An Experimental Investigation on Self Curing Self Compacted Concrete

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Abstract - *The objective of the investigation is to study the strength characteristics of self compacting concrete by using self curing agent. To study concrete mix with and without Self curing agent were subjected to different types of curing i.e. conventional(water curing) and self curing(Air curing). Self-curing is perform which will satisfy the water requirements of concrete while self-compacting concrete is ready so that it may be placed in tough position & in congested reinforcement present. This experimental work was aimed to make use of the benefits of both self curing concrete in addition with self compacting concrete. This research discuss the compressive and split tensile strength of the concrete. Self Curing Self Compacted concrete (SCSCC) usage of water soluble Polyethylene glycol (PEG) of molecular weight 4000 (PEG 4000). The mix design for the M60 grade is accomplished using the Nansu method. In this layout, super plasticizer is added at a dosage of 1.2 percent. The percentage of self-curing agent used from 0, 0.5, 0.1, 1.5 and 2 percent by weight of cement and fly ash at 4.89 percent by weight of concrete. From the experimental result is observed that optimal dosage PEG 4000 is achieved at one percent being maximum strength. It is also observed, the increase in PEG4000 dosage decreases the strength of concrete mix.*

***Key Words*: Self Compacting Concrete, Self Curing Concrete, Polyethylene Glycol, PEG 4000, Self Curing Self Compacted Concrete (SCSCC)**

1.INTRODUCTION

Self-compacting concrete (SCC) is a mixture of flowing concrete that is able to compact under its own weight. The highly liquid nature of the SCC makes it suitable for placement in harsh conditions and in a phase with high reinforcement. The use of SCC can also help reduce hearing-related damage in the workplace caused by concrete vibrations. The advantage of the SCC is that the time required to install large components is greatly reduced. [1]

As water becomes a daily threat, there is an urgent need to conduct research on saving of water in concrete construction and the curing. The treatment retains a satisfactory humidity in its original state in order to improve the desirable features. However, effective treatment does not always work in most cases. Self-adhesive or internal healing is a method that can be used to provide additional moisture to the concrete to obtain an effective flow of cement and to reduce isolation. Internal treatment means the introduction of a treatment agent in concrete that will act as an internal water source. The role of self curing agent is reducing water evaporation in concrete mix. [2] Subsistence refers to the process by which the flow of cement occurs due to the availability of additional internal water that is not part of the mixing Water. Typically, curing concrete means creating conditions so that water is not lost from the surface that is, curing is considered to occur from the outside to the inside. In contrast, self curing allows for curing from the inside to out. [3]

2. EXPERIMENTAL METHODOLOGY

This chapter deals with the experimental program particulars. The materials used, concrete mix details and casting procedures are explained.

2.1 Materials:

Cement:
Cement is one of the important constituents of mortar. Ordinary Portland cement was used confirming to IS 12269:1987 [5]. The specific gravity of the cement 3.16; initial setting time and final setting time were 35 minutes and 560 minutes.

Fine Aggregate (FA):
The fine aggregate was used from river locally available, confirming to IS383:1970 [4]. The specific gravity of FA was 2.7 and bulk density was 1560.

Coarse Aggregate (CA):
The Coarse aggregate of 10mm size was used confirming to IS 383:1970. [4]. The specific gravity used was 2.6 and bulk density was 1505.

Fly ash:
In this experimental work, the specific gravity of Fly ash was used is 2.8 and of grey colour.

Polycarboxylate Ether (Super Plasticizer):
The high range water reducing admixture commonly known as super plasticizer, which used for improving the flow or workability for decreased water cement ratio without sacrificing the compressive strength.

Polyethylene Glycol-4000:
The Polyethylene glycol is condensation polymer of the ethylene oxide and water H2O. The general formula for polyethylene glycol is given by H(OCH2CH2)nOH, where n is

a average number of repeating oxy-ethylene groups typically from 4 to about 180. Before adding of water in concrete the chemicals were mixed with water thoroughly. The molecular weight of polyethylene glycol-4000 was 3600 – 4400 and the physical form was of white flakes, water soluble.

Water:
In this experimental work, Potable water was used.

