International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 12 | Dec 2018 www.irjet.net p-ISSN: 2395-0072

Experimental Investigation of Self Compacting and Self Curing Concrete with Different Admixture

Mr. Afsal Kallengal[1]

[1]*M.E Structural Engineering, Department of Civil Engineering, RVS Campus, Coimbatore, India*

Abstract :- *A self-compacting concrete (SCC) is the one that can be placed in the form and can go through obstructions by its own weight and without the need of vibration. . The major advantage of this method is that SCC technology offers the opportunity to minimize or eliminate concrete placement problems in difficult conditions. Therefore, the objective of this study is to investigate the strength of concrete by both the combination of self compacting and self curing of concrete.*

Key Words: *Self compacting concrete, Curing, Polyethylene glycol, Conplast SP430, Compressive Strength*

1. INTRODUCTION

These days apart from steel, concrete is the most and widely used as structural material in construction field. Concrete defined as a composite material made up of composed granular material (the aggregate or filler) embedded in a hard matrix of material (cement or binder) and water that fills the space between the aggregate particles and bind them together. There are many types of concrete with different material used and mix design. Along with the compaction, curing plays a predominant role in achieving better strength, durability, water tightness, abrasion resistance, volume stability and resistance to freezing and thawing. Curing is a major factor which is important for the hydration process to continue particularly in the initial ages. However, adequate curing is not always possible by conventional curing techniques and it is recommended to make the embedded water available for curing in order to overcome this problem.

1.1 Experimental Procedure

The different methods used in this research include the following:

(i) Background study

Literature survey was carried out to check previous studies related to this thesis.

(ii) Collection of raw Materials

All the materials were collected and delivered to the laboratory. These are Cement, Fine Aggregate, Coarse Aggregate, Conplast SP430, and Polyethylene Glycol.

(iii) Materials Tests

Tests were conducted on the materials to determine their properties and suitability for the experiment.

(iv) Mix Proportioning (Mix Design)

Concrete mix design was prepared using the Indian Standard Code method. M25 design is prepared with code.

(v) Specimen Preparation

The concrete cube specimens were prepared in the laboratory.

(vi) Testing of specimens

Laboratory tests were carried out on concrete samples. The test conducted for compressive strength.

(vii) Data Collections

This was mainly based on the tests conducted on the prepared specimens in the laboratory.

(viii) Data Analysis and Evaluation

The test results of the samples were compared with the respective control concrete properties and the result were presented using tables, pictures. Conclusions and recommendations were finally forwarded based on the findings and observation.

1.2 MATERIALS USED

1.2.1 CEMENT

There are two requirements for any cement in the concrete mix design. That is compressive strength development with time attainment of appropriate rheological characteristics, type and production of cement.

Table 1.1 Properties of Cement

PROPERTIES	STANDARD VALUES	OPC USED IN PRESENT STUDY
Standard consistency	30-35	34%
Initial setting time	>30 min	38min 12sec
Final setting time	< 600min	560min
Fineness	25-35%	28.50%

1.2.2 FINE AGGREGATE

The fine aggregate used in manufacturing of concrete should be free from debris, fungi and chemical attack. It plays a vital role in concrete, so it should durable, angular and sharp edges then only it gives a rich mix concrete and workability.

Table 1.2 Properties of Fine Aggregate

PROPERTIES	RESULTS	STANDARD VALUES
Specific Gravity	2.56	2.30 – 2.60
Fineness Modulus	2.74	2.50 – 3.50
Bulk Density	17 kN/m³	-
Bulking	Fine grade	

1.2.3 COURSE AGGREGATE

Aggregates are the important constituents in concrete. They provide body to the concrete, reduces shrinkage and effect economy. Earlier aggregates were considered as chemically insert materials but now it has been recognized that some of aggregates are chemically active and also that certain aggregate exhibit chemical bon at interface of aggregate and paste. That more aggregates occupy 70-80 percentage of concrete: their impact on various characteristics and properties of concrete is undoubtedly considerable.

Table 1.3 Properties of Coarse Aggregate

PROPERTIES	RESULTS	STANDARD VALUES
Specific Gravity	2.78	2.6 – 2.9
Fineness Modulus	6.80	6 – 7
Bulk Density	16.50 kN/m³	

1.2.4 WATER

Water is an important in gradient of concrete as it activity participates in the chemical reactions with cement. The strength of cement concrete is mainly from binding action of the hydration of cement.

