Indian J.Sci.Res. 17(2): 327 - 329, 2018 ISSN: 0976-2876 (Print)
ISSN: 2250-0138(Online)

PROPERTIES OF SELF-COMPACTING CONCRETE WITH PERI-SHUTTERING TECHNOLOGY

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Abstract-Self-compacting concrete (SCC) is an innovative concrete that does not require vibration for placing and compaction. It is able to flow under its own weight, completely filling formwork and achieving full compaction, even in the presence of congested reinforcement. Complex shape of concrete structures and densely arranged bars make it more difficult to use a vibrator. In remote areas it is difficult to find skilled workers to carry out the compacting work at construction sites. SCC solves all this criteria. Selfcompacting concrete development must ensure a good balance between deformability and stability. Also, compatibility is affected by the characteristics of materials and the mix proportions; it becomes necessary to evolve a procedure for mix design of SCC. The present study presents an experimental procedure for the design of self-compacting concrete mixes. The test results for acceptance characteristics of self-compacting concrete such as slump flow presented. Further, compressive strength of normal graded (M30) and SCC containing 15% fly ash cubes at the ages of 7 and 28days was also determined and results are included here. With combination of SCC and shuttering gives the elimination of brick work and makes the work easier.

Keywords :Self compacting Concrete, Fly ash, Slump flow, Compressive strength

I. Introduction

Cement-based materials are the most abundant of all man-made materials and are among the most important construction materials, and it is most likely that they will continue to have the same importance in the future. The self-compacting concrete (SCC), is a modified product that without additional compaction energy, flows and consolidatesunder the influence of its own weight. The use of SCC offers a more industrialized production. Not only will it reduce the unhealthy tasks for workers, it can also reduces the technical costs of in situ cast concrete constructions, due to improved casting cycle, quality, durability, surface finish and reliability of concrete structures and eliminating some of the potential for human error. However, SCC is a sensitive mix, strongly dependent on the composition and the characteristics of its constituents.

Self-compacting concrete is considered a concrete that can be placed and compacted under its own weight without any vibration effort complete filling of formworks even when access is hindered by narrow gaps between reinforcement bars. Concrete that must not be vibrated is a challenge to the building industry In order to achieve such behaviour; the fresh concrete must show both high fluidity and good cohesiveness at the same time.

As the durability of concrete structures became an important issue in Japan, an adequate compaction by skilled labours was required to obtain durable concrete structures. This required led to the development of SCC and its development was first reported in 1989. SCC can be desired as a high performance material which flows under its own weight without requiring vibrators to achieve consolidation by complete filling of formworks even when access is hindered by narrow gaps between reinforcement bars. SCC can also be used in situations where it is difficult or impossible to use mechanical compaction for fresh concrete, such as underwater concreting, cast in-situ pile foundations, machine bases and columns or walls with congested reinforcement. Recently, this concrete has gained wide use in many countries for different applications and structural configurations. It can also be regarded as "the most revolutionary development in concrete

Construction for several decades".the type styles are provided throughout this document and are identified in italic type, within parentheses, following the example

A.FLY ASH

Fly ash is the finely divided residue resulting from the combustion of coal. It is a pozzolanic material that is commonly used in cement-based materials and the particles are generally finer than cement particles. The size of particles is largely dependent on the type of dust collection equipment. Diameter of fly ash particles ranges from less than 1μm-

150μm. The surface area is typically 300 to 500m2/kg although some fly ashes can have surface areas as low as 200m2/kg and as high as 700m2/kg. The relative density or specific gravity of fly ashes ranges between 1.9 and 2.8 and the colour is generally gray or tans (Halsted, 1986).

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Fig 1:Sample of fly ash

TABLE I. Physical properties of soil

TABLE II. Chemical Compositions of fly ash

Composition	Weights
Sio3	0.23 to 3
Cao	3.52 to 40
Mgo	2.52 to 25
Sio2	1 to 12
Al2o3	0.5 to 40

Parameters	Fly Ash
Bulk Density (gm/cc)	0.9-1.3
Specific Gravity	1.6-2.6
Plasticity	Lower or non-plastic
Shrinkage Limit (Vol stability)	Higher
Grain size	Major fine sand / silt and small per cent of clay size particles
Clay (percent)	Negligible
Free Swell Index	Very low
Classification (Texture)	Sandy silt to silty loam
Water Holding Capacity (WHC)(percent)	40-60
Porosity (percent)	30-65
Surface Area (m2 / kg)	500-5000

