International Journal of Enhanced Research in Management & Computer Applications
ISSN: 2319-7471, Vol. 6 Issue 10, October-2017, Impact Factor: 3.578

SCC as a Recent Trend in Construction Technology

Naveen Hooda

Assistant Professor, Civil Engg. Deptt., MRIEM, Rohtak

ABSTRACT

Self compacting concrete (SCC) is new-fashioned concrete technology which is not required to vibrate for placing and compaction. It can flow under its own weight, entirely stuffing formwork and attaining full compaction, even if congested reinforcement is there. This concrete after hardening become dense, homogenous & will have same properties and durability as that of conventional concrete which is vibrated. Complicated formation of concrete structure & closely arranged bares create problem in using a vibrator. Compaction with vibrator causes noise & health problems to workers also inconvenience to people in vicinity. In distant areas it is hard to find skilful workers to bring about compaction job at construction site. An effort is done in this paper to evolve self compacting concrete for few grades (M 15, M 20, M 254, M 30) working with ordinary portland cement, coarse aggregate, five aggregate, water, fly ash as an admixture and Master Glenium Sky (8630) as blend of super plasticizer 4 viscosity transforming vehicle. A no of trail for mix proportioning is made to fulfill workable properties of SCC. The fresh properties like slump flow test, slump flow T 50 an test and sieve segregation resistance tests were performed and examine for EFNARC guidelines. Moreover, compressive strength at age of 7 and 28 days in induced / concluded for SCC by trial and error mix proportioning approach.

Index Term : Self-compacting concrete, strength, durability, fly ash, compressive strength, super plasticizer, rid.

1. INTRODUCTION

Concrete nowaday "as construction material is used popularly around the world, and properties of it are going under changes with technological upgradation. Various concrete come into being to escalate different concrete properties. Thus, development is divided in four phases. Prior is conventional normal strength concrete comprised of four constituents only, that are cement, water, five and coarse aggregate.

Self compacting concrete is becoming popular globally due to its placement facility without any aid of compaction. It was developed in 1988 by Okamura in Japan initially. The specification and guidelines for SCC were formulated by "The European federation of specialist construction chemicals and concrete systems" (EFNARC). It is environmentally safe, as industrial waste are used. However both in conventional concrete and SCC material used are same, by only changing the proportion of mixing and with introduction of admixture SCC demand higher paste volume as compared to that conventional concrete. SCC is intended such that it gets compacted under its own weight and characteristics. The 7 days compressive strength is reduced and 28 days compressive strength is enhanced. Prmeability also reduces, placing is easier, superior surface finish compared to that of ordinary concrete. The cost for SCC is inflated because of addition/ inclusion of super plasticizers and insertion of more cement content. Besides the major advantage of SCC use is, it decreases time of construction and also cost of vibration. Consequently led to reduction of labour cost. Cement content can be minimize by with introduction of fly ash to SCC. Bonding ability will also be more that to ordirary concrete.

Self compacting concrete must have less coarse aggregate and high content of cement. Because of it, cost increases and also temperature during hydration that possibly will influence other properties like shrinkage and creep.

Essentials of SCC

Filling Ability : This is potential of SCC to flow and completely filling within formwork.

Passing Ability : It is the power of concrete of passing through small section in formwork and intently distributed reinforcement bars.

Resistance to segregation : It is the potential for sustaining mix's homogeneity during mixing, transporting and placing.

Material Used

Cement : OPC of Grade – 53 achievable from local market is used. Cement used is tested for various proportion as per is 4301-1988 and get conformed to specifications of is 12269-1987.

Fly Ash : Fly ash taken from Vijayawoda thermal power station. It is worthless product, generated by coal combustion. Fly ash also lessen pollution if compared with cement. Heat of hydration produced is low by using admixture like fly ash.

Fine Aggregate : Fine aggregate is miximized in SCC gradation and shape pray a major part in producing self compacting concrete. Locally available river sand as per IS 383-1970 is used.

Coarse Aggregate : Coarse aggregate of small size and limited amount are used to decrease internal stresses which cause blockage. Size used are 10mm, 12.5mm and 20mm.

