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Self Compacting Concrete with Super Plasticizer Polycarboxlic Ether

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ABSTRACT *Self-compacting concrete is fluid mixture suitable for placing in structure with congested reinforcement without vibration. Self-consolidating concrete is a highly flowable type of concrete that spreads into the form without the need for mechanical vibration. It eliminates mechanical vibration and reduces screeding, Eliminating vibration in precast production settings reduces noise. Self-compacting concrete is a non-segregating concrete that is placed by means of its own weight. It is to prepare a self compacting concrete with partially replacing of cement with fly-ash (5%, 10%,15%) that maintains all concrete's durability and characteristics meeting expected performance and requirements and also to prepare a self compacting concrete by adding Polycarboxylic ether that have all the properties of a concrete. It becomes necessary to evolve the procedure for mix design of SCC. The test results for acceptance characteristics of self compacting concrete such as slump flow and L- funnel are presented. Further, comprehensive Strength at the age of 7, 14 and 28 days was also determined and results are included here.*

Keywords: *self compacting concrete, fly-ash, mix design, Comprehensive strength.*

I. INTRODUCTION

Self-Compacting Concrete (SCC), which flows under its own weight and does not require any external vibration for compaction, has revolutionized concrete placement. SCC, was first introduced in the late 1980's by Japanese researchers , is highly workable concrete that can flow under its own weight through restricted sections without segregation and bleeding. Such concrete should have a relatively low yield value to ensure high flow ability, a moderate viscosity to resist segregation and bleeding, and must maintain its homogeneity during transportation, placing and curing to ensure adequate structural performance and long term durability. The successful development of SCC must ensure a good balance between deformability and stability. Researchers have set some guidelines for mixture proportioning of SCC, which include i) reducing the volume ratio of aggregate to cementitious material ; (ii) increasing the paste volume and water-cement ratio (w/c); (iii) carefully controlling the maximum coarse aggregate particle size and total volume; and (iv) using various viscosity enhancing admixtures . For SCC, it is generally necessary to use super plasticizers in order to obtain high mobility. Adding a large volume of powdered material or viscosity modifying admixture can eliminate segregation. The powdered materials that can be added are fly ash, silica fume, lime stone powder, glass filler and quartzite filler. Since, self-compactibility is largely affected by the characteristics of materials and the mix proportions, it becomes necessary to evolve a procedure for mix design of SCC. In this system, the coarse aggregate and fine aggregate contents are fixed and self-compactibility is to be achieved by adjusting the water /powder ratio and super plasticizer dosage. The coarse aggregate content in concrete is generally fixed at 50 percent of the total solid volume, the fine aggregate content is fixed at 40 percent of the mortar volume and the water /powder ratio is assumed to be 0.9-1.0 by volume depending on the properties of the powder and the super plasticizer dosage. This paper describes a procedure specifically developed to achieve self-compacting concrete. In addition, the test results for acceptance characteristics for self-compacting concrete such as slump flow and L-Box are presented. Further, the strength characteristics in terms of compressive strength for 7-days, 14days and 28 days are also presented.

1.1 Material used

- **Cement** : OPC grade 43
- **Coarse aggregate** : rounded 10-15 mm diameter
- **Fine aggregate :** zone 2
- **Fly-ash**
- **Superplasticizer :** polycarboxlic ether

II. METHODOLOGY

Self- Compacting Concrete is characterized by filling ability, passing ability and resistance to segregation. Many different methods have been developed to characterize the properties of SCC. In the experiment we use **M30** grade of concrete for the cube casting and to perform compressive strength test . No single method has been found until date, which characterizes all the relevant workability aspects, and hence, each mix has been tested by more than one test method for the different workability parameters. Table 1 gives the recommended values for different tests given by different researchers for mix to be characterized as SCC mix.

2.1 Table . Recommended Limits for Different Properties

TABLE NO : 1 Range of slump

Sr. No.	Property	Range
1.	Slump Flow Diameter	500-700 mm
2.	L-Box H2/H1	≥ 0.8

The slump flow test is used to assess the horizontal free flow of SCC in the absence of obstructions. On lifting the slump cone, filled with concrete, the concrete flows. The average diameter of the concrete circle is a measure for the filling ability of the concrete. The time T_{50cm} is a secondary indication of flow. It measures the time taken in seconds from the instant the cone is lifted to the instant when horizontal flow reaches diameter of 500mm.

