# Size Effect Study on Self Compacting Concrete

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***Abstract*— Concrete is the construction material widely used throughout the world. Construction materials used in the industry should be friendly with the environment during its usage. Self-compacting concrete (SCC) is an innovative concrete that does not require vibration for placing and compaction. It is able to flow under its own weight, completely filling formwork and achieving full compaction, even in the presence of congested reinforcement. The hardened concrete is dense, homogenous and has the same engineering properties and durability as traditional vibrated concrete. In order to obtain the properties of fresh concrete for SCC, proportion of mineral and chemical admixtures to be added. A review is presented based on the development of self-compacting concrete with mineral and chemical admixtures. Compiled test data revealed distinct difference in mechanical properties of normal and high strength self compacting concrete. To understand the behaviour of Self Compacting Concrete, it is necessary that several factors be taken into account for designing the mix proportions. Strength of concrete, type of cement, type of aggregate, water cement ratio, type of admixture are some of the important factors that affect the performance of concrete. Keywords—Soft storey, Shear wall, Storey drift, Storey displacement, Storey shear, Time period, Time history analysis, Response spectrum analysis, ETABS.**

## I. INTRODUCTION

Self-consolidating concrete (SCC) represents one of the most outstanding advances in concrete technology during the last two decades. Due to its specific properties, SCC may contribute to a significant improvement of the quality of concrete structures and open up new fields for the application of concrete like improved understanding of particle packing even at nanosacles.

SCC was first developed in 1986 by Okamura to address durability concerns. (Okamura H. and Ouchi M, 2003). SCC can be defined as a flowing concrete without segregation and bleeding, capable of filling spaces and dense reinforcement or inaccessible voids without hindrance or blockage. (Khayat K. H. and Monty H, 1999).

SCC offers many benefits to the construction practice which are simplicity in placement in complicated formwork and congested reinforcement, reduced construction times, especially at large construction sites, reduced noise pollution (since no vibrators are required), higher and more homogenous concrete quality across the entire concrete cross-section, especially around the reinforcement, concreting deep elements in single lifts, concreting at higher levels of tall buildings, improved surfaces and finishes and typically higher early strength of the concrete formwork can be removed quickly.

## II. REVIEW OF LITERATURE

### *A. General*

Bertil Persson (2001) carried out an experimental and numerical study on mechanical properties, such as strength, elastic modulus, creep and shrinkage of self-compacting concrete and the corresponding properties of normal compacting concrete. The study included eight mix proportions of sealed or air-cured specimens with water binder ratio (w/b) varying between 0.24 and 0.80. Fifty percent of the mixes were SCC and rests were NCC. The age at loading of the concretes in the creep studies varied between 2 and 90 days. Strength and relative humidity were also found. The results indicated that elastic modulus, creep and shrinkage of SCC did not differ significantly from the corresponding properties of NCC.

Nan Su et al (2001) proposed a new mix design method for self-compacting concrete. First, the amount of aggregates required was determined, and the paste of binders was then filled into the voids of aggregates to ensure that the concrete thus obtained has flowability, self-compacting ability and other desired SCC properties. The amount of aggregates, binders and mixing water, as well as type and dosage of super plasticizer to be used are the major factors influencing the properties of SCC. Slump flow, V-funnel, L-flow, U-box and compressive strength tests were carried out to examine the performance of SCC, and the results indicated that the proposed method could be used to produce successfully SCC of high quality. Compared to the method developed by the Japanese Ready-Mixed Concrete Association (JRMCA), this method is simpler, easier for implementation and less time-consuming, requires a smaller amount of binders and saves cost.