Water : used water is tasteless, colorless and fresh. Potaable water that is lacking organic compound is used.

Super Plasticizer : It is a chemical compound that works to improve workabillity without increasing water amount. Master Glenium Sky 8630 is admixture enhances flow of paste and avoid segregation. This admixture permit concrete mix to attain both concrete stability and self-compacting properties.

2 EXPERIMENTAL PROCEDURE

In this an effort is made to develop low and medium strengths of SCC by utilizing trial and error approach of mix proportioning. For SCC, it is essential that mixer is in sound condition and ensures uniform and complete mixing of solid material. Experience shows that time required for achieving complete mixing may be more than required for normal concrete as reduction in frictional forces and activating the admixture entirely. Experimental proceeding includes following steps :

2.1 Properties of material
2.2 Design of concrete mix
2.3 Concrete mixing
2.4 Tests for workability
2.5 Mould preparation
2.6 Properties after hardening

1 Properties of Material

Table 1:

Material	Bulk density	Specific gravity
Cement	1440 kg/m^3	3.11
Fly ash	14410.45	2.12
Coarse agg (10mm)	1600 kg/m^3	2.70
Coarse agg (12.5 mm)	1664.67	2.72
Fine agg	1560.22	2.62

2 Design of concrete mix

No mix design is specified in this paper so we followed IS 10262 (2009) code book applying EFNARC guidelines.
Suppose w/c ratio = 0.5 for all mixes
Select water content
From table 2 of IS 10262 (2009), limit of water content for 10 mm aggregate = 210 litre for slump of

300 mm = $210 + \left(\frac{30}{100}\right) \times 210$

= 273 litre

On trial basis with super plasticizer,
water content = 273 × .80 = 218 litre
Calculation of content of cement =
Water-cement ratio = 0.5

$$\text{Cement Content} = \frac{218}{0.5} = 436 \text{ kg/m}^3$$

Mix Calculation

Calculate concrete volume per unit as –
Volume of concrete = 1 m^3

$$\text{Cement Content} = \frac{\text{Cement Mass}}{\text{Specific Gravity}} \times \frac{1}{1000}$$

$$= \frac{436}{3.11} \times \frac{1}{1000}$$

$$= 0.140 \text{ m}^3$$

$$\text{Water Volume} = \frac{\text{Mass of Water}}{\text{Specific Gravity}} \times \frac{1}{1000}$$

$$= \frac{218}{1} \times \frac{1}{1000} = 0.218 \text{ m}^3$$

Aggregate Volume = 1 – (0.140 + 0.218)
= 0.642 m^3
Fine aggregate mass = 0.642 × 0.55 × 2.62 × 1000 = 926 kg
Coarse aggregate mass = 0.642 × 0.45 × 2.70 × 1000 = 781 kg

Proportioning of Mix for Trial

Cement = 436 kg
Water = 218 kg/m^3
Fine aggregate = 926 kg
Coarse agg = 781 kg
Cement : F.A. : C.A.
1 : 2.12 : 1.80

Table 2: Mix Proportions

Mix	Proportions	Water	Fly ash %	Aggregate Size (mm)
1	1 : 2.1 : 1.8	0.5	0	10
2	1 : 2.1 : 1.8	0.5	10	10
3	1 : 2.4 : 2.0	0.5	0	12.5
4	1 : 2.4 : 2.0	0.5	10	12.5
5	1 : 2.6 : 2.2	0.5	0	20
6	1 : 2.6 : 2.2	0.5	10	20

Table 3: Concrete Proportions

Mix	Cement	Fly ash	Fine aggregate	Coarse Aggregate	Water
1	436	0	926	781	218
2	390	44	926	781	218
3	380	88	926	781	218
4	370	43	965	820	210
5	332	82	965	820	210
6	285	0	1020	865	185

Concrete Mixing
Firstly we have to keep clean and in met condition. Fine and coarse aggregate placed for 1 minute in mixer. Then fly ash and cement were put in together with water and blended for next 2 minutes. Finally add super plasticizer. Mixing time should not exceed 15 minutes in total.