FIGURE NO :1 Slump flow

The passing ability is determined using the L- box test [10] as shown in Fig 3. The vertical section of the L-Box is filled with concrete, and then the gate lifted to let the concrete flow into the horizontal section. The height of the concrete at the end of the horizontal section is expressed as a proportion of that remaining in the vertical section (H2/H1). This is an indication of passing ability. The specified requisite is the ratio between the heights of the concrete at each end or blocking ratio to be ≥ 0.8.

FIGURE NO : 2 L-box test

FIGURE NO: 3 Compressive strength test is performed by comprehensive strength test machine

2.2 Experimental procedures

- The **M30** grade of concrete is used in this experiment and the mix design is prepared for M30.
- The materials are firstly mix by properly weigh batching process.
- The materials the mixed as by hand mixing process
- SCC1 is normal mix prepared as without any superplasticizer additional or nor any fly-ash mix. The SCC1 mix is to prepare the self compacting concrete without any additional superplasticizer.
- Thereafter SCC2, SCC3 , SCC4 mix is prepared at 5%, 10%, 15%, addition of fly-ash and also superplasticizer is used as per mix design.
- The slump flow test performed on the mixes to the check the filling ability of the mixes.
- The L-box test is performed on the mix to check the passing ability of the mixes.
- 9 Cubes/mixes are casted to check the compressive strength of the concrete . 3 cubes are for 7 day test , 3 cube for 7 days and 3 cubes for 28 days test. Whole 36 cubes are casted to check the compressive strength of the cube .
- Average compressive strength are taken as a comprehensive strength at the day .
- Comparison b/w normal concrete and self compacting concrete are performed to get the conclusion.

2.3 Mix Proportions

TABLE NO : 2 MIX PROPORTION

Sr.No.	Mix	Cement (Kg/m^3)	Fly ash (Kg/m^3)	F.A (Kg/m^3)	C.A (Kg/m^3)	Water (Kg/m^3)	S.P. (%)
1	SCC1	551	0	1008	712	223	0
2	SCC2	523	28	1008	712	179	1.14
3	SCC3	496	55	1008	712	179	1.14
4	SCC4	468	83	1008	712	179	1.14

III. TEST RESULTS

3.1 Workability and compressive strength results

TABLE NO : 3 RESULTS

Sr.No	Mix	Slump flow (mm)	L-box Blocking ratio(H2/H1)[d]	7days (MPa)	14days (MPa)	28days (MPa)
1	SCC1	676.7	0.90	12.00	18.64	24.87
2	SCC2	713.33	0.95	13.13	19.65	27.57
3	SCC3	660	0.90	11.15	17.46	26.54
4	SCC4	670	0.67	12.21	15.92	24.21

The consistency and workability of SCC1 to SCC5 satisfied slump flow property but SCC3 was the only mix to have T50 cm as 2 sec, thus satisfying both slump flow and time property. In addition, all the mixes SCC1 to SCC5 have the V-funnel time T_f between 6-12 sec and V-funnel time T_{5min} within the range of T_f +3. The L-Box blocking ratio H2/H1 could not be satisfied for SCC1.

IV. CONCLUSION

1. The 0% fly ash mix have the normal filling ability but the compressive strength is not gained
2. The SCC1 to SCC5 mixes can be easily used as medium strength SCC mixes, which are useful for most of the constructions; the proportions for SCC3 mix satisfying all the properties of Self-Compacting Concrete can be easily used for the development of medium strength self-compacting and for further study.
3. In the test results we got the best result on SCC2.
4. As SCC technology is now being adopted in many countries throughout the world, in absence of suitable standardized test methods it is necessary to examine the existing test methods and identify or, when necessary to develop test methods suitable for acceptance as International Standards. Such test methods have to be capable of a rapid and reliable assessment of key properties of fresh SCC on a construction site. At the same time, testing equipment should be reliable, easily portable and inexpensive. A single operator should carry out the test procedure and the test results have to be interpreted with a minimum of training. In addition, the results have to be defined and specify different SCC mixes. One primary application of these test methods would be in verification of compliance on sites and in concrete production plants, if self-compacting concrete is to be manufactured in large quantities.

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