STUDY ON M60 GRADE STEEL FIBRE REINFORCED SELF COMPACTING CONCRETE

Self-concrete

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***Abstract*: Self compacting concrete has been described as "the most revolutionary development in concrete construction for several decades". A self-compacting concrete, which has excellent deformability and resistance to segregation and can be filled in heavily reinforced form work without vibrators was developed 20 years ago. SCC is defined as a concrete, which can be placed and compacted into every corner of formwork, purely by means of its self-weight by eliminating the need of either external input from vibrators or any other type of effort. Due to its specific properties, SCC may contribute a significant improvement in the quality of concrete structures and open up new fields for the application of concrete. The use of self-compacting concrete is spreading worldwide because of its very attractive properties in the fresh state as well as after hardening. SCC improves the quality, durability and reliability of concrete structures and eliminates some of the potential for human error. It will replace manual compaction of fresh concrete with a modern semi-automatic placing technology and in that way improve health and safety on and around the construction site.As the main feature of SCC is the behavior in the fresh state, the mix design is especially focused in this point. SCC is designed to be able to flow under its own weight without external vibration and with sufficient viscosity. The flow behavior can be roughly evaluated by the slump flow test. For SCC we will need a high final spread and a maximum limit to the slumping time T 50cm. A concrete mix can only be classified as self-compacting concrete if the requirements for all three characteristics i.e. filling ability, passing ability, segregation resistance, are fulfilled. Superpasticizers are an essential component of SCC to provide the necessary workability. Other types may be incorporated as necessary, such as viscosity modifying admixtures (VMA) for stability; air-entraining admixtures to improve freeze thaw resistance, retarders for control of setting etc. Fly ash is a fine inorganic material with pozzolanic properties, which can be added to SCC to improve its properties.**

Index Terms*: *self-concrete

I. INTRODUCTION

1.1 General

At present world is witnessing the construction of very challenging and difficult Civil Engineering structures. Quite often, concrete being the most important and widely used material is called upon to possess very high strength and sufficient workability properties. Efforts are being made in the field of concrete technology to develop such concrete with special characteristics. Researchers all over the world are attempting to develop high performance concrete by using various admixtures in concrete up to certain proportions. One of the most outstanding advances in the concrete technology for the last decade is "**Self Compacting Concrete (SCC)**".
The main characteristics of SCC are the properties in the fresh state. The mix design is focused on the ability to flow under its own weight without vibration, the ability to flow through heavily congested reinforcement under its own weight, and the ability to retain homogeneity without segregation. Due to its specific properties, SCC may contribute a significant improvement of the quality of concrete structures and open up new fields for the application of concrete.

Self-Compacting Concrete (SCC) is defined as: "A Category of high- performance concrete that has excellent deformability in the fresh state and high resistance to segregation and can be placed and compacted under its self-weight without applying vibration". SCC is also referred as self-leveling concrete, super workable concrete, self-consolidating concrete, highly flowable concrete, non-vibrating concrete etc.

I. Application of SCC

The use of self compacting concrete is recommended for all applications, where the mentioned advantages are necessary to assure a good concrete quality.

Congested Structures

Skill of workers

Decreasing

Self-compacting concrete

Solution

Durable concrete structures

The application of SCC is limited to special cases where it is impossible to use ordinary concrete. Practical applications of SCC worldwide are

- Of the most outstanding applications of SCC in Japan, Yakoham land mark tower and Akashi-kaikyo-bridge are significant examples.
- SCC was used for the construction of wall of a large LNG tank belonging to Osaka gas Company in 1998.

II.PROPERTIES OF FRESH SCC:

SCC differs from conventional concrete in that its fresh properties are vital in determining whether or not it can be placed satisfactory. The various aspects that govern the workability of SCC are: its

- *Filling ability:*

Ability of fresh concrete to flow into and all spaces within the formwork, under its own weight.

- *Passing ability:*

Ability of fresh concrete to flow through tight openings such as spaces between steel reinforcing bars without segregation or blocking.

- *Segregation resistance:*

Ability of concrete to remain homogeneous in its form while in its fresh state. All these need to be carefully controlled to ensure that its ability to be placed remains acceptable.

