Review on Self Compacting Concrete by Using Mineral Additives

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Abstract: **Self compacting concrete (SCC) flows into place Fresh self-compacting concrete and around obstructions under its own weight. Self-compacting concrete decreases construction time, labour and equipment uses on construction,, and helps in achieving use without applying vibration in congested reinforced concrete structures characterized by difficult casting conditions. However, because it usually requires a larger content of binder and chemical admixtures compared to ordinary concrete, its material cost is generally 20–50% higher, which has been a major hindrance to a wider implementation of its use. The fresh concrete properties and compressive strength at 1, 7 and 28 days of such SCC mixtures were measured. The parameters considered in the study were the contents of cement, water- cement ratio ,Fly ash, Micro silica & Metakaolin. The responses of concrete are recorded from Slump−flow test, L−box, U-box and V−funnel.**

Keywords: Self Compacting Concrete, test, material, cost optimization.

INTRODUCTION

In recent years, many quite important studies about SCC have been made. The most important difference between SCC and ordinary concrete is the existence of filler material in the SCC mixture. Thus, there are also many studies about the effects of filler materials on the properties of SCC. According to the conclusions of these studies, the benefit of filler material usage in SCC can be said as improved workability with reduced cement content. By this way, low heat of hydration and decreased shrinkage cracking can also be obtained.
Moreover, since cement is the most expensive component of concrete, reducing cement content can be said as an economic solution. Besides, the pores between aggregates are fulfilled and impermeable concrete can be produced. Therefore, the durability of concrete is also increased. Industrial by-products such as fly ash (FA), Micro silica & Metakaolin are generally used as filler materials in SCC. Thereby, the workability of SCC is improved and the usage amount of by products can be increased at the same time. In addition, such usages of by-products in cement or concrete provide economical benefits and prevent environmental pollution. In this study, it is aimed to investigate the effect of Fly Ash as fine material on the fresh and hardened properties of SCC. Fresh concrete tests such as slump-flow, V-funnel, L-box, unit weight, air content and hardened concrete tests such as compressive strength, flexural strength, and compactness were attempted to make this objective achieved and determine the optimum fly ash replacement ratio in SCC.

REVIEW OF LITERATURE

M. Collepardi (2001)summarizes the results on flowing and cohesive super plasticized mixtures studied and placed in the 1970's and 1980's with properties very close to those of Self Compacting Concrete (SCC) presently considered to be the most advanced cementatious material. Case histories (from Hong Kong, Newyork and Trieste, Italy) concerning placing of super plasticized self-leveling concrete without any vibration at all, published in the 1980's are re-examined to compare them with the present SCCs. In particular, the paper deals with the ingredients of these mixtures (super plasticizer, cement, fly ash, ground lime stone, silica fume, etc.) by examining their specific role in determining the main properties of these concretes, such as fluidity, on the one hand, and the resistance to segregation, on the other. Some interesting new material, such as ground fly ash or powder from recycled aggregates, appear to be very promising for manufacturing SCC in agreement with the requirements needed for sustainable progress.

M. Collepardi, S. Collepardi, J.J. Ogoumah olagot and R. Troli (2004)described that during the last decades new cementatious material were available. This represent a sort of technical revolution with respect to the traditional concrete. The most important innovative "High Tech" materials are self-compacting concretes (SCCs) in this present paper composition, the performances and some practical application of high-performance SCCs are shown. The test methods L-box test, U-box test, V-funnel test, Slum-flow test and cube compressive strength test. The most important basic principle for flowing and unsegregable concrete including SCCs is the use of super plasticizer combined with a relatively high content of powder in terms of Portland cement, mineral additions, ground filler, and very fine sand. A partial replacement of Portland cement by fly ash was soon realized to be the best compromise in terms of rheological properties, resistance to segregation, strength level, and crack-freedom, particularly in mass concrete structures exposed to restrained thermal stresses produced by cement heat hydration.

G. De Schutter (2005) three key of properties of SCC namely-filling ability, passing ability and resistance to segregation for mix design purposes in the lab and for compliance purposes on site to recommend a range of result for the chosen tests to identify suitable SCC. It also laid on the scientific basis of these tests by fundamental rheological measurements and assess the use of these tests in real construction. It also deal with the avoidance of duplication of work in different European countries and to establish agreed guidelines for draft standards for the test method and encouraged the use of self compacting concrete in general construction and to realize the potential economic and environmental benefits of the technology.

