A REVIEW ARTICLE ON DURABILITY OF SELF-COMPACTING CONCRETE USING HIGH VOLUME FLY ASH

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Abstract :This study was shown to develop concrete with acceptable durability and micro-structural properties using metakaolin (MK) and rice husk ash (RHA), Fly ash, and silica fume. They are carried out test on high volume fly-ash concrete were: coefficient of permeability, durability, water absorption, porosity, tensile, compressive and flexural strengths. 0%-80% replacement of cement by fly-ash. The compressive, tensile and flexural strength was carried out for 7, 28, & 90, 365 days for hardened concrete. Slump flow, Flow table, J-Ring, L-box, U-box, and V-funnel tests were conducted in concrete's fresh state. Using metakolin, the compressive strength is increases in 7 days and 28 days and durability is more, compare to normal concrete. Using Silica fume-F & fly ash combination on SCC, the compressive strength is increase in 28 days. If only fly ash is used then the surface water absorption increase. The effect of SF is more than FA. Use of Nano particles (SiO_2, TiO_2, & Al_2O_3) to replacement of cement. The compressive & flexural strength is increase, Also hardness increase.

Keywords—Self-Compacting Concrete, Fly-Ash, Metakolin (MK), Rice Husk Ash (RHA), Silica Fume.

I. INTRODUCTION

The history and development of SCC can be divided into two key stages: its initial development in Japan in the late 1980s and its subsequent introduction into Europe through Sweden in the mid- to late-1990s.

Self-Compacting Concrete or Self-Consolidating Concrete, SCC, is defined as a Concrete that is able to flow under its own weight and completely fill the formwork, even in the presence of dense reinforcement, without the need of any vibration, whilst maintaining homogeneity.
It was originally developed in Japan, to overcome the problems caused by lack of complete and uniform compaction through vibrators. It has since proved to be economically beneficial because of a number of factors are improved durability and compressive strength, easier placing and hence reduction in manpower at the time of placing, better surface finishes, greater freedom in design which can lead to thinner concrete sections, reduced noise levels because of absence of vibration, faster construction, reduction in site manpower, easier placing, improved durability, greater freedom in design, thinner concrete sections, reduced noise level, Safer working environment.
The study on the use of calcareous fly-ash in SCC are very limited. This lack of interest could be attributed to the particular behavior of calcareous fly ash in concrete mixture.

Anhad Singh Gill et.al [1] was study conducted on Durability properties of self-compacting concrete incorporating metakaolin& rice husk ash. After that another study was shown which was on replacement of cement throughmetakaolin& in addition replacement of fine aggregate by rice husk ash. After that two test carried out, one was on fresh flow, L-box, U- box, V- funnel tests are carried and tests are carried on hardened concrete for 7, 28, 90, and 365 days. As per IS9103:1999 magnesium sulphate is used to increase strength of concrete and metakaolin is used to replacing by cement by weight in 3 proportions of 5,10,& 15 & fine aggregate are replaced through rice husk ash in 10%propotion. The compressive strength increases (28 days strength is 27%, 90 days strength is 42%, 365 days strength is 48%) compare with natural SCC. Water absorption (45%) and porosity (46%) decreases in compare with control mix. And loss of compressive strength in 4.8% occurs in 365 days due to sulphate attack.

Stefanus A Kristiawanet.al [2] did study on Effect of high volume fly ash on shrinkage of self-compacting concrete. Authors are using Self-compacting concrete which is prepared by including fly ash by way of cement replacement at 35%, 55% and 65% by way of weight.V-funnel test, L-Box, J-Ring, Box Type &Flow table test are carried out on fresh concrete. Cylinder specimens (75 mm X 275 mm) be there cast. Super plasticizer are used as per ASI 209R & CEB-FIP 1990, for increase the strength. The authors have investigated 2 types of shrinkage (1) Drying shrinkage (2) Autogeous shrinkage. Both the shrinkage are decrease by used of high volume fly ash.

Hayder H. et.al [3] was investigation on Shear behavior of full-scale high volume fly ash-self consolidating concrete (HVFA-SCC) beams. Authors have replaced the use of cement by two material i.e fly ash & hydrated lime. The replacement level is 50%, 60%, & 70%. Ultimate shear, cracking, deflection, slump flow, J-ring & L-box test are carried out on fresh concrete. The experimental sample beam size is 4000 mm (13 ft) in length, 457 mm (18 inch) in thickness, and 305 mm (12 inch) in width. Slump flow test is carried as per ASTM 1611 & j-ring is as per ASTM C1621. Compressive strength greater than 35Mpa in 3 days. Low longitudinal reinforcement shear strength's capacity is more

compare to CC beam. Increase longitudinal reinforcement not shown in any effect. Increasing the cement replacement level from 50% to 70%, increases the shear ductility by 35% it's higher than the CC beam. 70% cement replacement the level increase deflection more than crack.

