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INVESTIGATION OF SELF COMPACTING CONCRETE BY USING SELF CURING AGENTS

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ABSTRACT

In this study strength parameters of self-compacting concrete, self-curing concrete, Self-compacted self-curing concrete M20 and M25 grade are compared with Conventional Concrete. Mechanical properties of the concrete specimens such as compressive strength, and flexural strength are to be perfomed. Self-compacting concrete describes concrete with the ability to compact itself by means of its own weight the requirement for vibration. It is proved to fill all recesses reinforcement spaces and voids even in highly reinforced concrete members.Self- compacting concrete incorporating self-compacting agents have been studied and tests are performed using self-compacting agents. The Self-curing of concreteis for maintaining satisfactory moisture content in concrete during its early stages in order to develop the desired properties. The concept of self-curing agents is to reduce the water evaporation from concrete and hence increase the water retention capacity of the concrete compared to conventional concrete. The chemical admixtures used in this study are conplast SP-430 for self-compacting concrete and polyethylene glycols (PEG) 600 as self-curing agents. The mechanical properties are found by testing the casted specimens such as cubes and beams of standard sizes for varying proportions. The parameters that very are fly-ash as 10%,20% and 30%. The percentage of conplast SP-430 and self-curing agents is kept constant as (0.9%)with reference to literature studies. The objective of this study is to compare the mechanical properties of self-compacting concrete, self-curing concrete, self-compacted self-curing with conventional concrete.

A self-curing concrete is provided to absorb water from atmosphere from air to achieve better hydration of cement in concrete. It solves the problem that the degree of cement hydration is lowered due to no curing or improper curing, and thus unsatisfactory properties of concrete. The self-curing agent can absorb moisture from atmosphere and then release it to concrete. The self-curing concrete means that no curing is required for concrete, or even no any external supplied water is required after placing. The properties of this self-cured concrete of this invention are at least comparable to and even better than those of concrete with traditional curing.

KEY WORD

Self-compacted, self-curing agents, fly ash, conventional concrete and polyethylene Glycols (PEG)

MATERIALS AND ITS PROPERTIES

The cement used in this specimen is ordinary Portland cement of 53 grade and the specific gravity is 3.14. The initial and final setting times were found as 30 and 356 min respectively. The size of coarse aggregate used was 12.5mm. The specific gravity of it is 2.73. Fine aggregate used was river sand passing through IS sieve 4.75 mm. As mineral admixture Fly ash was used in this work. The cement is replaced with 5%, 10%, 15% and 20% by weight of cement. To improve the workability of concrete Conplast SP430 (2% by weight of cementitious material had been used). To make the concrete as more workable with self compacting character, chemical admixtures of Viscosity Modifying Agent (VMA) Glenium Stream 2 of 0.5% by weight of cementitious material was used. Poly Ethylene glycol (PEG) was used for internal curing (0.5% by weight of cement.) Mix designs of Self compacting concretes were developed by means of trail mixes based on the guidance given in EFNARC. Standard 150mm cube was produced.

Table 1 EFNARC (2005) Specifications and Guidelines for Self Compacting Concrete

Constituents	Ranges
Coarse aggregate	28-35% by volume of the mix
Water/Powder	0.8-1.1 (by volume)
Powder content	380-600kg/m3 (160-240liters/m3
Cement conotent	350-450kg/m3
Air content	2%

Tests on cement

The normal consistency, initial setting time, final setting time, soundness, specific gravity and compressive strength of cement were determined as per IS Specifications and results are tabulated in Table 2.

Table 2 Test result of cement

Sl. No	Particulars	Results
1	Specific Gravity	3.05
2	Soundness test (Le – Chatelier test	2mm expansion
3	Initial setting time	75 minutes
4	Final setting time	230 minutes
5	Average compressive strength at 3 days 7days 28days	 34.3 Mpa 44.6 Mpa 63.2 Mpa

Tests on aggregates

The properties of aggregates used were determined as per IS Specifications and reported on Table 3.

Table 3 Properties of Aggregates

Sl. No	Particulars	Results
1	Specific Gravity	2.73
2	Fineness Modulus	2.8
3	Grading Zone 2.73	Zone II

Tests on water

Analysis of water was done to determine the presence of aggressive chemicals and the results are given in Table 4.