II.Objectives

1) To determine the SCC characteristics by conducting laboratory tests such as Compressive strength,Slump cone.
2) To determine the above properties of the SCC admixed with Class F Flyash by 15% of proportion.
3) To compare the various changes occurred in the SCC with the admixture i.e.Fly ash

III. Literature review

EFNARC (2002) investigated that the SCC flows alone under its dead weight up to levelling, airs out and consolidates itself thereby without any entry of additional Compactionenergy and without a nameable segregation. Due to the high content of powder, SCC may show more plastic shrinkage or creep than ordinary mixes. These aspects should therefore be considered during designing and specifying SCC.

N R Gaywala, D B Raijiwala-Denser reinforcement is possible with SCC. More innovative design, more complex shape, thinner section, etc are possible. Safe working environment is Possible due to the elimination of manual labour (vibrating operator, mason etc.) for compaction and finishing works.

IV. Materials used

The materials used in the present investigation were

1.Self Compacting Concrete
2.Class F Fly ash

V.Test to be conducted

1. Fineness, normal consistency of cement
2. Initial and Final setting time of cement
3. Aggregates sieve Analysis
4. Slump flow test
5. Compressive strength of SCC with 15% fly ash

VI.Results&Discussions

TABLE III. Physical properties of cement

S.no	Test Parameters	Results
1.	Normal Consistency	31.5%
2.	Fineness	296m^2/kg
3.	Initial Setting time	275mins
4.	Final Setting time	310mins

TABLE IV.Aggregate Sieve Analysis for 20 mm dia

IS Sieves 'mm'	Weight Retained (gms)	% wt. Retained	Cum % Retained
40	0	0.00	0.00
20.0	620	12.40	12.40
10.00	3842	76.84	89.24
4.75	532	10.64	99.88
Pan	6	0.12	100.00
Total Weight:	5000		

TABLE V:Fresh Concrete properties of SCC having fly ash 15%

Mixture ID	Slump flow (mm)
M40 (SCC with 15% fly ash)	690mm
M30 (Normal Grade)	110mm

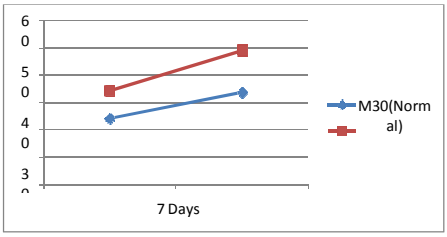
TABLE VI.Compressive Strength Normal Graded (M30) Concrete (7, 28 days)

Grade*	Life of Cube	Weight (kg)	Load (KN)	Compr. Strength (N/sq.mm)	Avg (N/sq. mm)
M30 (Normal)	7 Days	8.098	539	23.96	24.16
		8.144	544	24.18	
		8.122	548	24.36	
	28 Days	8.120	749	33.29	33.69
		8.078	770	34.22	
		8.168	755	33.56	

TABLE VII.Fresh Concrete properties of SCC having fly ash 15%

Grade*	Life of Cube	Weight (kg)	Load (KN)	Compr. Strength (MPa)	Avg (MPa)
M40 (SCC)	7 Days	8.146	763	33.91	34.31
		8.048	764	33.96	
		8.020	789	35.07	
	28 Days	8.016	1096	48.71	48.95
		8.192	1130	50.22	
		8.082	1078	47.91	

Fig 1 Compressive Strength of Normal graded concrete and 15% fly ash SCC concrete cubes



VII.Conclusions

- Self-consolidating concrete is still considered by many to be a “Special” concrete. The addition of fly ash as a replacement for cement will not only Decrease the price of SCC, but also there are also environmental benefits that Occur from the utilization of a waste material and the reduction in landfillspace.
- SCC can be placed at a faster rate with no mechanical vibrators, resulting in saving in placementcosts.
- SCC gives good finishing as compared to ordinary concrete without any external mean ofcompaction.
- The maximum compressive strength,self compacting concrete can be obtained by addition of 15% of fly ash in mix as compared to addition of 15% and
- SCC gives good durability properties as compared to the ordinaryconcrete.Considering the economy and the durability of conventional concrete structures,itis observed that the quality and the density of the concrete, as well as the compaction of the concrete are main parameters that cause deterioration. For this, SCC offers new possibilities andprospects.

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