It get the requirement of water should be reduced that required chemical reaction of unhydrated cement excess water would end up in only formation undesirable voids (or) capillaries in the hardened cement paste in concrete.

Table 1.4 Properties of water

PROPERTIES	RESULTS	STANDARD VALUES
pH	6.70	Not less than 6
Organic	120mg/l	200mg/l
Inorganic	1850mg/l	3000mg/l
Sulphate	165mg/l	400mg/l
Chlorides	1120mg/l	2000mg/l
Suspended	620mg/l	2000mg/l

1.2.5 CONPLAST SP 430

It is a chloride free, super plasticizing admixture based on selected sulphonated naphthalene polymers. It is supplied as a brown solution which instantly dilutes in water. To provide excellent acceleration of strength at all ages by significantly reducing water demands in a concrete mix. It has been formulated to get high water reductions upto 25% without loss of workability or to produce high quality concrete of reduced permeability.

It makes possible major reduction in w/c ratio which allows production of high strength concrete without excessive cement concrete. It increases workability levels are maintained longer than other super plasticizers admixture. It improves cohesion and particle dispersion minimizes segregation bleeding and pumpability. It permits easier construction with quicker placing and compaction and it reduces labor cost with increasing water content. We used the chemicals with the percentage of weight of the cement as 0.1%, 1%, 1.5%, 2%.

Fig 1. Conplast SP 430

1.2.6 POLY ETHYLENE GLYCOL 400

Polyethylene glycol (PEG) of molecular weight 400 (PEG 400) for dosages ranging between 0.1 to 1% by weight of cement added to mixing water. The optimum dosage of PEG-400 for providing maximum strength was observed to be 1%. The optimum dosage of PEG-400 for providing maximum strength was observed to be 1%. POLYETHYELENE GLYCOL(PEG) of average molecular weight (M.W) from 200 to 10000 as self curing agent and to

decide the optimum dosage for different curing condition under air atmospheric conditions and to study the compressive strength and water retention by varying the percentage of PEG from 0% to 1% by weight of cement for self-compacting and compare it with conventional SCC. Concrete weight loss with time measured to determine the water retention capacity.

In this experiment we using strength of self-curing concrete by adding POLYETHYLENE GLYCOL(chemical admixture) at 3%, 3.5%, 4%, 4.5% and also comparing with conventional concrete to study the compressive strength and split tensile strength.

Fig 2. Polyethylene Glycol 400

2. TESTS FOR COURSE AGGREGATE

2.1. Specific gravity test

This test is done to determine the specific gravity of coarse aggregate by density bottle method. Specific gravity is the Ratio of the weight in air of a given volume of a material at a standard temperature to the weight of an equal volume of distilled water at the same stated temperature.

Table 2.1 Specific gravity test for coarse aggregate

Description	Sample 1	Sample 2	Sample 3
Wt. of empty bottle (W_1)(g)	650	650	650
Wt. of bottle + Coarse Aggregate (W_2)(g)	1060	1060	1060
Wt. of bottle + CA + Water (W_3)(g)	1735	1735	1735
Wt. of bottle + Water (W_4)(g)	1470	1470	1470
Specific gravity (G)	2.85	2.85	2.85
Average specific gravity		2.84	

3. TEST FOR FINE AGGREGATE

3.1 Specific gravity test for fine aggregate

This experiment is done to determine the specific gravity of fine grained sand by density bottle method. Specific gravity is the Ratio of the weight in air of a given volume of a material at a standard temperature to the weight of an equal volume of distilled water at the same stated temperature.

Table 3.1 Specific gravity test for fine aggregate

Description	Sample 1	Sample 2	Sample 3
Wt. of empty bottle (W_1)(g)	633	633	633
Wt. of bottle + Fine aggregate (W_2)(g)	1464	1465	1464
Wt. of bottle + FA + Water (W_3)(g)	1969	1968	1969
Wt. of bottle + Water (W_4)(g)	1467	1467	1467
Specific gravity (G)	2.7	2.65	2.75
Average specific gravity		2.64	

4. TEST FOR CEMENT

4.1. SPECIFIC GRAVITY OF CEMENT

This experiment is done to determine the specific gravity of the cement by density bottle method. Specific gravity is the Ratio of the weight in air of a given volume of a material at a standard temperature to the weight of an equal volume of distilled water at the same stated temperature.