Table 4: Test results of normal and aggressive water

Sl. No	Description of the test	Normal water	Aggressive water	Permissible value as per IS 456-2000
1	ph	7.38	3.8	Not less than 6
2	Sulphate	174 mg/lit	950 mg/lit	400 mg/lit
3	Chloride	108 mg/lit	1280 mg/lit	500 mg/lit

Concrete Mix Design

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The Erntroy and Shacklock's method was used for the mix design. After conducting tests on trial mixes, the final proportion arrived at was 0.28: 1:1.29:3.01 to get a compressive strength of 28 MPa

Tests on Hardened Concrete

Required numbers of specimens were cast to determine the compressive strength and flexural strength. The tests were conducted at 7,28, days on High Performance Concrete and control cement concrete specimens as per IS specifications.The results are tabulated in Table 5,6 and 7

The compression test was conducted as per IS 516 – 1959 using compression testing machine and the compressive strength was found out for all the cube specimens. The size of cube is 150mm x 150mm x 150mm. Ultimate compressive strength = Force (N) just before rupture / (original c/s area)

The results are tabulated in Table 5,6 and 7

Table 5 Compressive strength test results M20 Grade

Compressive strength N/mm^2				
Days	7 days			
Conventional concrete	18.50			
Fly ash	0%	10%	20%	30%
Self-compacting concrete	17.7	18.0	17.9	18.3
Self-curing concrete	17.6	17..9	17.4	18.5
Self-compacting Self-curing concrete	17.9	18.5	17.3	18.7
Compressive strength N/mm^2				
Days	28 days			
Conventional concrete	30.53			
Fly ash	0%	10%	20%	30%
Self-compacting concrete	29.35	28.44	29.2	30.2
Self-curing concrete	29.29	28.54	29.8	30.6
Self-compacting Self-curing concrete	29.75	28.84	28.8	30.8

Table 6 Compressive strength test results M25 Grade

Compressive strength N/mm^2				
Days	7 days			
Conventional concrete	27.78			
Fly ash	0%	10%	20%	30%
Self-compacting concrete	28.21	26.23	25.92	27.45
Self-curing concrete	28.32	26.03	26.16	27.48
Self-compacting Self-curing concrete	28.12	26.15	25.78	28.43
Compressive strength N/mm^2				
Days	28 days			
Conventional concrete	43.33			
Fly ash	0%	10%	20%	30%
Self-compacting concrete	36.42	37.45	41.22	43.09
Self-curing concrete	36.32	37.05	41.25	43.31
Self-compacting Self-curing concrete	36.51	37.32	41.62	43.59

Flexural strength test

This test was carried out for determining the Flexural strength of concrete. The method of testing was done as per IS 516-1959. Test specimens prisms in shape were 500x100x100mm.

Table 7 flexural strength test results M20

flexural strength N/mm^2				
Days	7 days			
Conventional concrete	2.84			
Fly ash	0%	10%	20%	30%
Self-compacting concrete	2.13	2.31	2.45	2.76
Self-curing concrete	2.17	2.63	2.35	2.93
Self-compacting Self-curing concrete	2.21	2.52	2.85	2.85
Flexural strength N/mm^2				
Days	28 days			
Conventional concrete	3.88			
Fly ash	0%	10%	20%	30%
Self-compacting concrete	3.26	3.43	3.65	3.87
Self-curing concrete	3.29	3.47	3.75	3.80
Self-compacting Self-curing concrete	3.30	3.52	3.70	3.97

Table 8 flexural strength test results M25

Flexural strength N/mm^2				
Days	7 days			
Conventional concrete	2.98			
Fly ash	0%	10%	20%	30%
Self-compacting concrete	2.45	2.50	2.62	2.90
Self-curing concrete	2.51	2.54	2.67	2.95
Self-compacting Self-curing concrete	2.55	2.60	2.68	3.10
Flexural strength N/mm^2				
Days	28 days			
Conventional concrete	4.09			
Fly ash	0%	10%	20%	30%
Self-compacting concrete	3.33	3.45	3.65	3.87
Self-curing concrete	3.40	3.61	3.73	4.12
Self-compacting Self-curing concrete	3.55	3.72	3.78	4.30

(LITERATURE REVIEW)

GENDRAL

Self-compacting concrete was first developed in 1988 so that durability of concrete structures can be improved. Since then, various investigations have been carried out and the concrete has been used in practical structures in Japan, mainly by large construction companies. Investigations for establishing a rational mix- design method and self-compactability testing methods have been carried out from the viewpoint of making it a standard concrete. Recommendations and manuals for self-compacting concrete were also established. The Some of studies about self- compacted and self curing concrete are dicussed in this chapter. **B.Vidivelli et al. (2013)**The objective of this study is comparing the flexure behaviour of self-compacting concrete beams. This research is proposed to replace the constituent materials by mineral Admixtures and adding chemical admixtures. Also it is proposed to use self-curing compound instead of conventional water curing. Mechanical properties such as modulus of concrete have been found out and compared with controlled beams, self-compacting concrete beams, self-curing concrete beams and admixture beams. Compressive strength of self-compacting concrete was increased 12.86% with comparing conventional concrete. Tensile strength of self- compacting concrete was increased 9.82 % with comparing conventional concrete. Compressive strength of self-curing concrete and admixture was increased 8.9% and 12.03% with comparing conventional concrete. Flexural capacity of self-compacting concrete beams show better results. The ultimate load and ultimate deflection for self-compacting concrete beam was increased 36% and 32.65% when compared control beams. **C.Selvamony et al.(2010)** In this study, the effect of replacing the cement, coarse aggregate and fine aggregate by limestone powder (LP) with silica fume, quarry dust and clinkers respectively and their combinations of various proportions on the properties of SCC has been compared. Fresh properties, flexural and compressive strengths and water absorption properties of Concrete were determined. The use of SF in Concrete significantly increased the dosage of superplasticiser (SP). At the same constant SP dosage (0·8%) and mineral additives content (30%), LP can better improve the workability than that of control and fine aggregate mixtures by (5 % to 45 %). From the experimental investigation, it was observed that both admixtures affected the workability of SCC adversely. A maximum of 8% of lime stone powder with silica fume, 30% of quarry dust and 14 % of clinkers was able to be used as a mineral admixture without affecting the self-compactability. Silica fume was observed to improve the mechanical properties of SCC, while lime stone powder along with quarry dust affected mechanical properties of SCC adversely.

