THE ADMIXTURE COMBINATION EFFECTS ON SELF COMPACTING CONCRETE, CHARACTERISTIC PROPERTIES

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ABSTRACT:

An experimental study on self-compacting concrete (SCC) having water cement content of zero.40with the work involving in 3 varieties of mixes particularly the primary consisting of various percentages of ash (FA) mixed with concrete, second with completely different percentages of oxide fume (SF) with self-compacting concrete testing for its engineering properties and third employing a mixture of ash with super plasticizer SP-430 for a notable variation in its strength characteristics, when the preparation of every combine cylindrical specimens are casted and cured for seven & twenty eight days for testing its properties.
Concrete, despite being wide used Constructions. Thanks to its sturdiness & value effective, has many disadvantages, like poor enduringness, higher greenhouse emission emissions, and therefore the inability to realize best strength unless absolutely compacted. And sufficiently recovered. to resolve these difficulties, a deal of analysis is being done to enhance a specific specialty. One in all these studies diode to a brand new breakthrough called SCC,

That permits complete compaction while not the utilization of external forces. SCC high workability, that makes its pump ready, yet as high segregation resistance. Chemical additives like super plasticizer and consistence modifier improve the work & ability of concrete by reducing segregation & bleed in freshman concrete.
Since the study concerned is with self-compacting concrete, slump cone associated V-funnel tests ar administrated on the contemporary SCC whereas concrete compressive & split enduringness values are determined on hardened blocks as engineering properties. it's been found that there's a rise in compressive strength of SCC with two hundredth addition of oxide fumes to the concrete compared with half-hour of ash for twenty eight days cured specimens & additionally the specimens containing super plasticizer with ash within the concrete are going to be robust & provides notablecompressive&split enduringness with sensible workability characteristics when put next to solely ash & oxide fumes that has been mixed with self compacting concrete.

KEYWORDS: Water cement ratio, fly ash & silica fumes, super plasticizer-SP 430, mix design, compressive & Split tensile strength.

INTRODUCTION

Concrete, despite being widely used Constructions. due to its durability & cost effective, has several disadvantages, such as poor tensile strength, higher CO_2emissions, and the inability to achieve optimal strength unless fully compacted. And sufficiently healed. To solve these difficulties, a deal of research is being done to improve a particular specialty. Rice husk ash, when used instead of cement, improves mechanical properties of hardness concrete by high up 15%. Limestone powder improves mechanical belonging and longevity of concrete by having a good compact network, and fine marble powder creates extremely good concrete cohesion.

For concrete commixtures with a higher content of silica, the average spillage is lower. In the early stage of concrete, SCC mixtures made with fly ash have poor confrontation to sorptivity, water absorption, abrasion resistance, and chloride permeability; however, these properties decrease with age and a 30% increase in ash The average leakage is smaller for cementitious combinations containing more silica. Fly ash-based SCC mixes initially exhibit poor resistance to sorptivity, water absorption, abrasion resistance, and chloride permeability; however, these

characteristics improve with age and flow qualities after ash content was increased by30%. The goal of this study is to find out how different chemical and mineral admixtures affect the characteristics of freshly mixed, hardened concrete. Chemical admixtures are crucial to the creation of SCC. Polycarboxylic ether, synthetic copolymer, and polyalcohol—technically known as cementitious material, viscosity modifier, and anti-build additive—are the most frequently employed chemical additions.

SELF-COMPACTING CONCRETE

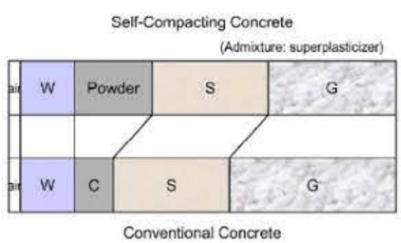
Due to its own weight, S.C.C. may be compacted and laid with little or no vibration.,without segregation or seepage of the new concrete, yet staying cohesive enough tobe handled.SCC has a super plasticizer, high fines content and a viscosity modifier.The superplasticizer adds fluidity to the mix, while the finer content gives it stability,resulting in resistance to oozing and segregation. By using silica and fly ash into SCC concrete mixtures instead of only Portland cement, less superplasticizer is required to provide a homogeneous pour than in concrete mixtures just comprised of Portland cement.