Tests for Workability
Several tests were performed to fulfill fresh properties of SCC. In current work slump flow, T_{50} cm and sieve segregation tests were carried out.

- Slump flow test (filling ability)
- T_{50} cm slump flow (viscosity)

Slump flow and T_{50} cm tests
Slump test is done to verify filling ability of concrete without any kind of difficulty. Apparatus needed is Mould, base plate, ruler trowel and stop watch. Basically mould and base plate must be clean and in dry condition and mould should be placed in centre of base plate.

SCC is filled in slump cone upto its top level. By using trowel, it is leveled and residue overlying on base plate is cleaned soon. Cone now is lifted up and allow concrete to flow. At the same time, stop-watch started. Time that concrete takes to reach 50 cm circle is noted as "T 50 cm slump test" and average diameter that measured on both side is "slump value". T 50 cm value vary from 2 to 6 secs and value of slump flow 600 to 800 mm.

Mix	Slump Flow (mm)	T 50 cm (seconds)
1 (0%)	660	2
2 (10%)	666	2
3 (20%)	674	3
4 (30%)	684	4
5 (0%)	645	3
6 (20%)	648	3

Mould Preparation
Cubes are put to use in this experiment. Mould must be clean and oiled prior to pouring of concrete. After completing workability tests, against strength, concrete for 24 hours kept ins mould then removed and for curing peace it in curing tank and remove after certain period clear up and tested.

Properties after hardening
Compressive Strength Test
Is 516-1959 contains test for demonstrating compressive strengths of concrete. Shape and size of cubical specimen is 15 × 15 × 15 cm. Minimum 3 specimen are coasted for performing test. Cubes are cured to date of testing and are removed from curing tank and tested soon after. In testing machine, cubes are placed in such a way that load is applied to opposite side of casting of cube, which is not to bottom and top.

Compressive strength which is measured, is calculated by dividing maximum load applied to cross sectional area of specimen under test and expressed as N/mm^2. Average value of3 specimen must be taken.

Mix	7 day comp. st. (N/mm^2)	28 days Comp. st.	Grade of concrete	Target mean strength fck=fck+1.65*s (N/mm^2)
1	09.86	27.37	M 20	26.6
2	15.11	31.11	M 25	31.6
3	29.33	37.33	M 30	38.25
4	13.24	29.74	M 25	31.6

S = Standard Deviation in N/mm^2
as per table 1 of IS (10262 – 2009)
For M 20 and M 25 S is 4
For M 30 S is 5

CONCLUSION

- Through analysis we concluded that partially replacing OPC with fly ash do not affect fresh concrete properties to act as self compacting concrete.
- Using fly ash improves cohesiveness of mix, its workability and at last durability of mix.
- Using fly ash direct issues of environment and economy and consequently supporting concrete technology.
- Fly ash reduces strength of concrete if used more than 40% and causes segregation.
- Through analysis we get idea that self compacting concrete also can be done for low and medium strengths.
- With this experiment we come to know that flow ability of 10 and 12.5 mm aggregate is more than 20 mm size aggregate.
- SCC is produced by adding an innovatory viscosity modifying agent with super plasticizer. This composition produces a mix which is very stable 4 robust.

REFERENCES

[1]. EFNARC (The European Federation of Specialist Construction Chemicals and Concrete Systems). The European guidelines for self compacting concrete, May 2005.
[2]. Vipul Kumar, Study on mix design of self compacting concrete, International Research Journal of Engineering and Technology (IRJET), Volume – 2, Issue – 5, Aug. 2015.
[3]. EN 206-1, 2000 – Concrete Part 1 – Specification, performance, production and conformity.
[4]. Khayat K.H. Guizani Z., "Use of Viscosity Modifying Admixture to Enhance Stability of Fluid Concrete", ACI materials journal (94) 4, (1997), 332-340.
[5]. Various Authors (67 Contributions), "Self Compacting Concrete", First International RILEM Symposium on SCC, Stockholm, 9/1999.
[6]. Sonebi M. (2004), "Medium strength self-compacting concrete containing fly ash : modelling using factorial experimental plans", Vol.34, pp. 1199-208.