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HIGH PERFORMANCE SELF COMPACTING CONCRETE: A REVIEW

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***Abstract*— High performance self-compacting is a sub division of special concrete that required special dispatch, implementation and conformity which cannot be possible unless with addition of some material such as chemical and mineral admixture as well as excellent mix design which may be due to the availability of materials in the nation, it also required a better curing in order to take care of any endogenous behaviour.**

In this study, an extensive literature review has been conducted on the material characterization of self-compacting concrete and its potential for large scale field applicability, which may leads to achieve the rheological properties of concrete. Similarly, the paper highlights the current challenges regarding the implementation of self-compacting concrete in full scale structures. Also strives to assist engineers to better understand the unique characteristics and capabilities of SCC, such as high strength, high workability, durability, etc.

Keywords: High performance self-compacting concrete, workability requirement, mechanical properties, durability.

INTRODUCTION

In this era, the utilization of self-compacting concrete has expanded and many analysis and investigations were carried all over the world to find superlative and efficient mix composition. Self-compacting concrete is a new category of concrete characterized by its ability to expanse into place, fill form work, and encapsulate the reinforcement area under its own self weight, without the need of vibration, and provide a better working environment, also give proper consolidation without bleeding or segregation.
However, high performance concrete can be describe as part of special concrete that require more attainment and consistency/concern more than ordinary traditional concrete, which can only be possible with the addition of some special materials.
This research can help to produce self-compacting concrete by available materials, because even with the existing of guidelines and specification there are practical differences in how self-compacting concrete may be produce. This differential primarily arises from the difference in cementations' materials available in each region;
Moreover an intensive mix design has to be done and this can only be achieves by different trials and review from previous literature. Special care must be taken to begin curing the concrete as early as possible.
The self-compacting concrete help to reduce significantly the construction period as well as the amount of personal necessary to accomplish the same work, due to the reduction in man power, where it reduces emplace cost of entire project (economic viability).

LITERATURE REVIEW

Mohammad Kamran, Mudit Mishra (2014) studied the effect of fly ash with PPC and OPC cement on fresh and hardened properties of self-compacting concrete. It was observed that result of PPC with least fly ash content gained more strength at the age of 7 days, while the remaining samples had very less strength at the ages of 7days.
Furthermore, it was found that the compressive strength of OPC samples with the least fly ash content at ages of 7 and 28 days achieved maximum strength, but the average strength of OPC sample was much higher than that of PPC sample in each proportion of fly ash, because of physical features of PPC sample showed the addition of super plasticizer and moisture on sample which result in abatement of strength, whereby the sample with OPC where dried and no moisture developed over the surface of the sample.

Ghafoori and Diawara (2014) observed that transportation time affects the fresh properties of self-compacting concrete. This study is useful in simulating batching and transporting concrete at different times under a control room temperature and relative humidity (21± 2 & 25.5%) in comparison to the control transportation time of 10min. they found losses in workability as the transportation time increased. Also it is showed the influence of hot temperature in the form of flow ability loss, decreased plastic viscosity, and dynamic stability gains; whereas the selected cold temperature affected the fresh characteristics of self-compacting concrete by marginal gained in flow ability, a minor change in viscosity, and a slight to no improvement in resistance to dynamic segregation.
Moreover, the self-compacting concrete made with 635mm slump flow and transported beyond 40min under each selected cold temperature experienced progressive and excessive losses in slump flow and their T50 time could not be evaluated.

Ahmad and Ridha (2014) observed the effect of steel fiber to light weight aggregate concrete, it was found that inclusion of steel fiber more than 2%, may reduce the volume fraction which lead to very significant in splitting tensile strength and slightly significant in density. Similarly, it was found that the compressive strength of concrete increases with increment in the percentage of steel fiber. The percentage decrease in compressive strength and split tensile strength for mix with normal weight sand and porcelinite coarse aggregate was higher than the percentage decreased for mix with natural river gravel and porcelinite fine aggregate. Therefore the decreases depend on the mix which includes normal weight sand and natural river sand.

Farhad Aslani, Shami Nejadi (2012) found that most of the creep result predicted by the proposed models was slightly over than 10% to the experimental result. It was observed that, the proposed model provided a good prediction, the results were mostly conservative especially after age of 300 days, the maximum difference (10%) between predicted and experimental results shows that, the proposed shrinkage model provided a better prediction of creep data for SCC mixture with a coefficient of correlation factor of 0.9, 0.93, 0.90 and 0.89 compared to N-SCC experimental results.
It showed that after the commencement of drying, the shrinkage strain developed rapidly within the first two or three months and more than 50% of shrinkage occurred during this period.
The final shrinkage strain for self-compacting concrete mixture was not much different from each other after 364 days. Where by the creep strains increased quickly for first few weeks after loading, with almost 50% of creep occurring in the first 40 days. The maximum creep coefficient was related to S-SCC with PP fibres in the mixture, the creep coefficient of S-SCC mixture at age of 364 days was 11%, 15%, and 13% higher than N-SCC, D-SCC mixture.

