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Flexural Behavior of M30 Grade of Self Compacting Concrete Beams Blended with Alccofine and Fly ash

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Abstract - *This investigation is mainly focused on the effect of mineral admixtures fly ash (FA) and Alccofine (AF) on the flexural behaviour of reinforced SCC beams. In this study, replacement level of FA was kept at 20% for all concrete mixes with varying dosages of AF (0%, 5%, 10% & 15%). The compressive strength and flexural strength properties of SCC were determined. During this investigation on reinforced SCC beams, the flexural properties viz. Moment carrying capacity, cracking load, cracking moment, ultimate load, service load and ultimate deflection were determined. These properties were compared with M 30 grade of conventional concrete (CC). As the replacement level of AF increases from 0% to 15%, the cement content has been decreased from 80% to 65%. That's why, flexural behavior of reinforced beams C75FA20AF5 and C70FA20AF10 was less when compared to C80FA20AF0. However, the addition of AF is contributing to the additional strength and partially compensating the strength loss due to reduction of cement percentage. The flexural behavior of the beams C75FA20AF5 and C70FA20AF10 are comparable with M 30 grade CC beam. Hence, these two mixes can be graded as M 30 grade of SCC.*

Key Words: (Flyash, Alcofine, Flexural behavior, self compacting concrete)

1. INTRODUCTION

Many research societies are worked together for finding the accepted and recommended on the design of self compacting concrete and application of self compacting concrete in the form work etc., but the design self compacting concrete is based on the standard guidelines of EFNARC, is the European Federation give to special design in concrete system and construction in chemical industry.

SCC can be identified depends on the concrete fresh characteristics like passing ability, segregation resistance and passing ability as per the EFNARC guidelines. Passing ability can be defined as the ability to pass through the congested areas without any blocking. Filling ability is the able to fill the form work under its own weight completely. Segregation resistance is the maintain uniform mixture through the place and in transportation. Self compacting concrete (SCC) also contain other characteristics like consistency and robustness for maintaining quality mixture, SCC apps also play a major role. Robustness relates to SCC's capacity to maintain its new assets when the quality, amount and environmental circumstances of constituent materials change.

SCC requires good fresh properties, it follow the some specification. Which are possible only by the minimizing of coarse aggregate content and increases the high powder content and use of SP, due to these the cost may be increases and also cause temperature rise due to the hydration process. Therefore to overcome of this problem by the replacement of cement with a mineral admixture, due to this we can increase the fresh properties and reduce the heat of hydration. In this research, fly ash class F (FA) and Alccofine 1203(AF) has been utilized as mineral admixtures in partial replacement of cement in all the mixes of SCC, due to these to reduce the cost and heat hydration, to save environment from landfills and reduce greenhouse gas (CO2) emissions.

2. LITERATURE REVIEW

Rheological speaking, SCC have a low yield stress and plastic viscosity to assure a balancing the fresh properties. A low yield value is needed to improve deformation capacity, while viscosity is essential to SCC for maintain homogeneity in handling and compaction up to before hardening. Sufficient viscosity is required to ensure proper deformation velocity, passing ability and segregation resistance (Newman and Choo, 2003).

Alccofine is a new invention from Ambuja cement, based on the slag of high glass satisfied with small calcium silicate. Alccofine is an ultra-fine cemented material, reduces the water requirement by up to 70% to replace concrete structure with a specified workability. As verified by ASTM C989-99, Alccofine 1203 was used. The particle size of Alccofine is lesser than cement, fly ash and silica fume etc

3. EXPERIMENTAL STUDY

In this study mainly explains about the effect of mineral admixtures FA and AF on the plastic state and hardened properties of SCC. In this study we have to replace the level of FA was assigned at 20% for all concrete mixes with varying dosages of AF (0%, 5%, 10% & 15%). This result compared with SCC mechanical properties of M 30 grade of conventional concrete (CC).

In which, have to used OPC 53 grade of cement, class F fly ash and alccofine as additives, crushed granite stones of size 12.5mm, river sand and SP were used in preparing of fresh concrete of SCC mixes take the w/cm as 0.36 (by weight). Take the materials quantity for sufficient volume, the materials such as dropped in a pan mixture like cement, fly ash and alccofine with the addition of sufficient water content start the pan mixture up to 5 minutes make the paste content after that again add the sand and course aggregate with addition of water required and SP and mixed properly for 5 minutes. After that taking the fresh concrete into the bucket and fill in the slump cone and V-funnel, and L-box from this test find out the deformation rate, viscosity and segregation resistance. As well as prepared the cube and beams fin out the compressive strength and flexural strength. The flexural behavior of reinforced SCC beams was investigated.

