IMPACT: International Journal of Research in Engineering & Technology (IMPACT: IJRET)
ISSN(E): 2321-8843; ISSN(P): 2347-4599
Vol. 2, Issue 5, May 2014, 271-274

STUDY ON FRESH PROPERTIES OF SELF COMPACTING CONCRETE WITH PROCESS FLY ASH

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ABSTRACT

Self compacting concrete (SCC) is a latest innovation in concrete technology and it is gaining popularity all over the world because of its self flow ability but it requires the large amount of powder content. We have replaced the cement by fly ash in different percentage in laboratory and variations in fresh properties of Self Compacting Concrete are studied. During the study Slump flow, slump flow T_{50cm} time, L box passing ratio test, V funnel passing time test were carried out according to the EFNARC standards. Studies show the increase in the flow ability of the self compacting concrete as fly ash percentage get increases.

KEYWORDS: Self Compacting Concrete, Fly Ash & Fresh Properties of SCC

INTRODUCTION

There has been an increase in using self-compacting concrete (SCC) in recent years and a number of papers have been published [1–6]. Self-compacting concrete is innovative type of concrete which has the characteristics of self placed and compacted under its own weight without segregation and bleeding and with little or no vibration. SCC was first developed in Japan around late nineteen eighties because concrete dualities got affected by poor workmanship and less number of skilled worker availabilities [4]. It gained popularity in last few decades because it leads to improve concrete quality, productivity and working conditions compared to normally vibrated concrete (NVC) [2]. SCC allows the construction of more slender building elements and more complicated and interesting shapes. The production of SCC allows the pumping of concrete to a great height and the flow through congested reinforcing bars without the use of compaction other than the concrete self-weight.

EXPERIMENTAL PROGRAMME

Materials

Standard 53grade Ordinary Portland cement having specific gravity of 3.14 is used as per IS 12269 (1987). Processed Class F fly ash of a specific gravity 2.3 and other chemical composition follows specification as per IS 1727:1967. Crushed course aggregate of 10 mm down size with specific gravity of 2.8 and bulk density of 1450kg/m3 are used and followed by IS specification as IS 383. Locally available river sand of specific gravity 2.7 and bulk density 1800kg/m3 and of Zone II type is used. It follows specifications as per IS 383. To enhance workability and to reduce the w/c ratio Polycarboxylate polymers based super-plasticiser are used as per IS 9103. Water soluble VMA is used to enhance segregation resistance and to improve the viscosity of the mix. Potable water for mixing and curing of concrete specimens is used.

Mix Design

Self compacting concrete prepaid with the basic ingredients like Cement, Fly Ash, Coarse Aggregate, Fine Aggregate, Water, Super Plasticizer, VMA in various proportions such that homogeneous mix can be produced. This proportioning of concrete mixes consists of determination of the quantities of respective ingredients necessary to produce concrete having adequate, but not excessive, workability and strength for the particular loading and durability for the exposure to which it will be subjected.

Total five different mixes were employed with different fly ash content to examine the fresh properties of the self compacting concrete (SCC). For five different mixes Ordinary Portland Cement is replaced by Fly ash as 30%, 40%, 50%, 60% and 70 % of total binder materials and different designed mix named A30, A40, A50, A60 and A70 respectively. In the study various Fresh properties like slump flow, J ring flow, Slump flow T50 time, L box passing ratio and V funnel time are observed for all mixes.

The binder consists of Ordinary Portland Cement and Fly Ash. Details of A30 design mix is given in the table 1. For all the mix binder content kept constant as a 560 kg/m3 and water to binder ratio also maintain consistent as a 0.34 for all the design mix.

Table 1: Design Mix of A30

Constituent	Quantity (Kg/M3)
Cementitious Material	560
Cement	70% of Cementitious Material
Fly ash	30% of Cementitious Material
Coarse aggregates (<10 mm)	615
Fine aggregates	1010
W/ C Ratio	0.34

RESULTS AND DISCUSSIONS

All mixes exhibited high workability, in that the flow spread (i.e. diameter) for all mixes is in excess of 725 mm. These values are inline of the EFNARC standard limits as Slump flow of 650 to 800 mm required for SCC. By visual examination of mixes containing FA suggest that there is further increase in workability as fly ash content increases as compared with the A30 mix, for the same dosage of admixtures (i.e. 1.0%). It seems that concrete containing FA will cause an increase in workability at constant water to binder ratio. So it is well established that the use of FA in concrete reduces the water demand for a given workability.