- *III.Workability:*

The level of fluidity of the SCC is governed chiefly by the dosage of the super plasticizer. Overdosing of which may lead to the risk of segregation and blockage. Consequently the characteristics of the fresh SCC need to be carefully controlled using preferably two of the different types of tests.

- *IV.Segregation Resistance:*

Due to the high fluidity of SCC, the risk of segregation and blocking is very high. Preventing segregation is therefore an important feature of the control regime. The tendency to segregation can be reduced by use of sufficient amount of fines (<0.125 mm), or using a Viscosity Modifying admixture (VMAV)

Funnel test and V funnel test at T 5minutes

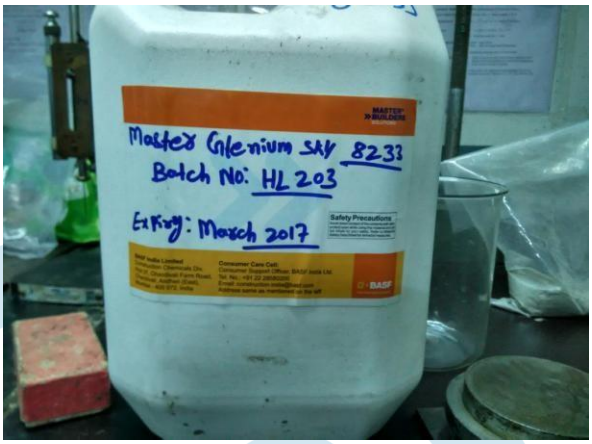
(a)

(b)

S.no	I.S.Sieve	Weight retained (gm)	% Wt retained (gm)	Cumulative % of wt retained	Percentage passing (By weight)
1	10 mm	-	-	-	100
2	4.75 mm	13	1.30	1.30	98.70
3	2.36 mm	24	2.40	3.70	96.70
4	1.18 mm	142	14.20	17.90	82.10
5	600µ	564	56.40	74.30	25.70
6	300 µ	230	23.00	97.30	2.70
7	150 µ	20	2.70	100.00	0
8	Lower than 150 µ	7	-	-	-
Total		1000		294.00	

V.Dosage

The normal dosage of Glenium B 233 is between 0.5 and 1.5 liters per 100 kg of cement (cementious materials). Dosage outside this range is permissible subject to trial mixes.



TEST RESULTS

S.No.	Specimen size	% of steel Fibres of aspect ratio 50.	Load In KN	AVG Split tensile Strength in N\mm^2 (2P/πld)
I	150x150mm	0.00%	130.1	3.68
II	150x150mm	0.25%	138.3	3.91
III	150x150mm	0.50%	152.8	4.32
IV	150x150mm	0.75%	162.7	4.60
V	150x150mm	1.00%	187.1	5.29
VI	150x150mm	1.25%	219.2	6.20
VII	150x150mm	1.50%	186.7	5.28

DISCUSSION ON TEST RESULTS

VI. Mix proportions

In the present investigations, the mix proportioning is done using Erntroy &Shaklok method for M-60 grade concrete. The Resulting mixes are modified after conducting trials at laboratory, duly following the EFNARC guidelines to achieve self- compacting ability of concrete. Test specimens of cubes, beams, cylinders are caste with batches of seven varieties of SCC by varying the percentage of steel fibers from 0.00%to 1.50% (by volume of concrete.)

The usage of superplasticizer increased linearly with increase in percentage of steel fibers content and maximum dosage of 1.40 lts at 1.50% of steel fibre demanded to keep the self compacting parameters within EFNARC specifications. The increase in dosage of superplasticizer with increase of steel fibre for maintaining the balance between fluidity and resistance to segregation of flow able concrete.

Fresh concrete.

The workability of test results is given in table 5.10. Fig. 5.5.3 to 5.5.9 shows the various test results of fresh SCC and EFNARC acceptance criteria limits. Conventional SCC has satisfied all the parameters according to EFNARC specifications .The T 50 cms slump flow test result value, v funnel& v funnel at T 5 mts test result value, increased as the % of steel fibers increased in SCC.

The mixes were self-compactable and any means of external vibration is not applied for compaction during casting of the specimens. This shows that steel fibre reinforced concrete can also be produced using SCC technology, without any vibration

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