Experimental Investigation on Self Compacting Concrete by Rice Husk Ash Partial Replacement of Ordinary Portland Cement

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Abstract: Self-Compacting Concrete (SCC) is commonly compacting in own weight and flowing concrete, that does not require vibration tools such as mechanical vibrators, tamping rods, etc. In this project an attempt has been to a part of replacing cement by Rich Husk Ash, super plasticizer gelniumand Viscosity Modifying Agent to improve some of the properties of concrete. self-compacting concrete with adding different water percentage reductions, the compressive and flexural strength is to be determined. superplasticizers are significantly used to increase the ease and rate of flow. The self-compacting concrete (SCC) simplicities the pouring and eradicates construction difficulties. The Self-Compacting Concrete made by partially varying coarse aggregate with different replacements. The mix ratio of M50 for SCC is to be determined. In order to obtain the optimum mix ratio different combination are to be tried by varying the water content.

Keywords – self compacting concrete, compressive strength, tensile strength, flexural strength

1. INTRODUCTION

The introduction of the modern self-compacting concrete is associated with the drive towards better quality of concrete pursued in Japan in late 1980's where the lack of uniform and complete compaction had been identified as the primary factor for the poor performance of concrete structures. In the early 1990's there was only a limited knowledge about SCC, but in modern, present day self-compacting concrete can be classified as an advanced construction material, this offers many advantages and benefits over conventional concrete. Self-compacting concrete has been described as the most revolutionary development in concrete construction for several decades.
The characteristics of self-consolidating concrete are flow ability, segregation resistance and passing ability. Quality control of flow ability is typically predicted by the final diameter of a slump-flow test; a larger diameter indicates higher flow ability. Segregation resistance concerns the ability to retain homogenous distribution of aggregates; segregation can occur both during and after casting. The ability to keep the homogeneity of the aggregate distribution is governed by the volume fraction, distribution and physical properties of the aggregates

2. EXPERIMENTAL INVESTIGATION

2.1 ORDINARY PORTLAND CEMENT (OPC)

Cement is a binding material used in construction that sets, hardens, and adheres to other materials to bind them together. In this present study, Ordinary Portland Cement (OPC) of grade 53 is used for all concrete mixes. The specific gravity of cement is found as 3.15 and the standard consistency was 30%. The initial setting time was found to be 30 min and the final setting time was found to be 480 min. The cement used in this study is fresh and without any lumps.

2.2 FINE AGGREGATE

In this study, Cauvery River sand has been used as a fine aggregate. The sand was washed and screened at site to remove deleterious materials and tested as per the procedure given in IS: 2386-1968. Locally available river sand is confirmed to zone III of table 4 of IS 383– 1970 was used. The specific gravity of sand is 2.74. For increased workability and for economy as reflected by use of less cement, the fine aggregate should have a rounded shape.

Table1.1 Test on Fine aggregate

Properties	Value
Fineness modulus	2.52
Bulk density	1670 kg/m3
Water absorption	1.05%

2.3 COARSE AGGREGATE

Coarse aggregate used for this investigation is angular and is obtained from nearby quarry. The aggregate passing through 20 mm sieve and retained on 10 mm sieve is used to increase the strength. The specific gravity of coarse aggregate was found to be 2.60.

Table 2.2 Test on Coarse aggregate

Properties	Value
Fineness modulus	6.25
Bulk density	1650 kg/m^3
Water absorption	1.15%

2.4 SUPER PLASTICIZERS

It is known as high range water reducers. In this work, the super plasticizer used is known commercially as "GLENIUM244". It is a new generation of modified polycarboxylic ether. It is compatible with all Portland cements that meet recognized international standards. Super plasticized concrete exhibits a large increase in slump without segregation.

3. RESULT AND DISCUSSION

3.1 COMPRESSIVE STRENGTH

During the time of testing, each specimen must keep in compressive testing machine. The size of specimen is 150mm x 150mm x 150mm. The maximum load at which concrete block is breaking will be observed and noted. From the noted values, the compressive strength may calculate by using the below formula.

Compressive Strength = Load / Area

3.2 SPLIT TENSILE STRENGTH

Split Tensile Test is the theoretical maximum indirect tensile stress obtained by splitting the specimen under a concentrated compressive line load. The size of cylinders 300 mm length and 150 mm diameter are placed in the machine such that load is applied on the opposite side of the cubes are casted

3.3 FLEXURAL STRENGTH

Flexural strength is the theoretical maximum tensile stress reached in the bottom fiber of a test beam during a flexural strength test. During the testing, the beam specimens of size 7000mmx150mmx150mm were used. Specimens were dried in open air after 7 days of curing and subjected to flexural strength test under flexural testing assembly.