The W/C ratio is equal to ordinary plasticized concrete, assuming the same required strength.

• High fluidity with a low water cement ratio (0.40), W/Cm. This is accomplished by combining a highly efficient water reduction admixture (HRWR) with stabilizing chemicals to assure mixture integrity. Depending on the characteristics of the cement, the volume ratio of water and

portland cement is assured to be 0.9 to 1.0, with the content of granite powder fixed at 50% of the volume of dry matter and fine aggregate placed at 40% of the volume of the mortar fraction. To achieve self-compaction, the plasticizer dosage and the final W/Cm ratio are chosen.

WHAT IS SCC? -Self-compacting concrete, SCC, that flow under its own weight but not require a compaction operation separately, to flow through sections with strong rein forcing .The cement binders and water ratios in SCC are nearly identical to those in ordinary concrete mix. The differences in the mix, on the other hand, lead the SCC to create a strength that become stronger without vibrate. concrete because better links are formed between the hardness paste and the aggregate and reinforced. SCC can be poured into constructions up to fifth meters tall because the aggregates do not segregate due to its properties. SCC can also be pour more quickly then conventional concrete.



TYPES OF S.C.C- Self-compacting concrete, SCC, that flow under its own weight but not requires a compaction operation separately, to flow through sections with strong rein forcing. The cement binders and water ratios in SCC are nearly identical to those in ordinary concrete mix. The differences in the mix, on the other hand, lead the SCC to create a strength that become stronger without vibrate concrete because better links are formed between the hardness paste and the aggregate and reinforced. SCC can be poured into constructions up to fifth metres tallbcause the aggregates do not segregate due to its properties. SCC can also be pourmore quickly then conventional concrete.

Self-compacting concrete, SCC

LITERATURE ANALYSIS-

1.Erhan et al, 2015[14] in their experimental study detailed the fresh as well as the rheological behavior of the SCC when it is merged with nano silica and fly ash. Four different mixes with a w/c ratio of 0.3 and nano silica replaced with Portland cement at 0%, 2%, 4% and 6% to the weight of binder were formulated. Fly ash is incorporated for the 2%, 4% and 6% of nano silica containing self compacting concrete at 25%, 50% and 75% respectively to the weight of the total binder ratio. The incorporation of the nano silica in SCC is noted to enhance the slump flow and the V funnel flow at 25%, 50% and 75% also. Whereas for the L-Box test, the L-Box height ratio tend to increase with the fly ash content. The rheological tests for the same exposed the shear thickening of the self-compacting concrete by theaddition of the nano silica whereas the addition of the fly ash decreased the same. The fly ash content in SCC is also noted to decrease the mechanical properties of the SCC developed in this investigation.

2.Benaicha et al,2015[15] experimentally studied the effects of silica fume and viscous modifying agents on the rheological and the mechanicalbehaviour of the SCC. In order to ascertain the rheological parameters slump test, L-box test, segregation test, V-Funnel test were conducted. In case of the mechanical properties, the compressive strength, tensile strength and modulus of elasticity were analysed. This study revealed the improvement in the plastic viscosity and the yield stress under a regulated condition of constant water/cement ratio along with the super plasticizer. In case of the mechanical properties, the SCC obtained with silica fume is noted to show better results than the SCC with VMA. Henceforth the paper concludes that based on the easy availability of a material, the VMA or the silica fume can be chosen accordingly.

