weight and less segregation. It has found application in reinforced concrete sections containing congested reinforcements. Poor quality of vibration of concrete, in congested locations, has often been a shortcoming traditional concrete. In such situations, SCC, which flows under its weight and does not require any external vibration, has revolutionized the concrete placement.

The development of self-compacting concrete (SCC) also referred to as Self Consolidating Concrete has recently been one of the most important developments in building industry.

One of the disadvantages of SCC is its cost, associated with the use of chemical admixtures and use of high volumes of Portland cement. The main objective of the present work is to investigate compressive strength and split tensile strength of egg shell powder based self compacting concrete and to find the optimum combination

METHODOLOGY

Methodology of this work is shown in fig 1

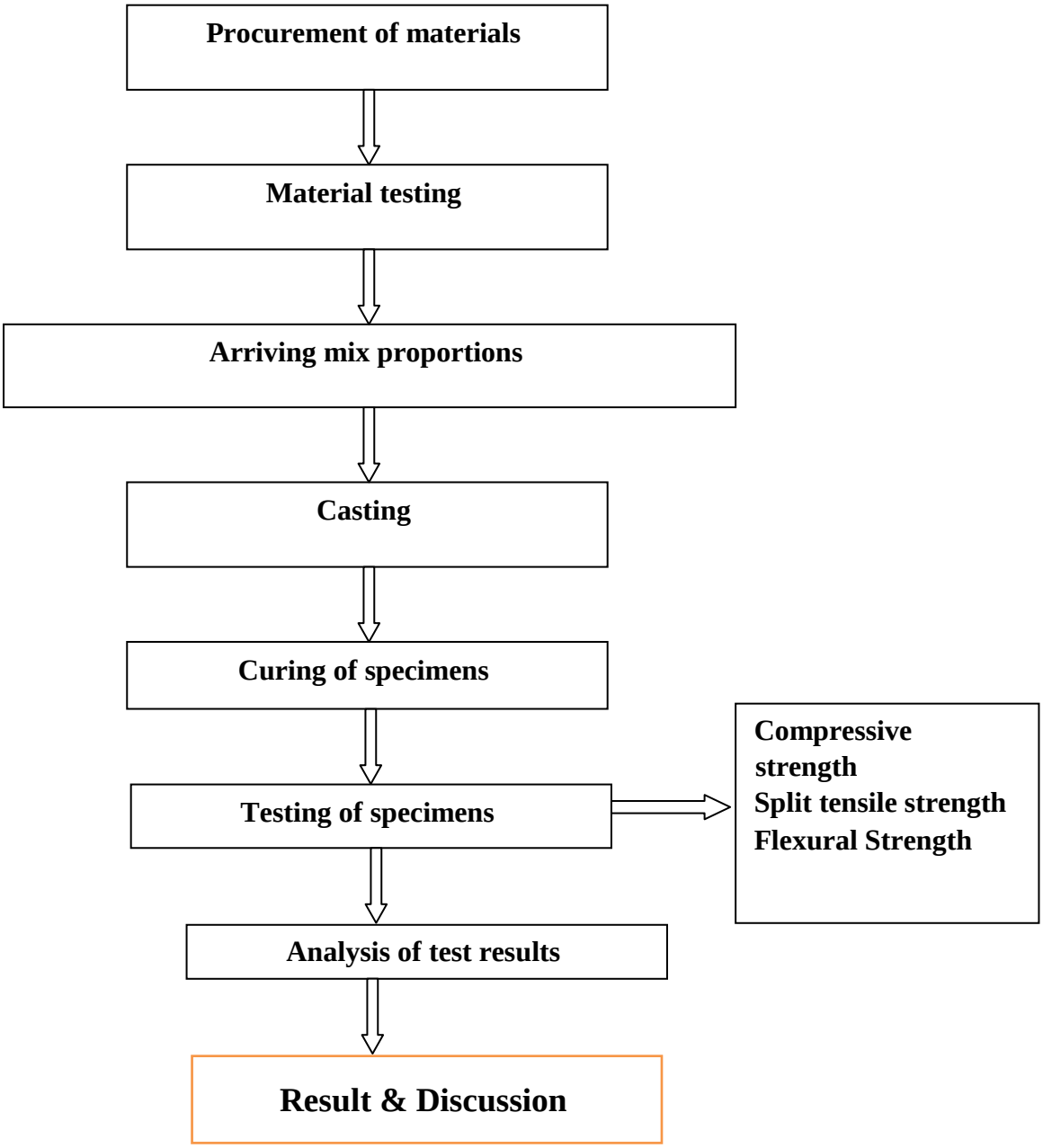

Fig 1 Flow Chart of methodology

CEMENT

Portland Pozzolanic cement with specific gravity 3.15 was used in casting the specimens.

EGG SHELL POWDER

Eggshell powder of size less 90micron with specific gravity 1.5 was used in this work

FINE AGGREGATE

. The river sand conforming to zone II as per IS 383-1970 was used. Specific gravity was found to be 2.63. particles passing through 4.75mm sieve and retained on 2.36mm was used

COARSE AGGREGATE

Hard granite broken stones of less than 12.5mm size were used as Coarse Aggregate. The results of Specific Gravity was found to be 2.65

CHEMICAL ADMIXURES

Superplasticizer is an essential component of SCC to provide necessary workability. Supaflo SPL (Special) is the superplasticizer used here.

WATER :

Potable tap water available in laboratory with P_H value of 7.0 ± 1.0 and confirming to the requirement of IS 456-2000 was used for mixing concrete and curing the specimen as well.