3.4 TEST ON HARDENED CONCRETE

Table 3.1 Compressive strength test

Specification	Compressive Strength (N/mm2)			Remark
	@ 7 days	@ 14 days	@ 28 days	
20% water reduced	24.5	32	45	Admixture is added at a constant ratio of **1.5** in all combinations.
15% water reduced	24	33	45.2	
10% water reduced	25.5	33.2	46.5	
5% water reduced	26	35.2	48.5	
0% water reduced	28	36	51	

Table 3.2 Split Tensile strength test

Specification	Split Tensile Strength (N/mm^2)			Remark
	@ 7 days	@ 14 days	@ 28 days	
20% water reduced	5.34	6.57	8.79	Admixture is added at a constant ratio of **1.5** in all combinations.
15% water reduced	5.55	6.91	8.81	
10% water reduced	5.9	6.97	8.54	
5% water reduced	5.17	6.67	8.37	
0% water reduced	5.22	7.2	8.66	

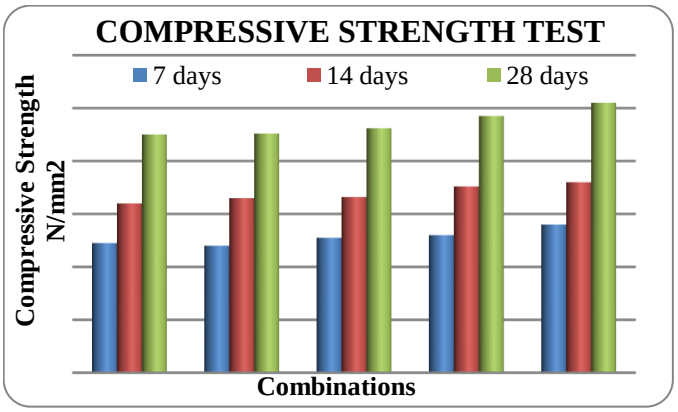

Fig 3.1 Compressive Strength for various % replacement.

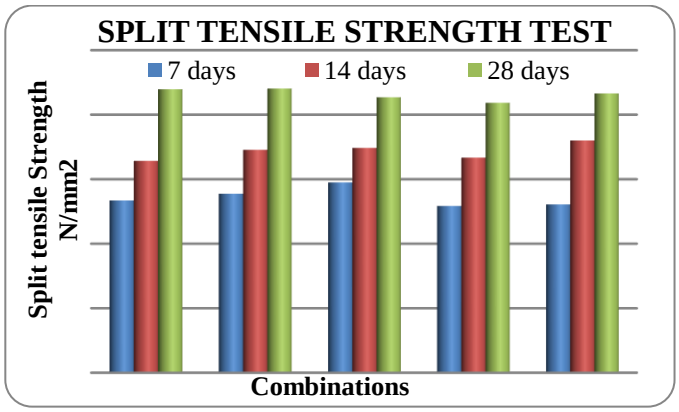

Fig 3.2 Split tensile strength for various % replacement.

Table 3.3 Flexural strength test

Specification	Flexural Strength (N/mm2)			Remark
	@ 7 days	@ 14 days	@ 28 days	
20% water reduced	24.5	32	45	Admixture is added at a constant ratio of **1.5** in all combinations
15% water reduced	24	33	45.2	
10% water reduced	25.5	33.2	46.5	
5% water reduced	26	35.2	48.5	
0% water reduced	28	36	51	

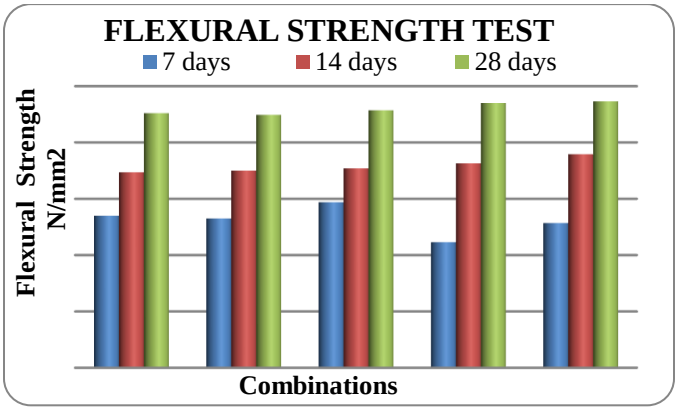

Figure 3.3 Flexural Strength for various % replacement.

