EFFECT OF SIZE OF COARSE AGGREGATE ON THE PROPERTIES NCCAND SCC

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Abstract

Controlled concrete is made with different variations of aggregates like 10mm, 12.5mm, 16mm and 20mm sizes and also made combination with the replacement of cement with Fly ash. But when came to our research for self-compacting concrete maximum size of aggregates used are 16mm only. Self compacting concrete is wide adopted in concrete for the employment of mass construction. Especially it is employed in the place of engorged reinforcement wherever the compaction can't be done simply. Aside from the assorted uses, it offers the speed of development, provides higher workability and therefore the rate of flow within the plane abundant difficult steel reinforcing bars. Self-compacting concrete may be a product wants the addition of admixtures like Viscosity Modifying Agent (VMA) and Air Entraining Agent (AEA) to the concrete mix so as to extend the benefit and therefore the rate of flow become ease and homogeneity. In this research paper, we study the fresh properties of self-compacting concrete with the variation of aggregates sizes like 10mm, 12.5mm, 14mm and 16mm from the total weight of coarse aggregates and also with the various combinations of admixtures. The fresh properties of self-compacting concrete are done such as passing ability, workability, flowability and finally compressive strength were compared with conventional concrete. SCC characteristics such as flow ability, passing ability and segregation resistance have been verified using slump flow, L box and V funnel tests.

Introduction

Self Compacting Concrete

The adaptability and the utilization of cement in the development business need not be accentuated. For two decades the exploration going on as typical and high quality cements. According to Seems to be: 456-2000 [code of principle for plain and reinforced] the solid, which going from 25-55 MPa is called standard concrete and more than 55 MPa can called as high quality cement.

SCC is another sort of High Performance Concrete (HPC) which has a great deformability and isolation opposition. By name it very well may be characterized as a solid, which can course through and fill the holes of support and the edges of the molds with no requirement for outside vibration. SCC compacts itself because of its self weight and de-circulates air through totally while streaming in the structure work. SCC can likewise be utilized in circumstances where it is troublesome or difficult to utilize mechanical compaction of new concrete, for example, submerged cementing, cast in-situ heap establishments, machine bases and segments or dividers with clogged fortification.

Advantages of self compacting concrete

1. Safe working environment.
2. Speed of placement, resulting in increased production efficiency.
3. Ease of placement, requiring fewer workers for a particular pour.
4. Better assurances of adequate uniform consolidation.
5. Reduced wear and tear on forms

from the vibrator.

6. Reduced wear on mixers due to reduced shearing action.

7. Improved surface quality and few bug holes, requiring fewer patching.

Mechanism For Achieving Self-Compactability

Essentially expanding the water content in a blend to accomplish a flowable solid like SCC is clearly not a reasonable choice. Rather, the test is to build the stream capacity of the molecule suspension and simultaneously keep away from isolation of the stages. The principle instrument controlling the harmony between higher stream capacity and steadiness are identified with surface science. The advancement of SCC has in this way been firmly subject to surface dynamic admixtures just as on the expanded explicit surface zone acquired through the utilized fillers.

Viscosity Modifying Agent

Consistency changing operators are added to build the thickness of the solid so as abstain from draining and isolation as concoction admixtures increment the stream capacity of the solid. To ensure that the solid isn't excessively runny, has a long setting period and loses its holding VMAs are utilized.

VMA's are admixtures intended for explicit applications. Reducing the segregation in highly flow able / self-compacting concrete

- Reducing the washout in underwater concreting
- Reducing the friction and pressure in pumpable concrete
- Reducing the powder content in self compacting concrete
- Reduction in bleeding in the laid concrete.

Fresh Properties Of SCC

Fresh SCC mixes must meet three key properties:

1. Ability to flow into and completely fill intricate and complex forms Under its own weight
2. Ability to pass through and bond to congested reinforcement under its own weight.
3. High resistance to aggregate segregation.

The workability of SCC can be characterized by the properties like filling ability, passing ability and segregation resistance. Tests on fresh concrete are Slump flow & T50 test, V- Funnel, L - Box test, U - Box apparatus test, J-Ring test.

Review of Literature

Self-compacting cement was created from the start in Japan by **Prof.Okamura of Kochi college of Technology in 1986.** Concentrates to create SCC and its usefulness have been completed by Ozawa and Maekawa (1989) at the University of Tokyo. Research researchers everywhere throughout the world have announced the need of admixtures in SCC.

Yahia et al. (1999) and Naik and Kumar (2003) have announced a decrease in the measurements of superplasticizer by utilizing fly fiery debris and impact heater slag in self-uniting cement requiring comparative droop stream contrasted with cement made with Portland concrete as it were.

Okamura and Ouchi (2005) have explored the impact of superplasticizer on the harmony among flowability and thickness of mortar in SCC. Nan Su et al. (2001) 32 Okamura (2003) and EFNARC

rules (2002 and 2005) have proposed the blend structure strategies for SCC utilizing distinctive mineral admixtures. Numerous specialists have announced the utilization of fly fiery debris, GGBS and so forth., as filler materials in SCC.