Table 4.1 Specific gravity test for cement

Description	Sample 1	Sample 2	Sample 3
Wt. of empty bottle (W_1) (g)	633	633	633
Wt. of bottle + cement (W_2)(g)	1231	1231	1231
Wt. of bottle + cement + kerosene (W_3)(g)	1695	1695	1695
Wt. of bottle + kerosene (W_4)(g)	1190	1190	1190
Specific gravity (G)	3.00	3.00	3.00
Average specific gravity		3.15	

4.2 FINENESS TEST

Fineness of cement is a relative measure of particle size. The fineness of cement has an important bearing on the rate of gain of strength and also on the rate of evolution of heat. Finer cement offers a greater surface area for hydration and hence the faster and greater the development of strength. Maximum number of particles in the sample of cement should have a size less than 90 micron. The smallest particle may have a size of 1.5 micron. An average size of the cement particles may be taken as 10 micron. To find the fineness of the given cement the equipments required are, IS sieve 90

micron25 mm or 40 mm bristle brush Thus from the results we infer that the fineness of the cement is 28.50%

5. MIX DESIGN CALCULATION

5.1 CONCRETE MIX DESIGN CALCULATION FOR M25 GRADE WITH PROCEDURE

Concrete mix design is required to gain target strength in structures.

Concrete mix design of M25 grade of concrete can be calculated.

DATA REQUIRED FOR CONCRETE MIX DESIGN

(i) Concrete mix design stipulation

a). Characteristic compressive strength required in the field at 28DAYS grade designation – **M25**

b). Nominal maximum size of aggregate – 20MM

c). Shape of coarse aggregate – angular

d). Degree of quality control available at site – as per is:456

e). Type of exposure the structures will be subjected to (as defined in is:456) – mild

f). Type of cement : psc conforming is:455

(ii) Test data of material (to be determined in laboratory)

a). Specific gravity of cement = 3.15

b). Specific gravity of fine aggregate = 2.64

c). Specific gravity of coarse aggregate = 2.84

d). Fine aggregate confirm to zone ii of is – 383

5.2 ESTIMATION OF MIX INGREDIENTS

a) Volume of concrete = 1 m^3

b) Volume of cement = (383.2 / 3.15) x (1/1000)

= 0.122 m^3

c) Volume of water = (191.6/1) x (1/1000)

= 0.1916 m^3

d) Volume of total aggregate = 1 – (0.122 + 0.1916)

= 0.6864 m^3

e) Mass of coarse aggregate = 0.6864 x 0.589 x 2.84 x 1000

= 1148.18 kg/m^3

f) Mass of fine aggregate = 0.6864 x 0.442 x 2.64 x 1000

= 800.95 kg/m^3

6. CONCLUSIONS

To find the self curing and self compacting properties of concrete the preliminary tests for materials were conducted.

It is obtained that, specific gravity of cement 3.15, fineness of cement is 28.5%,specific gravity of coarse aggregate 2.54,specific gravity of fine aggregate 2.64, proper mix for adding various percentage of chemicals is designed.

REFERENCES

[1] Mr.Sanjay raj A , Yogananda N ; " Experimental investigation on self curing and self compacting concrete by replacing natural sand by M-sand and coarse aggregate by light weight aggregate for M40 grade concrete"- REVA institute of technology and management Bangalore, Volume 4, issue No.8 August 2014.

[2] Riaz ahamed K , Pradeep Kumar A, Durai priyadharsini, Kalaivani K, Kingsta Beautline M " Experimenal study on self curing concrete using Sodium Ligno sulphate, International journal of emerging technologies and engineering, Volume 2, issue No.4 April 2015.

[3] Mr. Ramaloghar, Mr. Bhagwat duokar, Mr. Ambadass kale " A Study on internal curing of self compacting concrete using admixtures PEG400 and Super plasticizers. International journal of science technology and management Volume 5, issue No.12 December 2016.

[4] Mr.H,j.h Brouwers,H.j Redix. This paper addresses experiments and theories on Self-Compacting Concrete. First, the features of "Japanese and Chinese Methods" are discussed, in which the packing of sand and gravel plays a major role. Mr.J,M.Khatib. The influence of including fly ash (FA) on the properties of self-compacting concrete (SCC) is investigated. Portland cement (PC) was partially replaced with 0–80% FA. The water to binder ratio was maintained at 0.36 for all mixes. Properties included workability, compressive strength, ultrasonic pulse velocity (V), absorption and shrinkage.