2.2 Mix Design

There is no standard method for SCC mix design. The blend design for the M60 grade is accomplished using the Nansu method. Super plasticizer polycarboxylate ether is at a dosage of 1.2 percent in this layout. The fly ash admixtures are added to the blend at 4.87% by weight of concrete and PEG 4000 at 0, 0.5 to 2% by weight of cement. Water/cement ratio was 0.40. After trial mixes, final mix proportion adopted in this study is given in Table 1

Table -1: Final Mix Design per m3 of Concrete for M60

Cement (kg/m^3)	Fly ash (kg/m^3)	FA	CA	Water (lit/m^3)	Super plasticizer (%)
390	120	1100	810	204	1.2

2.2 Test on Concrete

Tests for Fresh Properties of Concrete

Slump cone test, V funnel and L box test were conducted to measure the workability of concrete mix IS specification.

Tests for Hardened Properties of Concrete

Compressive Strength Test

The compressive strength test was conducted as per IS 516 – 1959, cubes of size 150mm x150mm x150mm using a compression testing machine (CTM). The test was conducted on both conventional concrete as well on self curing concrete with varying % of PEG-4000.

4 Split Tensile Strength Test

The spilt tensile strength test was carried out by placing a cylindrical specimen of size 300mm in height and of 150 mm diameter.

3. RESULT AND DISSCUSION

3.1 Detail of specimen:

Following Table 2 shows the six mixes used in this experiment with varying proportion of PEG4000.

Table-2: Details of specimen

Mixes	Percentage of PEG4000	Type of curing
M1	PEG 0% (WC)	Traditional curing(Water Curing)
M2	PEG 0% (AC)	Traditional curing (Air Curing)
M3	PEG 0.5%	Self curing
M4	PEG1%	Self curing
M5	PEG 1.5%	Self curing
M6	PEG 2%	Self curing

3.2 Test Results:

Workability Test:

The workability test results of various dosages of Polyethylene Glycol 4000 are shown in Table 3.

Table-3: Test result of workability test

Test	M_1	M_2	M_3	M_4	M_5	M_6
Slump flow test	650	635	630	640	645	650
L-box	0.7	0.7	0.72	0.75	0.78	0.8
V-funnel	12	14	14	13	12	10

Compressive Strength Test:

The compressive strength test results of various dosages of Polyethylene Glycol 4000 are as shown in Table 4.

Table-4: Test results of Compressive strength

Details of the specimen		Compressive strength (N/mm²)	
		7 days	*28 days*
PEG 0%	Traditional curing	48	69.5
PEG 0%	Self Curing	23	38
PEG 0.5%	Self curing	31	44
PEG1%	Self curing	49	70
PEG 1.5%	Self curing	43	62.5
PEG 2%	Self curing	36	54

Split Tensile Strength Test:

The spilt tensile strength test results of various dosages of Polyethylene Glycol 4000 are shown in Table 5.

Table-5: Test results of Split Tensile strength

Details of the specimen		Compressive strength (N/mm²)	
		7 days	*28 days*
PEG 0%	Traditional curing	4.3	6.3
PEG 0%	Self Curing	3.3	4.5
PEG 0.5%	Self curing	4.4	5.3
PEG1%	Self curing	4.8	6.7
PEG 1.5%	Self curing	4.5	5.9
PEG 2%	Self curing	3.6	5.1

4. CONCLUSIONS

From this experimental study, the following findings are observed:

1. The use of self-curing agent in concrete increases the strength characteristics of concrete under an air curing system is gives the better retention of water and causes continuous hydration of cement paste resulting in reduction in voids .
2. It has been observed that 2% PEG4000 provides a lower compressive and split tensile strength compared to 1% PEG.
3. So it is found that addition of PEG at a high dose of over 1% of cement would not give the expected strength and practically not applicable.
4. Compared to conventional curing concrete, setting time of SCSCC is slow with increase in PEG dosage.
5. In this experiment, 1 percent of PEG gives better result as compared to 0.5%, 1.5%, 2% of PEG as a self curing agent.
6. In desert regions, Self curing concrete is an option to conventional cure concrete where water shortages are major problem.

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