Hajime Okamura and Masahiro Ouchi (2010) tended to the two noteworthy issues looked by the global network in utilizing SCC, to be specific the 35 nonappearance of a legitimate blend plan strategy and good humored testing technique.

Mayur Vanjare and Shriram Mahure (2015) completed a trial study on to concentrate on the likelihood of utilizing waste material in a planning of creative cement. One sort of waste was recognized: Glass Powder (GP). The utilization of this waste was proposed in various rate as a rather than bond for generation of self-compacting concrete. The expansion of glass powder in SCC blends lessens the self- compactability qualities like filling capacity, passing capacity and by Malhotra VM et al (1993). The stream worth reductions by a normal of 1.3%, 2.5% and 5.36% for glass powder substitutions of 5%, 10% and 15% individually.

Material Used In NCC And SCC

Materials used play very important role in determing the workability of concrete, especially In SCC. The aggregates that are to be used should strictly adhere to the code and in case of coarse aggregate, maximum aggregate size to be used for good workability should 14 mm.

Table: 3.1 Shows The Properties of Cement

s.no	Characteristics	Values	Standard values
1	Normalconsistency	33mm	33 to 35 mm
2	Initial setting time	40 min	< 30mins
3	Final setting time	300 min	> 600 mins.

Table 3.2 Shows The Characteristics of Sand

S.No	Characteristics	Value
1.	Bulking	12.8%
2.	Specific gravity	2.65
3.	Water absorption	12.8%
4.	Fineness modulus	2.8

Quality of Water

The coarse total picked for SCC was regularly round fit as a fiddle, all around evaluated and littler in most extreme size than that utilized for customary cement. The size of coarse total utilized in self-compacting cement was between 10mm to 16mm. The adjusted and littler total particles give better flowability and deformability of cement and furthermore forestall isolation. Evaluated total is additionally significant especially to cast concrete in profoundly clogged support or formwork having little measurements. Squashed stone metal of sizes 16 mm to 10 mm reviewed got from the locally accessible quarries was utilized in the present examination. The totals utilized are fitting in with IS 383. Like the fine totals material testing is accomplished for coarse total too.

Mix Design

The following phases are the mixes of NCC with and without fly ash: -

- **NCC with 60%, 65%, 80% of total weight of aggregates without fly ash content.**

Mix-1:- 3 cubes for each mix contain 60% of total weight of aggregate.

1) 20 mm □ 60%
   16 mm □ 40%
2) 16 mm □ 60%
   12.5 mm □ 40%
3) 12.5 mm □ 60%
   10 mm □ 40%

Mix-2:- 3 cubes for each mix contain 65% and 35% of total weight of aggregate.

1) 20 mm □ 65%
   16 mm □ 35%
2) 16 mm □ 65%
   12.5 mm □ 35%
3) 12.5 mm □ 65%
   10 mm □ 35%

Mix-3:- 3 cubes for each mix contains 80% and 20% of total weight of aggregate

1) 20 mm □ 80%
   16 mm □ 20%
2) 16 mm □ 80%
   12.5 mm □ 20%
3) 12.5 mm □ 80%
   10 mm □ 20%

- **NCC with 60%, 65%, 80% of total weight of aggregates with containg fly ash content**

Mix-1:- 3 cubes for each mix contain 50% of total weight of aggregate.

1) 20 mm □ 50%
   16 mm □ 50%
2) 16 mm□ 50%
   12.5 mm□ 50%
3) 12.5 mm □ 50%
   10 mm □ 50%

Mix-2:- 3 cubes for each mix contain 70% and 30% of total weight of aggregate.

1) 20 mm □ 70%
   16 mm □ 30%
2) 16 mm □ 70%
   12.5 mm □ 30%
3) 12.5 mm □ 70%
   10 mm □ 30%

Mix-3:- 3 cubes for each mix contains 85% and 15% of total weight of aggregate

1) 20 mm □ 85%
   16 mm □ 15%
2) 16 mm □ 85%
   12.5 mm □ 15%
3) 2.5 mm □ 85%
   10 mm □ 15%

MIX DESIGN (ACI committee 211.1-91 method)

DESIGN STIPULATIONS FOR PROPORTIONING(Conventional Sand)

Table 4.1: Mix design Ratio for normal concrete

Cement	Fine aggregate	Coarse aggregate

426.6	693	1126
1	1.62	2.63

Mix design proportions for normal concrete with 20% of fly ash content :-

Table 4.4: Mix design Ratio for flyash concrete

Cement	Fine aggregate	Coarse aggregate
380.645	694.96	944.103
1	1.82	2.48

Mix design calculations for M40 grade by using admixtures

Water content (kg/m^3)	Cement content (kg/m^3)	Fine aggregate (kg/m^3)	Coarse aggregate (kg/m^3)	VMA
191.6	378.3	621.23	873.23	2%

Results And Conclusion

Table 5.1: test results for 28 days of 60% weight of total aggregate

Size of coarse aggregate	Percentage(%) of aggregates of each size from total weight of aggregates	Compressive strength N/mm^2
20 mm 16 mm	20 mm -50% 16 mm -50%	46.12 N/mm^2
16 mm 12.5mm	16 mm -50% 12.5 mm -50%	46.67 N/mm^2
12.5mm 10 mm	12.5mm -50% 10 mm -50%	47.7N/mm^2