Bouzoubaa and Lachemi (2001) carried out an experimental investigation to evaluate the performance of SCC made with high volumes of fly ash. Nine SCC

mixtures and one control concrete were made during the study. The content of the cementitious materials was maintained constant (400 kg/m3), while the water/cementitious material ratios ranged from 0.35 to 0.45. The self-compacting mixtures had a cement replacement of 40%, 50%, and 60% by Class F fly ash. Tests were carried out on all mixtures to obtain the properties of fresh concrete in terms of viscosity and stability. The mechanical properties of hardened concrete such as compressive strength and drying shrinkage were also determined. The SCC mixes developed 28-day compressive strength ranging from 26 to 48 MPa. They reported that economical SCC mixes could be successfully developed by incorporating high volumes of Class F fly ash.
Hajime Okamura and Masahiro Ouchi (2003) addressed the two major issues faced by the international community in using SCC, namely the absence of a proper mix design method and jovial testing method. They proposed a mix design method for SCC based on paste and mortar studies for super plasticizer compatibility followed by trail mixes. However, it was emphasized that the need to test the final product for passing ability, filling ability, flowability and segregation resistance was more relevant.

### *B. Design of Reinforcement Beam*

TABLE I. DESIGN DATA OF REINFORCEMENT DETAILS

| BEAM | $A_{st}$provide(1%) |
|---|---|
| Small(100*100*370) | 2#8(100) |
| Medium(100*150*505) | 2#10(156) |
| Large(100*225*756) | 2#12(226) |
| BEAM | $A_{st}$provide(1.5%) |
| Small(100*100*370) | 2#10(156) |
| Medium(100*150*505) | 2#12(226) |
| Large(100*225*756) | 2#12+ 1#8(277) |

## IV. RESULTS AND DISCUSSION

In this study, fresh and hardened properties of SCC were investigated for different volume of binder (450-500 Kg/m³) and W/B ratio (0.29-0.34 by weight) with corresponding variation in the paste volume. The paste volume was varied from 350 liter to 450 liter. The replacement of cement by fly ash in binder were also constant for all mixes proportions (cement: fly ash= 70:30). Also, doses of super plasticizer were kept constant for all mixes proportion (SP=0.5%of weight of binder). The ability of SCC for compacting under its own weight is generally the main subject of such studies according to appropriate criteria given by the EFNARC committee (EFNARC; 2002). In the present study, such properties of SCC produced, and were investigated for all proportion. For selected proportion of mixes, cubes and beams were casted. The cubes were tested for compression after 28 days of curing under compressive testing machine having 200 tone capacities. The beams were tested under four point loading, and load vs. Deflection curve were prepared. The deflection was measured with the help of dial gauge having list count 0.001 mm. The beams were tested in digital universal testing machine having capacity 60 tones.

TABLEII. RESULT OF S.C.C.BEAM

| Designation Beam | Maximum load Kn | Maximum displacement mm |
|---|---|---|
| Small | 33.560 | 3.2 |
| Medium | 76.890 | 4.4 |
| Large | 148.360 | 6.1 |