H.Y. Leunget.al [4] was working on Sorptivity of self-compacting concrete containing fly ash and silica fume. In this authors have presented the surface water absorption of self-compacting concrete encompassing fly ash &silica fume by sorptivity test. Ordinary Portland cement was partly replaced by different mixtures of fly ash & silica fume. Metakaolin is used for increase the strength. Compressive, sorpitivity tests are carried on hardened concrete. Silica fume-F & fly ash combination reduces surface water absorption. If single fly ash is used then the surface water absorption increase. FA & SF adopted the SCC mixes, the water absorption higher. The outcome of Silica fume is considerably more than FA. Both FA & SF mixes used, 28 days cube result the compressive strength is increase. In this concrete long time maintenance need.

Pawel Niewiadomskiet.al [5] was conducted study on properties of self-compacting concrete modified with nanoparticles. In thisauthors have replaced use of cement by nanoparticles. In nanoparticles authors have used SiO_2, TiO_2, & Al_2O_3. Compressive strength, flexural strength, hardness, & elastic modulus test are carried out on hardened concrete. All test values higher are 28 and 90 days with compare normal concrete.

Fernando Pelisseret.al [6] was working on efficient self-compacting concrete with low cement consumption". Authors have replaced use of cement by fly ash and metakolin. Self-compacting concretes (SCC) necessity have high fluidity, cohesion & would not segregate. These properties of fresh concrete rise the cost of production, mainly for minor projected strengths. In that work, a low Portland cement alignment of SCC, with additionalmetakaolin& fly ash was studied to estimate its rheological & mechanical properties. Cement consumption index decrease to 7.8 kg/m^3.Mpa, its achieved higher compressive strength. Cement metakolin ratio 1:3, the compressive strength higher (67.2Mpa) using cement consumption index 7.87.8 kg/m^3.Mpa.

Chinmaya Kumar Mahapatra et.al [7] did study on Hybrid fiber reinforced self-compacting concrete with fly ash and colloidal Nano silica: A systematic study.The current methodicalstudies on properties of hybrid fiber reinforced self-compacting concrete (HyFRSCC) by crimped steel fibers (CSF) & polypropylene fibers (PPF) along through class F fly ash (FA) &colloidal Nano silica (CNS). Compressive strength & tensile strength test are carried out on hardened concrete. praportion of 10% FA, 0.4% CNS, 1.25% CSF & 0.167% PPF establish to be in optimal recommendation. From result it's concluded that fresh & harden properties of hybrid fiber reinforce SCC have Good spilt tensile strength.

Cosa Alexandraet.al [8] was working on Mix Design of Self-Compacting Concrete with Limestone Filler versus Fly Ash Addition. Self-compacting concrete is nowdays the privileged choice of the construction industry, surpassing the usage of ordinary concrete through reducing cast-in-place equipment &labour, while perfectly filling formwork under its own weight. On the other hand, the mix design & production methods are more prone to human mistakes than those for ordinary concrete & are vital for structural solutions. Furthermore, a compaction was performed in the middle of self-compacting concrete by limestone filler & self-compacting concrete with high volume fly ash added as per 63% cement replacement. SCC is an excellent replacement of the ordinary concrete, careful study and proper measures should be imposed before casting RC element.

Nipat Puthipadet.al [9] did study on Enhancement in self-compatibility and stability in volume of entrained air in self-compacting concrete with high volume fly ash. Authors have carried out the tentative study on the effect of entrained air bubbles on the improvement of self-compatibility in which fresh concrete is used with high volume of fly ash. The stability in form of volume of entrained air bubbles was also analyzed. In this study lower water retention & ball-bearing effect of fly ash &entrained air bubbles were considered to affect the self-compatibility of fresh concrete. The results showed us that higher the fine aggregate contented in mortar (s/m) of SCC more be able to be employed as replacement. Ratio of cement with fly ash (fa/p) rises owing to the higher ball-bearing effect of fly ash, in malice of reduction in water to powder ratio (w/p). The ball-bearing effect of entrained air bubbles, with definite type of air-entraining agent (AEA), was also found to further increase the self-compatibility of fresh concrete with fly ash. However, the stability in volume of entrained air bubbles tended to be reduced as fa/p increased, due to higher amount of large entrained air bubbles produced. Apparently, the spherical shape of fly ash is tended to cause the unification and escape of entrained air bubbles in SCC.

II. CONCLUSION

From the review of various research paper the following conclusions are drown.

1. The replacement of cement by metakolin (MK) & rice hask ash (RHA) shows the compressive strength increases compare to natural SCC. The compressive strength found in 28 days is 27%, 90 days is 42%, and 365 days is 48%.
2. By, using high volume fly-ash in beam with SCC method, the Compressive strength greater than 35Mpa in 3 days. There are Low longitudinal reinforcement, its shows that shear capacity is more compare to CC beam. Also the cement replacement level from 50% to 70%, increases the shear ductility by 35% it's more than the CC beam.
3. The replacement of cement by Nano particles (SiO_2, TiO_2, & Al_2O_3) it's found the Compressive strength & flexural strength was increases compare to normal concrete in 28 & 90 days. Also hardness, & elastic modulus increases.

4. By, using metakaolin and fly ash to replacement of cement.itsshowns that the cement consumption index decreases to 7.8 kg/m^3.Mpa and higher compressive strength is obtained. When the Cement metakolin ratio 1:3 the compressive strength found higher (67.2Mpa) using cement consumption index 7.878 kg/m^3.Mpa.

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