N. Krishna Murthy, A.V. Narasimha Rao , Ramana Reddy I. Vand, M. Vijaya Sekhar Reddy (2012)
Self-compacting concrete (SCC) possesses enhanced qualities and improves productivity and working conditions due to elimination of compaction. SCC is suitable for placing in structures with congested reinforcement without vibration and it helps in achieving higher quality of surface finishes. However utilization of high reactive Metakaolin and Fly ash as an admixtures as an effective pozzolan which causes great improvement in the pore structure, also compactibility is affected by the characteristics of materials and the mix proportions, it becomes necessary to evolve a procedure for mix design of SCC .In this paper presents an experimental procedure for the design of self-compacting concrete mixes. The relative proportions of key components are considered by volume rather than by mass. A simple tool has been designed for self compacting concrete (SCC) mix design with 29% of coarse aggregate, replacement of cement with Metakaolin and class F fly ash, combinations of both and controlled SCC mix with 0.36 water/cementatious ratio(by weight) and 388 litre/m3 of cement paste volume. Crushed granite stones of size 16mm and 12.5mm are used with a blending 60:40 by percentage weight of total coarse aggregate. Detailed steps are discussed in this study for the SCC and its mortar.

"Guidelines and Specification for Self Compacting Concrete" (2002)
Self-compacting concrete (SCC) has been described as "the most revolutionary development in concrete construction for several decades". Originally developed to offset a growing shortage of skilled labour, it has proved beneficial economically because of a number of factors, including faster construction, reduction in site manpower, better surface finishes, easier placing, improved durability, greater freedom in design, thinner concrete sections, reduce noise levels, absence of vibration, safer working environment. Originally developed in Japan, SCC technology was made possible by the much earlier development of super plasticizers for concrete. SCC has now been taken up with enthusiasm across Europe, for both site and precast concrete work.

Frances Yang in (2004) Investigation the technology behind creating SCC, including its components and mix proportioning techniques. It highlights numerous benefits in using SCC and refers to the various tools used to parameterize its properties. Precautionary measures that should be taken in developing and working with the mix are discussed. Lastly listed are some exemplary applications.

Soo-Duck Hwang, Kamal H. Khayat and Olivier Bonneau (2010) described proper selection of test methods and workability specifications are key concerns in the optimization and control testing of self consolidating concrete (SCC). An experimental program was carried out to evaluate the suitability of various test methods for workability assessment and to propose performance specifications of such concrete used in structural applications. Various workability characteristics were determined for approximately 70 SCC mixtures made with water-cementatious material ratio (w/c) of 0.35 and 0.42. Workability responses included the Slump flow, J-Ring, V-Funnel flow time, L-Box, filling capacity and surface settlement tests. Comparisons of various test methods indicate that the L-box blocking ratio (h_2/h_1) $\geq$ 0.7, J-Ring flow of 600 to 700 mm, slump flow minus J-Ring flow diameter $\leq$ 50 mm, or V-funnel flow time $\leq$ 8 seconds. Such SCC should have a settlement rate of 0.16%/h at 30 minutes, corresponding to 0.5% maximum settlement.

Pratibha Aggarwal, Rafat Siddique, Yogesh Aggarwal, Surinder M. Gupta (2008) that Self compacting concrete is a fluid mixture suitable for placing in structures with congested reinforcement without vibration. Self compacting concrete development must ensure a good balance between deformability and stability. Also, compatibility is affected by the characteristics of materials and the mix proportions; it becomes necessary to evolve a procedure for mix design of SCC. The paper presents an experimental procedure for the design of self compacting concrete mixes. The test results for acceptance characteristics of self compacting concrete such as slump flow, J-ring, V-funnel and L-box are presented. Further, compressive strength at the ages of 7, 28 and 90 days was also determined and results are included here.

Cristian Druta (2003) about self compacting concrete is that it is able to flow and consolidate under its own weight and is desecrated almost completely while flowing in the formwork. It is cohesive enough to fill the spaces of almost any size and shape without segregation or bleeding. This makes SCC particularly useful wherever placing is difficult, such as in heavily-reinforced concrete members or in complicated work forms. The objectives of this research were to compare the Splitting Tensile and Compressive Strength values of self compacting and normal concrete specimens and to examine the bonding between the coarse aggregate and the cement paste using the Scanning Electron Microscope. All SCC mixtures exhibited greater values in both splitting tensile and compressive strength after being tested, compared to normal concrete. The splitting strength increased by approximately 30%, whilst the compressive strength was around 60% greater. In addition, the SCC tensile strength after 7 days were almost as high as those obtained after 28 days for normal concrete. This was possible due to the use of mineral and chemical admixtures, which usually improve the bonding between aggregate and cement paste, thus increasing the strength of concrete.

CONCLUSION

To increase the stability of fresh concrete (cohesiveness) using increased amount of fine materials in the mixes. To development of self-compacting concrete with reduced segregation potential. The systematic experimental approach showed that partial replacement of coarse and fine aggregate with finer materials could produce self-compacting concrete with low segregation potential as assessed by the V-Funnel test. 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. It has been verified, by using the slump flow, V−funnel, 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. SCC with mineral exhibited satisfactory results in workability, because of small particle size and more surface area.

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