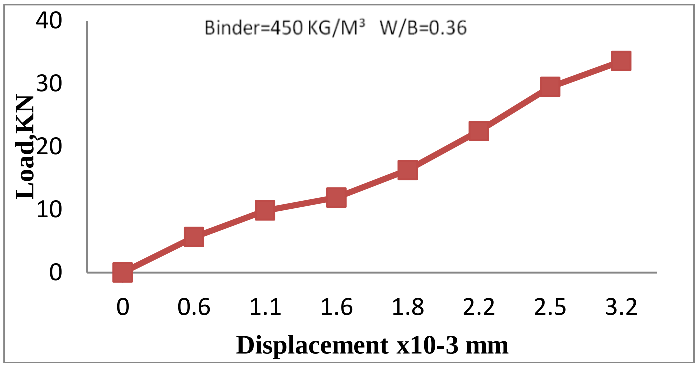


Fig.1 Small Size beam of SCC without fibre

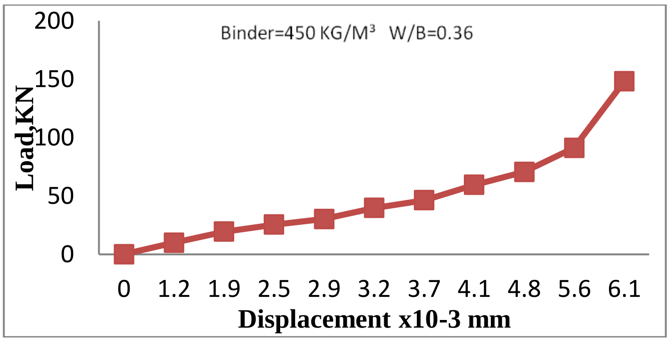


Fig.2 Large Size beam of SCC without fibre

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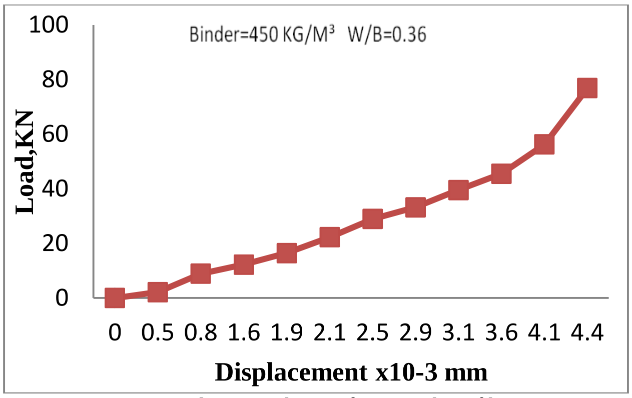


Fig.3 Medium Size beam of SCC without fibre

TABLE III Result of SCC with glass fibers Beam (Pt = 1%)

| Designation BEAM | Maximum load KN | Maximum displacement mm |
|---|---|---|
| Small | 35.870 | 3.1 |
| Medium | 79.980 | 4.9 |
| Large | 165.760 | 6.8 |

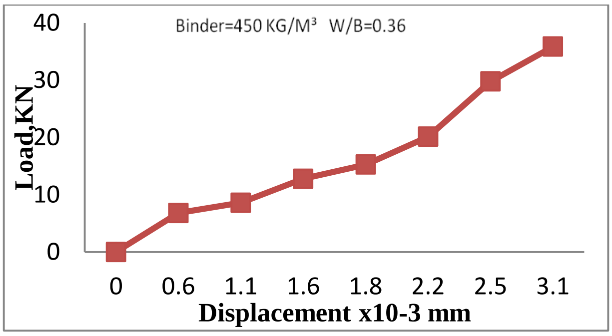


Fig. 4 Small Size beam of SCC with Glass fibre

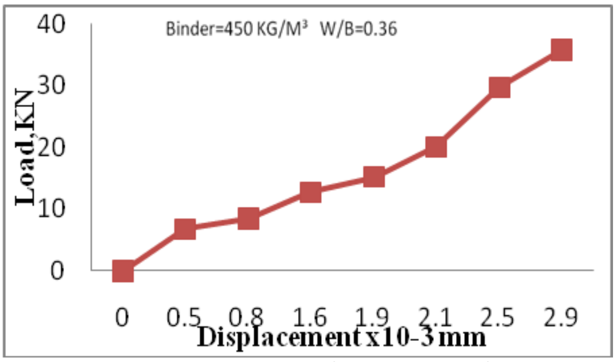


Fig. 5 Medium Size beam of SCC with Glass fibre

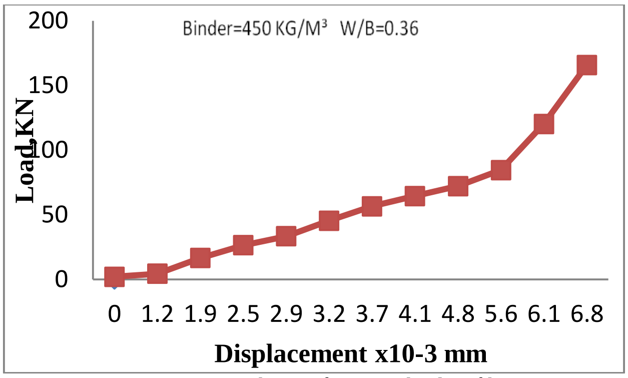


Fig.6 Large Size beam of SCC with Glass fibre

TABLE IV Result of SCC with Steel fibers Beam (Pt = 1%)

| Designation BEAM | Maximum load KN | Maximum displacement mm |
|---|---|---|
| Small | 39.780 | 3.3 |
| Medium | 89.232 | 5.1 |
| Large | 196.872 | 7.5 |