Review on self-curing concrete

Nisa group et al. (2014) discussed about compressive strength and durability. Depending up on the nature of work the cement, fine aggregate, coarse aggregate and water are mixed in specific proportions to produce plain concrete. Plain concrete needs congenial atmosphere by providing moisture for a minimum period of 28 days for good hydration and to attain desired strength. The properties of hardened concrete, especially the durability, are greatly influenced by curing since it has a remarkable effect on the hydration of the cement. In the present study, the affect of admixture (PEG 4000) on compressive strength, split tensile strength and modulus of rupture by varying the percentage of PEG by weight of cement from 0% to 2% were studied for M20. It was found that PEG 4000 could help in self curing by giving strength on par with conventional curing. It was also found that 1% of PEG 4000 by weight of cement was optimum for M20 grade concretes for achieving maximum strength without compromising workability. The optimum dosage of PEG4000 for maximum Compressive strength was found to be 1.5% for grades of concrete. Strength of self-curing concrete is on par with conventional concrete. Self –curing concrete is the answer to many problems faced due to lack of proper curing. Wrapped curing is less efficient than Membrane curing and Self-Curing it can be applied to simple as well as complex shapes. **M.Manoj Kumar et al. (2013)** studied about self –curing concrete means that no external curing required for concrete. The concept of self-curing is to reduce the water evaporation. As defined by ACI, The grade of concrete selected was M40. The self –curing materials used are the use of Super Absorbent Polymer (SAP) and the application of wax based membrane curing compound on the demoulded concrete specimens. The effect of variation in strength parameters i.e., Compressive Strength, Splitting Tensile Strength and Flexural Strength were studied for different dosage of self-curing agent (0.2% - 0.4% weight of cement) and compared with that of conventional cured concrete. The optimum dosage is 0.3% Addition of SAP leads to a significant increase of mechanical strength (Compressive and Splitting tensile). Compressive strength of self-cured concrete for dosage is 0.3% was higher than water cured concrete. Split tensile strength of self-cured concrete for dosage of0.3% was higher than water cured concrete. Flexural Strength of self-cured concrete for dosage of 0.3% was lower than water cured concrete. Performance of the self-curing agent will be affected by the mix proportions mainly the cement content and the w/c ratio. There was a gradual increase in the strength for dosage from 0.2 to 0.3% and later gradually reduced. The Self-cured concrete using SAP was more economical than conventional cured concrete.

SCOPE OF STUDY

1. This type of concrete can be used in areas where the water is insufficient during construction and the vibrators are not accessible.
2. The replacement cement by fly ash reduces the co_2 emission to the atmosphere Which in turn reduces the greenhouse effect.
3. As a result it does not requires any vibration and any external curing.
4.To study the mechanical properties of self-compacted concrete (SCC) with self -curing agents (SCA) by conducting the hardened test.

OBJECTIVES

The objective of this project is,
1. To study the mechanical properties of self-compacted concrete (SCC) by conducting hardened test.
2. To study the mechanical properties of self-compacted concrete (SCC) with self -curing agents (SCA) by conducting the hardened test.
3. To compare these two types of concrete with the convectional concrete.

CONCLUSION

From the experimental investigation it is found that the mechanical properties of the self-compacting concrete, self-curing concrete and self-compacted self-curing concrete such as compressive strength and compare the flexural strength of conventional concrete. The slump flow test is the most widely used method for evaluating concrete consistency in the laboratory and at construction sites. The consistency and workability were evaluated using the slump flow, L-Box, V funnel and fill box tests. Is was found that polyethylene glycol 600 can be used as self-curing agents in concrete.

The self-compacted self-curing concrete (SCSCC) shows better results when compared to conventional, self-curing and self- compacting concrete

The setting of SCSCC is slow compared to conventional concrete and self-curing concrete.

The 30% replacement of fly ash in SCSCC gives optimum results while compared to conventional self-compacting concrete, self-curing concrete.

Results infer that the Compressive strength value has found to increase in self-compacting concrete and self-curing concrete by 9%,2% and in day testing.

The flexural behavior of self-curing concrete shows lesser results when compared to conventional, self-curing, self-compacting concrete.

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