Table 5.2: test results for 28 days of 65% and 35% weight of total aggregate

Size of coarse aggregate	Percentage(%) of aggregates of each size from total weight of aggregates	Compressive strength
20 mm 16 mm	20 mm -70% 16 mm -30%	44.5 N/mm^2
16 mm 12.5mm	16 mm -70% 12.5 mm -30%	45.32 N/mm^2
12.5mm 10 mm	12.5 mm -70% 10 mm -30%	46.12 N/mm^2

Table 5.3: test results for 28 days of 80% and 20% weight of total aggregate

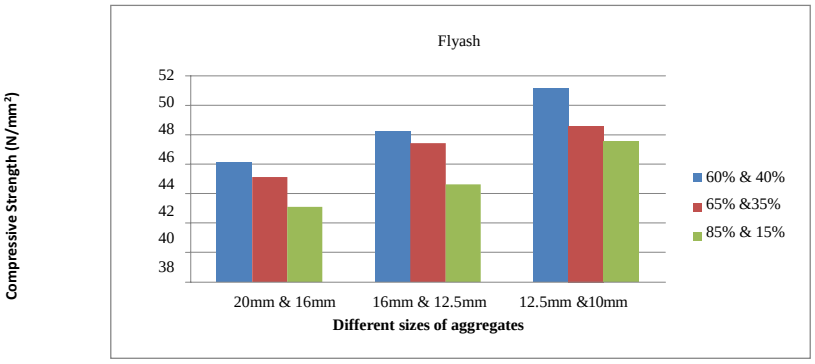
Size of coarse aggregate	Percentage(%) of aggregates of each size from total weight of aggregates	Compressive strength
20 mm 16 mm	20 mm -90% 16 mm -10%	44.5N/mm^2
16 mm 12.5mm	16 mm -90% 12.5 mm -10%	46.7N/mm^2
12.5mm 10 mm	12.5 mm -90% 10 mm -10%	47.6 N/mm^2

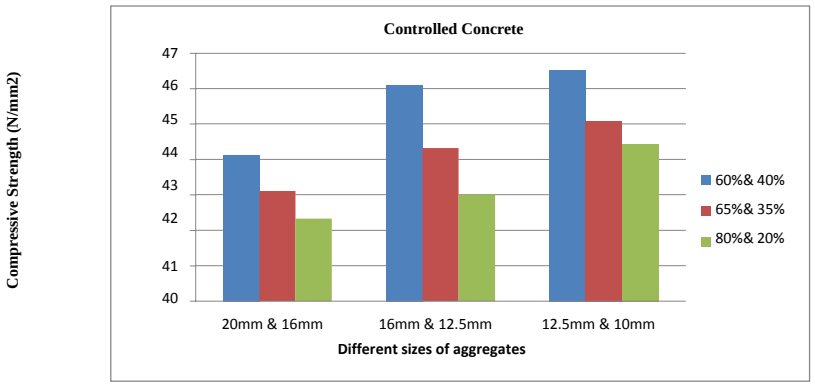
Table 5.4: test results for 28 days of 50% weight of total aggregate with flyash@20%

Size of coarse aggregate	Percentage(%) of aggregates of each size from total weight of aggregates	Compressive strength
20 mm 16 mm	20 mm -50% 16 mm -50%	47.13 N/mm^2
16 mm 12.5mm	16 mm -50% 12.5 mm -50%	47.8N/mm^2
12.5mm 10 mm	12.5 mm -50% 10 mm -50%	52.41 N/mm^2

Table 5.5: test results for 28 days of 85% and 15% weight of total aggregate with flyash@20%

Size of coarse aggregate	Percentage(%) of aggregates of each size from total weight of aggregates	Compressive strength N/mm^2
20 mm 16 mm	20 mm -70% 16 mm -30%	45.0N/mm^2
16 mm 12.5mm	16 mm -70% 12.5 mm -30%	46.43 N/mm^2
12.5mm 10 mm	12.5 mm -70% 10 mm -30%	47.51 N/mm^2





Conclusion

- In light of the blends with an expect to create execution blends, coming up next are the resolutions deliberate and point by point exploratory examination led on SCC Arrived.
- The blends are structured utilizing the lower size of total yielded preferred new properties over higher size of totals.
- As the quality of solid builds, the compelling size of total has diminished.
- In this thesis we will get the maximum compression strength by adding limited percentage of blended materials to the concrete
- Percentage of finer materials will always give higher strength

For Further Work

In view of the present examination, the accompanying angles have been proposed for further investigation.

- Further the investigation can be reached out by structuring the solid with various sorts of totals as the maintenance in mass of cement at raised temperatures is exceptionally impacted by the kind of total.
- Further the examination can be reached out on investigation of small scale structure by utilizing SEM and X-beam investigation.
- Adding of certain kinds of minerals to the solid u can get igher the pressure quality.
- By adding of compound admixture to the solid it might likewise change the a few properties like viscosity, strength, setting time and so forth

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