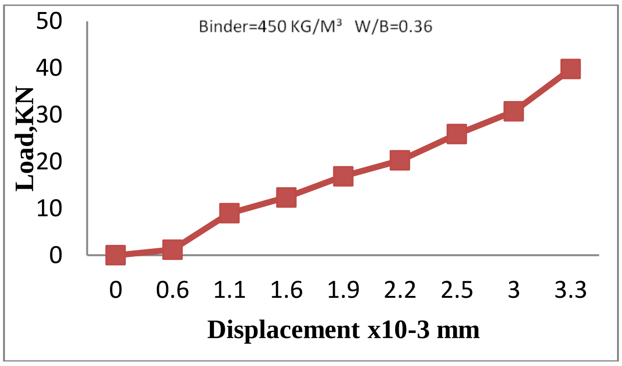


Fig.7 Small size beam

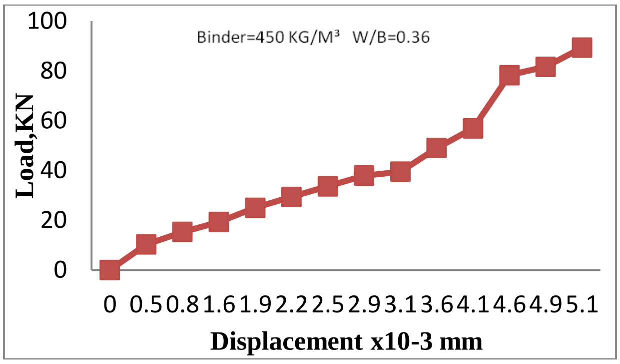


Fig.8 Medium size beam

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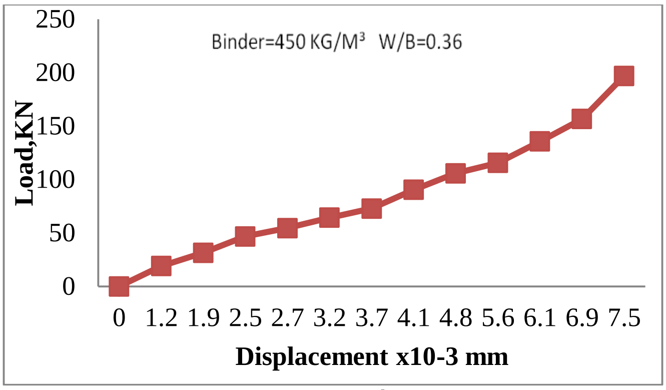


Fig.9 Large size beam

## V. CONCLUSION

Self compacting concrete is an innovative concrete that does not require vibration for placing and compaction.
It is able to flow under its own weight, completely filling formwork and achieving full compaction, even in the presence of congested reinforcement.
Self compability is depending on work ability of concrete. Indirectly its depend on ingredients of concrete like cement, sand and aggregate. Its also depend on dosage of super plasticizer and water binder ratio.
In my experiment it was observed that as binder quantity increase the workability of concrete was also increase.
It was happened due to increase in fine materials in total volume of concrete. Also I can conclude that for same binder quantity if increase water binder ratio. The workability of concrete was also increase.
The self – compacting concrete is very sensitive concrete with respect change in water quantity.
I conclude that addition of steel fibre and glass fibre are increasing the strength of concrete.
In my project i use Glass Fiber and without glass fiber (SCC) Concrete, after that I conclude strength of glass fiber concrete is more than SCC concrete about 10% to 20%.
I use Steel Fiber and without Steel fiber (SCC) Concrete, after that we conclude strength of Steel fiber concrete is more than SCC concrete about 30% to 40%.
I conclude that strength of Steel fiber concrete is more than Glass fiber concrete.

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