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Self-Compacting Concrete: A Review

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***Abstract:** This review paper includes the literature reviews related to behaviour of self compacted concrete. Concrete structure generally made without compaction but it is necessary to be compact to achieve desire strength and workability. This lead to produce self compacting concrete. To produce self compacted concrete is difficult because it is not economic and it requires producing in huge amount. The workability characteristics of SCC like filling ability, passing ability and segregation resistance are evaluated using workability tests which are slump flow-funnel and L-Box tests [1].concrete has to be vibrated highly to settle in such place where it is lot of reinforcement. There for to prevent these defects the self-compacting concrete is used [2].*
***Keywords:** Self compacting concrete, admixture, fly ash, silica fume, highly workable concrete.*

I. INTRODUCTION

Self-compacting concrete (SCC) is a basic type that not required any kind of compaction or vibration. It can stable on its own weight. So it is highly useful in different areas of construction that is there is no large window required for vibration of concrete because of its nature of settle down it self, construction work is fast and even, there is no chances for noise pollution so self compacting concrete is environment friendly. The normal concrete generally used as a construction material of building. Instead of that the use of self-compacting concrete requires special treatment and practices.

SCC is a concrete mix which has a low yield stress, high deformability, good segregation resistance (prevents preparation of particles in the mix), and moderate viscosity (necessary to ensure uniform suspension of solid particles during transportation, placement(without external compaction), and thereafter until the concrete sets).

The following categories show the current studies in SCC which are being conducted in many countries:

Use of rheometers to obtain data about flow behaviour of cement paste and concrete.

Proportioning methods for SCC,

Classification of SCC by different lab tests,

Issues related to SCC in construction[2]

A. Testing Fresh Properties of SCC

1) *Slump Flow Test:* Slump flow test apparatus is Slump cone has 20 cm bottom diameter, 10 cm top diameter and 30 cm in height. In this test, the slump cone mould is placed exactly on the 20 cm diameter graduated circle marked on the glass plate, filled with concrete and lifted upwards. The subsequent diameter of the concrete spread is measured in two perpendicular directions and the average of the diameters is reported as the spread of the concrete. T50cm is the time measured from lifting the cone to the concrete reaching a diameter of 50 cm. The measured T50cm indicates the deformation rate or viscosity of the concrete[5]
2) Test V-Funnel test apparatus is shown in Figure 1(b). In this test, trap door is closed at the bottom of V-Funnel and V-Funnel is completely filled with fresh concrete. V-Funnel time is the time measured from opening the trap door and complete emptying the funnel. Again, the V-Funnel is filled with concrete, kept for 5 minutes and trap door is opened. V-Funnel time is measured again and this indicates V-Funnel time at T5min[5].
3) L-Box Test L-Box test apparatus is shown in Figure 1(c). In this test, fresh concrete is filled in the vertical section of L-Box and the gate is lifted to let the concrete to flow into the horizontal section. The height of the concrete at the end of horizontal section represents h2 (mm) and at the vertical section represents h1 (mm). The ratio h2/h1 represents blocking ratio[5].

II. LITERATURE REVIEW

Payal Painuly et al.(2016)[1]presented a brief analysis on improving the strength of concrete by improving quantity of fine materials in the mix and by making the mix cohesiveness. In replacement of course aggregate and sand with fine material were useful for producing self-compacting concrete without segregation using V-funnel test. The amount of aggregates, binders and mixing water, as type dosage of super plasticizer to be used are the major factors influencing the properties of SCC.

Dinesh. A et al.(2017)[2] focused on experiment with admixture by increasing percentage amount of fly ash and silica fume In result they got low compressive strength by increasing fly ash and got more compressive strength using silica fume. In case of tensile strength they achieved same result as they got in case of compressive strength. So overall strength were improved by increasing amount of silica fume rather than fly ash.

N R Gayawala et al.(2011)[3] obtained maximum compressive strength by adding amount of fly ash by 15% and for tensile strength they also got maximum tensile strength by adding 15% amount of fly ash in self-compacting concrete they also found that SCC had good durability properties than normal concrete. For flexural strength and pull out strength addition of 15% of fly ash in mix is enough for maximum strength.

Zekong chen et al.(2015)[4] reviewed in process and application of self compacting concrete and they focused on quality control of self-compacting concrete. Self-compacting concrete was different than normal concrete in composition and requirements of material so strength of concrete in respect to environment service was important like carbonation resistance, shrinkage cracking performance which results as a long life concrete.

K.S. Johnsirani et al.(2013)[5] focused on experimental investigation by replacing fine aggregate with quarry dust. In experiment they used to add quarry dust by 0%, 25%, 50%, 75%, 100% and they find that after adding more than 25% of quarry dust in replacing the fine aggregate the strength of concrete gradually decrease.

Oladipupo S Olafusi(2015)[6] evaluate the fresh and Hardened properties of self compacting concrete from that they drawn a conclusion that

Rheological properties of conventional and self-compacting concrete were quite different.

water-cement ratio change the strength in self compacting concrete.

The compressive strength of a proper design (SCC) mix at 28days is of 85%-90% of conventional concrete.

H Eskandari et al.(2010)[7] reviewed in size effect in self-compacting concrete beams with and without notches. Experiments were conducted to determine future properties of SCC notches and notches beams under three conditions.

racture energy increases as compressive strength of the concrete increases Nominal strength of SCC beams shift from left to right with increasing compressive strength of SCC.

SCC is more ductile because it tries to reach the LEFM behaviour at larger sizes.