3.Divya et al, 2015[7] experimentally investigated the fresh concrete studies, mechanical properties and durabiity properties of SCC developed with replacement of the binder with 0%, 5%,10%,15% and 20 % of rice husk ash (RHA). A rise of 33% is noted in the compressive strength whereas the split tensile strength is noted to elevate up to 15% of replacement with RHA. Notable reduction is spotted in chloride ion permeability. Adequate non permeability is visualized for the SCC developed with 15% of RHA replacement. Porosity of the specimens considerably reduced with longer curing time owing to the higher percentage of rate of hydration with the longer concrete age. Henceforth a much denser concrete is obtained by 15% replacement of RHA which in turn developed the maximum compressive strength than all the other specimens casted.

4.Rahmat et al,2015[16] detailed the influence of nano silica and carbon nano fibers in the self compacting concrete. A combined study with fresh and hardened characterization along with the hardened concrete study is conducted in this study. The SCC thus developed in this study is continuously monitored for the first 24 hours to clearly observe the accurate characterization of the SCC. The carbon nano fiber in the cement paste elevated the flexural strength by 30% which also caused surface cracking. However maximum shrinkage is observed for an ultrasonic pulse velocity value between 1500-2000m/s. The nano silica in SCC notably improved the compressive strength also improved the early age cracking and thereby affecting the durability of the SCC developed too.

5.Mehmet et al, 2012[8] included the industrial waste materials such as marble powder, limestone powder and fly ash. In this experimental analysis, industrial waste materials were included in SCC replacing the total binding material at 5%, i10% and 20% by weight. Though the use of marble powder and lime stone powder tend to increase the water content, the addition of fly ash neutralized the same in turn achieving a target slump flow. Thus, the fillers elevated the percentage of super plasticizer in concrete and also increased the initial and final setting time of SCC. The 28 days compressive strength of the ternary mixes were comparatively lower than that of the binary mixtures. And a much similar pattern is noted for the spit tensile strength of SCC also. Both binary and ternary mixtures developed lower chloride ion penetration properties.

6.Mostafa et al,2015[17] studied the influence of class F fly ash, nano silica and silica fume on the SCC with high performance. In this analysis, adequate fraction of these admixtures was replaced with the total cement content in SCC. The rheological properties, thermal properties, transport properties and the mechanical properties were detailed in this study. The fly ash content is noted to improve the rheological parameters whereas the silica nano particles and silica fume improved the transport as well as the mechanical properties. The larger portion of mineral admixtures blended with minimum fraction of the nano powders is a promising combination for a high performance self-compacting concrete. 7.Rahmat et al, 2012[11] predicted the fresh and hardened properties of SCC incorporated with metakaolin. A total of 15 mixes with MK content of 0%, 5%, 10%, 15% and 20% were developed by varying the w/c ratio as 0.32, 0.38 and 0.45.With no VMA, the various mixes showed up good workability and rheological properties. The compressive strength of the concrete specimens were noted to increase up to 27% upon the 14 days of curing. The compressive strength of the same were also predicted by multiple regression analysis in terms of ultrasonic pulse velocity. The tensile strength gained up to 11 % than the control specimen. Lower absorption is recorded in the SCC specimens with good electrical resistivity also. Altogether a SCC mix with 10% of metakaolin replacement is an ideal proportion for developing economically efficient concrete with better fresh and hardened concrete properties.

8.Beata et al, 2013[12] experimentally investigated the effects of chemical admixtures on the hydration of cement and mixture properties in SCC with very high performance. With few admixtures, micro cracking is developed whereas with the analyzed mixtures, the C-S-H gel showed improvement. The workability loss is visible according to the type of admixture that is chosen, but it does not affect the air content of very high-performance self -compacting concrete. The HRWR admixtures based cement pastes also developed bubble bridges that overtook any other fluid action of the same.

9.Rafat et al,2013 [18] investigated the properties of SCC developed with coal bottom ash. Fine aggregate is replaced with 10%, 20% and 30% of coal bottom ash to investigate the fresh concrete properties such as slump flow, U-funnel test, L-box test, and J-ring test, along with the hardened concrete parameters such as abrasion resistance, compressive strength, chloride permeability and sorptivity. Betterment in compressive strength is observed at i28 days whereas the chloride permeability resistance decreases for 90 days and 365 days. A co relation between the abrasion resistance and the compressive strength is developed such that both are directly proportional, since the abrasion resistance highly influenced the compressive strength of the concrete.