Dubey Sanjay Kumar, Chandak Rajeev (2012) Studied that two trial mix (prepared with cement content 330kg/m3 and 360kg/m3, with powder content 420kg/m3 and 430kg/m3,constant lime content 90kg/m3). The dosage of super plasticizer was estimated to be from 1.5 to 3.0 % of powder content. It was found that both mix not satisfies the workability test parameters as well as segregation and bleeding occurred.
Another trial mix was formed by increasing the powder content to 480kg/m3, cement content to 360kg/m3, and lime 120kg/m3. Dosage of super plasticizer was 2.2% by weight of powder; cement was replaced by 4%, 8%, 12% of silica fume, and water content was kept constant. All the mix fulfilled workability parameters. Moreover, 7 days, 28 days and 60 day's compressive strength test results showed increased compressive strength by replacement of silica fume and decreased compressive strength by replacement of hydraulic lime. It was observed that 8% replacement of cement by silica fume increase the strength about 20%.

Snehal Afiniwala et al (2011) found that, all self compacting concrete mixes satisfies the criteria (slump flow ranges between 650mm to 800mm) except for 60% fly ash replacement. It was observed that flow decreased for both mixes with increased percentage of fly ash content. Moreover, dosage of super plasticizer or VMA may be adjusted if required to achieve higher slump especially for very congested reinforcement in horizontal surfaces. Similarly, L-box test result showed that increase in percentage of fly ash reduces passing ability.

A.A. Maghsoudi et al (2011) Investigated that the use of lightweight expanded clay (LECA) as light weight aggregate and 400 to 500kg/m3 cement content in Self-compacting light weight concrete (produced with specific weight less than 1900kg/m3). It achieved a compressive strength of 28.5Mpa at age of 28 days. Self-compacting light weight concrete (made with LECA) improved the rheological properties of fresh concrete (because of spherical shape) and also improved compressive strength by use of lower amount of cement.

Dr. Hemant, Sood et al (2009) Observed that by using Japanese method mix design as reference, initial mix design for the proposed study was carried out at course aggregate content 37% by volume of concrete, fine aggregate 47% by volume of mortar, water/ powder ratio was kept at 0.78. The dosage of super plasticizer was estimated to be from 1.5 to 3.0 of powder content (cement, fly Ash, Rice husk Ash) slump test unsatisfactory and high segregation was observed in the trial mix. Hence, observation showed that super plasticizer content increased to 2% with increased water/powder ratio, where by powder content kept constant at 60kg/m3 with varying content of fly ash and RHA. The workability parameters of mix SCC2 to SCC6 are satisfactory with slump flow between 615 and 750mm, this indicated that slump flow improves with the increases in fly Ash and decreased in Rice Husk Ash content. Moreover from 7 days and 28 days, it has been observed that increase in rice husk ash content in mixes (SCC2 to SCC5) from 7.5kg/m3 to 30kg/m3 increases water requirement of mixes, decreasing 7 days strength from 28Mpa to 23.56Mpa as well as 38Mpa to 27Mpa at 28 days. Hence, higher strength could have been achieved in case of normal temperature of 27 degree.

J. Annie Peter et all (2006) Observed that the dimensional stability and uniformity of under-reamed piles made of self-compacting concrete were superior to those cast with conventional concrete. However, the load deformation behaviour of the self-compacting concrete under- reamed piles and normal concrete piles were nearly similar under compression and tension. Furthermore, the durability of conventional concrete in soils mould is very much interior as compared to that of self-compacting concrete, also the in situ strength of piles cast against soil formwork was significantly lower as indicated by test on cores. Therefore self-compacting concrete for piles provided an exciting option of high performance concrete placed and cured against soil formwork.

CONCLUSIONS

It was concluded that, the deformability of self compacting concrete is evaluated with a minimum slump flow of 600mm leads to achieve SCC, which can never be possible unless with an excellent mix design. Also the viscosity of deformation of SCC is the parameters that have to be considered, it observed that by addition of some sufficient percentage of VMA in concrete mix reduces segregation risk as well as minimize the friction between coarse aggregate particles. In this regard, further research is required to interpret the dependencies of the hardened properties of self compacting concrete..

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