S.Dhiviya Bharti et al.(2017)[8] done prediction of compressive strength for self-compacting concrete using Artificial intelligence and Regression Analysis for that they developed models and done slump test. Models developed by ANN better results in prediction of fresh and hardened properties of SCC.

Arivalagan S et al. (2013)[9]done Experimental Analysis of self-compacting concrete incorporating different range of high-volumes of class-F fly ash. From the study conclusions could be drawn. Using the slump flow and V-funnel tests self-compacting concrete had better compatibility from own weight without external compaction. Use of class-F fly ash improve problem of extraction so pollution problem is reduce.

Gergely A. Sik(2012)[10,] focused on production scheduling. Self-compacting concrete required to produce in huge amount so the scheduling was required because it could be settled if it was not placed at site before time. The authors would like to optimize the relationship between the production scheduling and the delivery of the self-compacting concrete prefabricated specimens using ALVI software.

III. CONCLUSIONS

Followings are the predominant conclusions obtained from the studied literature reviews:

The strength of self compacting can be increase by use of admixture like fly ash, silica fume , etc. In result it was found that for achieving maximum strength of self compacting concrete only 15% fly ash is required if we add more than 15 % then the strength gradually started reducing in both compressive and tensile. Silica fume is Better admixture for both compressive strength and tensile strength without limit[3].

If we add the admixture replacement for we can have a better workable concrete. It has been verified ,by using the slump flow, T50 cm slump flow J-ring test, L-box test and U-tube tests, that self-compacting concrete (SCC) achieved consistency and self-compatibility under its own weight, without any external vibration or compaction[2].

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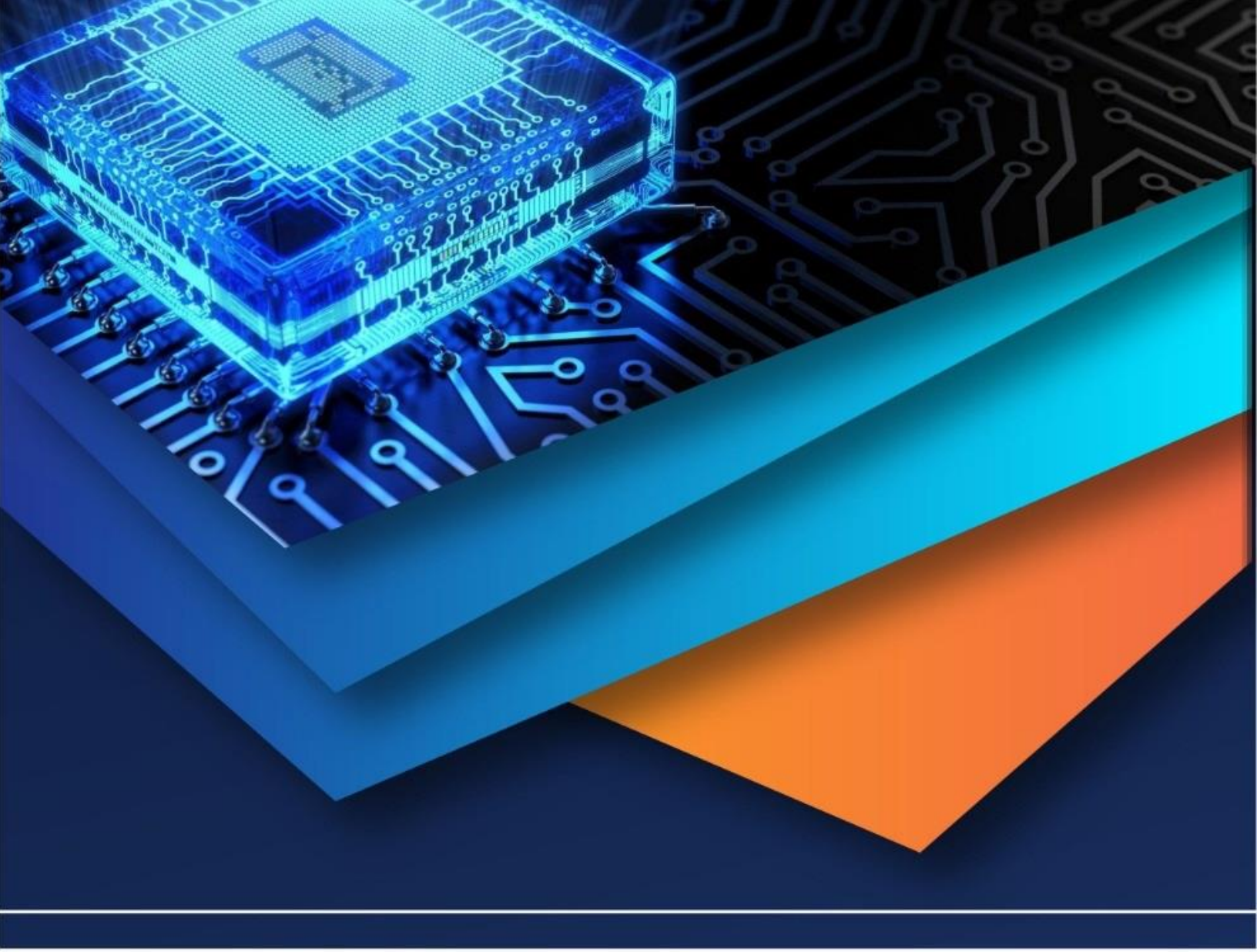

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