4. CONCLUSIONS

The following conclusion is

1. Based on the component test, the materials to be used satisfies the IS specification and they are adopted.
2. The mix ratio of M50 for SCC was determined based on IS 10262-2009.
3. As per EFRANCE GUIDE SCC satisfies the standard tests.
4. In order to obtain the optimum mix ratio different combination are tried by varying the water content.
5. The optimum mix ratio was achieved without reducing the water content and addition of admixture.

REFERENCES

1. Amir juma and V A K Prakesh (2012), 'A Review on Experimental Behavior of Self Compaction Concrete Incorporated with Rice Husk Ash', Vol .2 pp.76-80
2. EFNARC. "Specification and Guidelines for Self-compacting Concrete. European Federation of Producers and Applicators of Specialist Products for Structures", 2002.www.efnarc.org
3. Gritsada sua-iam and Natt makul(2012), 'Self-compacting Concrete Prepared Using Rice Husk Ash Waste from Electric Power Plants', Vol.488-489, pp.258-262.
4. IS: 383-1970, 'Speccification for Coarse and Fine aggregate from natural source for concrete', Bureau of Indian Standard, New Delhi.
5. IS: 456-2000, 'Plain and Reinforced Concrete Code for Partice ', Bureau of Indian Standard, New Delhi.
6. IS 10262-2009,'Concerte Mix Proportioning Guideline', Bureau of Indian Standard, New Delhi.

7. K. Ganesan, K. Rajagopal, K. Thangavel. (2008), "Rice Husk Ash blended cement: Assessment of optimal level of replacement for strength and permeability properties of concrete" Construction and Building Materials 22 pp. 1675–1683.
8. Md nor atan, hanizam awaing (2011), 'The Compressive and Flexural strengths of Self-Compacting Concrete using raw rice husk ash', Vol. 6, No. 6, pp.720 – 732.
9. M.S.shetty (2013)" Concrete Technology' S.Chand and Company Pvt .Ltd. New Delhi
10. M. A. Ahmadi, O. Alidoust, I. Sadrinejad, and M. Nayeri(2007)' Development of Mechanical Properties of Self Compacting Concrete Contain Rice Husk Ash',Vol.1,pp 100-103.
11. Amir juma and V A K Prakesh (2012), 'A Review on Experimental Behavior of Self Compaction Concrete Incorporated with Rice Husk Ash', Vol .2 pp.76-80
12. EFNARC. "Specification and Guidelines for Self-compacting Concrete. European Federation of Producers and Applicators of Specialist Products for Structures", 2002.www.efnarc.org
13. Gritsada sua-iam and Natt makul(2012), 'Self-compacting Concrete Prepared Using Rice Husk Ash Waste from Electric Power Plants', Vol.488-489, pp.258-262.
14. IS: 383-1970, 'Speccification for Coarse and Fine aggregate from natural source for concrete', Bureau of Indian Standard, New Delhi.
15. IS: 456-2000, 'Plain and Reinforced Concrete Code for Partice ', Bureau of Indian Standard, New Delhi.
16. IS 10262-2009,'Concerte Mix Proportioning Guideline', Bureau of Indian Standard, New Delhi.
17. K. Ganesan, K. Rajagopal, K. Thangavel. (2008), "Rice Husk Ash blended cement: Assessment of optimal level of replacement for strength and permeability properties of concrete" Construction and Building Materials 22 pp. 1675–1683.
18. Md nor atan, hanizam awaing (2011), 'The Compressive and Flexural strengths of Self-Compacting Concrete using raw rice husk ash', Vol. 6, No. 6, pp.720 – 732.
19. M.S.shetty (2013)" Concrete Technology' S.Chand and Company Pvt .Ltd. New Delhi
20. M. A. Ahmadi, O. Alidoust, I. Sadrinejad, and M. Nayeri(2007)' Development of Mechanical Properties of Self Compacting Concrete Contain Rice Husk Ash',Vol.1,pp 100-103.
21. S. Kanakambara Rao., "A Review on Experimental Behavior of Self Compaction Concrete Incorporated with Rice Husk Ash" International Journal of Science and Advanced Technology (ISSN 2221-8386).
22. Vilas V. Kirjinni & Shrishail B. Anadinni. (2009) 'Mixture Proportion Procedure for SCC', Indian Concrete Journal, pp 35-41, June 2009.
23. Vilas V. Karjinni, Shrishail B. Anadinni, Dada S. Patil (2009)'An Investigation on the Characteristic Properties of High-Performance SCC with Mineral Admixture', Indian concrete journal, pp 15-19.