Table 2: Fresh Properties of SCC Mixes

Mix	Slump Low (Mm)	Slump Flow T50 (S)	L Box	V. Funnel (S)
A30	730	4	0.84	11
A40	755	3.8	0.87	10.8
A50	760	3.4	0.9	10
A60	770	3	0.9	9.7
A70	780	2.7	0.92	9.5
EFNARc	650 – 800	2 - 5	0.8 - 1	6 – 12

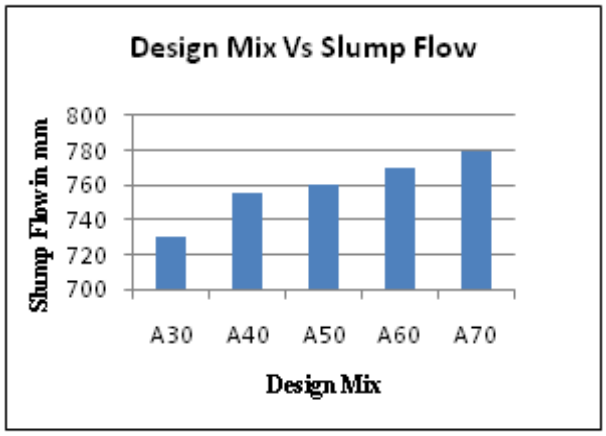

Figure 1: Graph of Slump Flow

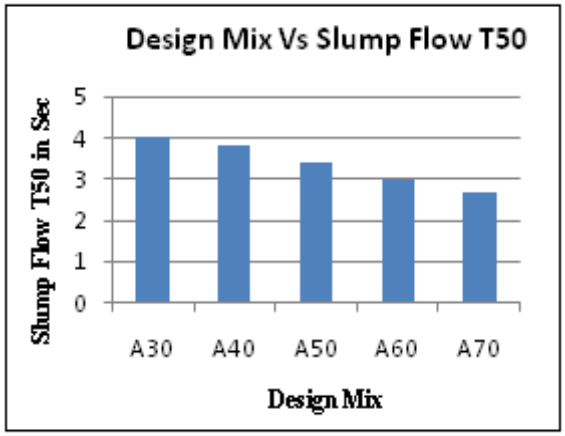

Figure 2: Graph of Slump Flow T50

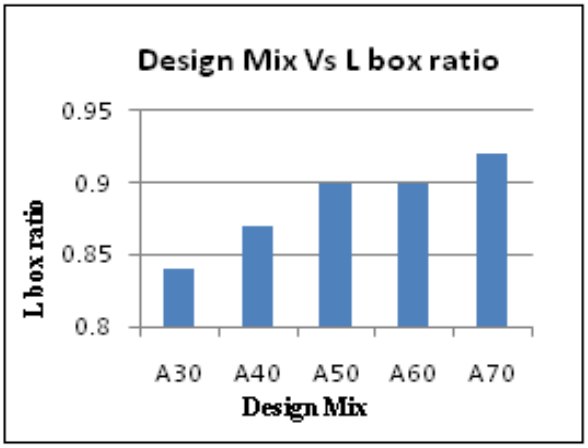

Figure 3: Graph of L Box Ratio

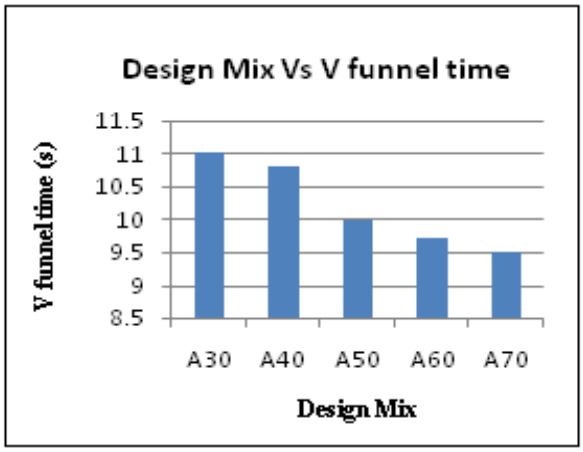

Figure 4: Graph of V Funnel Time

CONCLUSIONS

Based on the results presented in this paper, the following conclusions are drawn:

- Slump flow increases as the percentage of fly ash replacement increases in the mix and slump spread is increasing from 730 to 780 as fly ash increases from 30 percentage to 70 percentage.
- L box ratio is increases as the fly ash is increases in the mix as a replacement of the cement.
- V funnel passing time get reduce as the fly ash percentage increases from 30 to 70 percentage.
- Addition of fly ash increases the workability of the concrete, which enable us to reduce the water to binder ratio for the same workability.

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