3.1Mix Proportions

In the below tables awarded as different type of mixes as well indifferent proportions of constituent materials .which are shown in Table 3.1

Table 3.1 Different proportions of constituent materials

Mix Type	Binder kg/m3	Cement Kg/m3	FA Kg/m3	AF Kg/m3	Water l/m3	12.5mm kg/m3	Sand kg/m3	SP l/m3
C80FA20AF0	499	349	150	0	179.64	721.60	863.36	6.0
C75FA20AF5	499	324	150	25	179.64	721.60	863.36	6.0
C70FA20AF10	499	299	150	50	179.64	721.60	863.36	6.0
C65FA20AF15	499	274	150	75	179.64	721.60	863.36	6.0

3.2 Results and discussion

Below table represents the result of different type of SCC fresh properties which are awarded in the below table i.e., slump flow, T50cm, V-funnel time, and L-box ratio (h2/h1)

Mixes	Slump flow (mm)	T50 (Sec)	V-funnel (Sec)	L-box (h2/h1)
C80FA20AF0	662	3.63	7.92	0.91
C75FA20AF5	668	3.42	8.23	0.89
C70FA20AF10	676	2.92	6.9	0.95
C65FA20AF15	652	3.46	14.72	0.71

FIG 3.1 Mixing

Fig 3.2 Slump flow test L-box test, V-funnel test

3.3 Compressive strength

The compressive strength values of concrete mixes are tabulated in Table

Mixes	Compressive strength (MPa)		
	7 days	28 days	56 days
C80FA20AF0	28.36	41.2	39.26
C75FA20AF5	27.32	38.4	37.2
C70FA20AF10	20.95	36.8	35.6
C65FA20AF15	15.7	33.6	27.9
M 30 (CC)	22.96	36.9	35.46

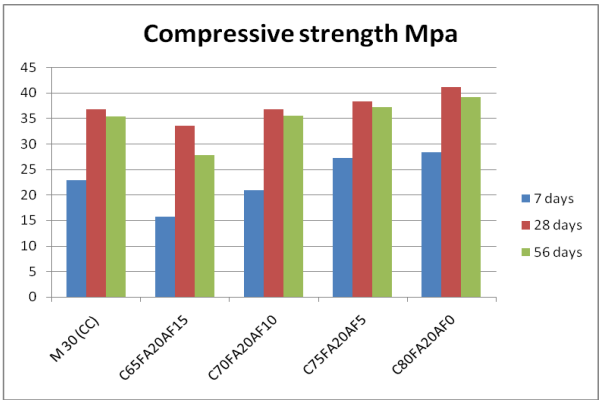

Fig 3.3 Compresive strength

It is notice that the mix C80FA20AF0 (0% of AF) give the higher compressive strength values at all ages. Because of this mix having higher 80% of cement when compare with 5% and 10% of AF mixes that's why it is give higher result. The mix C65FA20AF15 has got lower compressive strength values at all ages when compared to the other mixes. It is due to 65% of cement presented in the mix. As the replacement level of AF increases from 0% to 15%, the cement content has been decreased from 80% to 65%. That's why, the mixes C75FA20AF5, C70FA20AF10 and C655FA20AF15 have got lower compressive strength values when compared to C80FA20AF0. However, the addition of AF is contributing to the additional strength and partially compensating the strength loss due to reduction of cement percentage. Though the compressive strength of the mix C70FA20AF10 (20.95 MPa) is less than that of C75FA20AF5 (27.32 MPa) at 7 days, the compressive strength of C70FA20AF10 is marginally similar to C75FA20AF5 after 28 and 56 days of curing. As the 28-day compressive strength values of C75FA20AF5 and C70FA20AF10 are 33.35 MPa and 32.5 MPa, these two mixes can be graded as M 30 grade of SCC.

3.4 Flexural behavior of reinforced SCC beams

The moment carrying capacity values of reinforced SCC and CC beams are represented in Table

Mixes	Predicted moment carrying capacity (kN-m)- 28Days	Experimental Moment carrying capacity (kN-m)- 28Days
C80FA20AF0	6.56	14.86
C75FA20AF5	6.56	11.78
C70FA20AF10	6.56	11.26
M 30 (CC)	6.56	13.59

From the result that the mix C80FA20AF0 has been give the higher moment carrying capacity after 28 days of curing because of in this mix having 80% of cement. The mix C70FA20AF10 has been give the lower moment carrying capacity when compared to the other mixes because of It is having 70% of cement introduced in the mix. As the replacement level of AF increases from 0% to 10%, the cement content has been decreased from 80% to 70%. That's why, the mixes C75FA20AF5 and C70FA20AF10 have got lower moment carrying capacity when compared to C80FA20AF0. However, the addition of AF is contributing to the additional strength and partially compensating the strength loss due to reduction of cement percentage. Though the moment carrying capacity of C75FA20AF5 and C70FA20AF10 are slightly lower than that of M 30 (CC), they are comparable with that of M 30 (CC).

Fig 3.4 Flexural test of reinforced beam

4. CONCLUSIONS

- The mix C70FA20AF10 with 10% AF got higher values of fresh properties when compared to those of C80FA20AF0 and C75FA20AF5.
- The further increase of AF beyond 10% decreased the SCC fresh properties.
- The mix C65FA20AF15 is not meeting the SCC acceptance criteria.
- As the replacement level of AF increases from 0% to 15%, the cement content has been decreased from 70% to 65%. That's why, the mixes C75FA20AF5, C70FA20AF10 and C65FA20AF15 have got lower compressive strength properties when compared to C80FA20AF0.
- However, the addition of AF is contributing to the additional strength and partially compensating the strength loss due to reduction of cement percentage.
- As the 28-day compressive strength values of C75FA20AF5 and C70FA20AF10 are 38.40 MPa

and 36.80 MPa, these two mixes can be graded as M 30 grade of SCC.

- It is observed that the mix C80FA20AF0 has got higher moment carrying capacity
- The mix C75FA20AF5 has got lower moment carrying capacity

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