MIX DESIGN

The main characteristics of SCC are the properties in the fresh state. The mix design is focused on the ability to flow under its own weight without vibration, the ability to flow through heavily congested reinforcement under its own weight, and the ability to retain homogeneity without segregation. The workability of SCC is higher than "very High" degree of workability mentioned in IS 456:2000. Table 1 shows the mix proportion

Table 1 Mix Proportions

DESIGNATION	CEMENT %	% OF EGG SHELL POWDER	SUPER PLASTICIZERS IN LITERS	W/C RATIO
S0	**100**	**0**	**6**	**0.45**
S1	**85**	**15**	**6**	**0.45**
S2	**80**	**20**	**6**	**0.45**
S3	**75**	**25**	**6**	**0.45**
S4	**70**	**30**	**6**	**0.45**

TESTING OF CONCRETE

COMPRESSIVE STRENGTH TEST FOR CUBE

Compression test was carried out on cube specimens. The dimension of the specimen is 150mmX150mmX150mm. Cubes were cast for egg shell powder concrete for different percentage of replacement with cement 0,15,20,25,30% .

Three specimens were tested for each percentage at 7, 14, and 28days and average of three was taken. The individual variation of specimens was not more than + 15 percent of the average.. The maximum load applied to the specimen was recorded and any usual appearance in the type of failure was noted. Compressive strength result are shown in table 2

Calculation

$$f = P/A \text{ N/mm}^2$$

Where,

P = load at which specimen fails in Newton

A = Area over which the load is applied in mm^2

f = Compressive stress in N/mm^2

TABLE 2 COMPRESSIVE STRENGTH TEST FOR M20 GRADE OF CONCRETE

DESIGNATION	7 days Average Compressive strength (N/mm^2)	14 days Average Compressive strength (N/mm^2)	28 days Average Compressive strength (N/mm^2)
S0	**12.25**	**18.74**	**26.9**
S1	**14.23**	**18.88**	**26.77**
S2	**15.47**	**19.65**	**27.32**
S3	**15.82**	**20.13**	**27.89**
S4	**16.37**	**20.99**	**28.41**

SPLIT TENSILE STRENGTH FOR CYLINDER

The cylindrical specimens were tested for split tensile strength at an age of 7, 14 and 28. The dimension of the specimen is 150mmDia and 300mm height. Cylinders were cast for egg shell powder concrete for different percentage of replacement with cement 0,15,20,25,30% .The specimen were submerged in clean fresh water in a curing tank and kept there until taken out just prior to test. The specimens are not to be allowed to become dry at any time until they have been tested. After removing from water the specimens are tested. The dimensions of the specimens and their weight were recorded before testing. Three specimens were tested for each percentage at 7, 14 and 28days and average of three was taken.

The maximum load applied was then recorded. Any unusual type of failure was noted. Split tensile strength results are shown in table 3

Calculation

Tensile strength = $2P/\pi LD$

Where,

P = Load on the cylinder in N.

L = Length of the cylinder in mm.

D = Diameter of the cylinder in mm.

Table 3 SPLIT TENSILE STRENGTH TEST FOR M20 GRADE OF CONCRETE

DESIGNATION	7 days Average Split tensile strength (N/mm^2)	14 days Average Split tensile strength (N/mm^2)	28 Average Split tensile strength (N/mm^2)
S0	**1.45**	**2.97**	**3.93**
S1	**1.67**	**3.02**	**4.08**
S2	**1.83**	**3.41**	**4.11**
S3	**2.13**	**3.66**	**4.54**
S4	**2.74**	**3.78**	**4.82**

CONCLUSION

In the hardened stage, the Compressive Strength of the SCC at 7 & 28 days increases with 15% and 30% replacement of Egg shell powder in both cubes ,beams, cylinders. In the hardened stage compressive strength, split tensile strength and flexural strength were found to be good when percentage of egg shell were increased. Workability was found to be good for the entire category. Replacement of egg shell powder with cement for 15%, 20%, 25%, 30% showed good performance for 7, 14, 28days respectively. Compression strength, split tensile strength were found to increase with increase in egg shell powder, flow ability is ensured by using 12.5mm coarse aggregate. Workability was found to be good for the entire category. Replacement of egg shell powder with cement for 15%, 20%,25%,30% showed good performance for 7,14,28 days respectively

REFERENCES

1.s.chand, M.S.Shetty " CONCRETE TECHNOLOGY ".

2.Chan, Y.W., Chen, Y.S., Liu, Y.S., (2003). "Development of Bond

3.Strength of Reinforcement Steel in Self- Consolidating Concrete".DIN 1048, "Testing of hardened concrete", June 1991.

4.Nagamoto, N., and Ozawa, K., (1997). "Mixture proportions of self-compacting high performance concrete", ACI International, SP-172, pp.623-636.

5.Okamura, H. and Ouchi, M., (2003). "Self-compacting concrete", Journal ofAdvanced Concrete Technology, Vol. 1, No. 1, April, pp. 5-15.

6.Okamura, H. and Ozawa, K., (1995). "Mix design for self-compacting concrete", Concrete Library of JSCE, 25, pp. 107-120.

7.Okamura H., Ozawa K., *Mix Design for Self-Compacting Concrete*, Concrete Library of Japanese Society of Civil Engineers, June 25, 1995,p. 107-120.

8.EFNARC (European Federation of national trade associations representing producers and applicators of specialist building products),*Specification and Guidelines for self-compacting concrete*, February2002, Hampshire, U.K.

9.Metals and Ceramics Information Center. Engineering property data on selected ceramics. Vol. III, Single oxides. Defense Information AnalysisCenter. Columbus (OH): Battele Memorial Institute, 1981.