10. Ha Thanh et al,2016 [19] presented theinfluence of the super plasticizer and mineral admixtures (rice husk ash, silica fume and fly ash) on the self -compacting high- performance concrete in terms of the compressive strength of the mortar specimens. Expect the rice husk ash (RHA), both the fly ash and silica fume notedly decreased the filling and passing ability along with a hike in resistance to segregation and plastic viscosity. The bleeding in concrete is observed to mitigate with the addition of the rice husk ash. Thus, the macro-mesoporous nature of the rice husk ash can also be used as viscous modifying agent to improve the robustness of high-performance self -compacting concrete (HPSCC) at higher super plasticizer dosages. The coarser particles in RHA with large specificsurface area which thereby stipulated the attraction of the inter molecular forces and improved the compressive strength of the HPSCC. Therefore, a maximum compressive strength is visualized for SCC with 20% of fly ash and 20% of RHA. 11.Ali sadramomtazi et al, 2016[20] investigated the rheological, mechanical and durability characteristics of SCC developed with polyethylene terephthalatei (iPET) particles combined with the pozzolanic materials (fly ash and silica fume). These PET particles in SCC minimized the mechanical properties such as compressive strength, tensilestrength and flexural strength. To counterbalance the same, fly ash and silica fume were introduced into the mix. The lower specific gravity of these PET aggregates in concrete also reduced the density of concrete owing to the weak bonding between the PET aggregates and the cement paste. These parameters also reduced the ultra-sonic pulse velocity values due to the larger number of pores in the mix.

12.Wongkro et al,2014 [21] studied the effects on the compressive strength and chloride resistance of the SCC developed with high volume fly ash (HVFA) and silica fume in binary blended cement and terenary blended cement. Both HVFA and silica fume were replaced with cement at various proportions each and the tests were conducted. The binary blended cement with HVFA is noted to reduce the mechanical property (compressive strength). In contrary to the binary blended cement, the terenery blended cement improved the compressive strength. Nevertheless, both fly ash and silica fume were noted to increase the chloride resistivity at higher levels.

13.Navid et al, 2016 [22] analysed the influence of industrial waste (palm oil fuel ash) from power plant of palm oil industry in the SCC due to its high pozzolanic characteristics and abundance as an industrial waste. This industrial waste is replaced with OPC at 10%, 15% and i20% to investigate the mechanical and durability properties of the SCC thus developed. Both the mechanical and durability properties were noted to improve due to the reduced amount of portlandite in the system leading to the production of the C-S-H gel thereby densification of the matrix. This phenomenon also mitigated the open pores by blocking the networks.

14.Badogiannis et al, 2015 [23] studied the effects of metakaolin on the durability properties of self -compacting concrete. The Portland composite cement and limestone powder of high fineness were replaced with high purity metakaolin. Four mixtures were developed to find the blending nature of metakaolin with cement thereby to study the enhancement of the packing density. And another four mixes replacing metakaolin with lime -stone powder at different percentages were obtained to procure the same results. These two categories were compared with another one control mix, thus developing a total of nine mixes in this study. Crushed calcareous lime-stone aggregate and polycarboxylic based super plasticizer is involved to develop SCC at a w/c ratio of 0.6. to produce SCC. Various durability study such as open porosity, sorptivity, near surface water penetrability, Gas permeability and chloride penetrability were studied. Bases on the study the following conclusions were made. Slight improvement is found in open porosity percentage for both the replacement of cement with metakaolin and limestone powder with metakaolin.

ADVANTAGES AND DISADVANTAGES OF SELF-COMPACTINGCONCRETE

Advantages

Some of the important advantages SCC are as follows:

- In situations when castings are challenging because to congested reinforcement, access, and so on, SCC produces homogeneous concrete.
- SCC has a strong filling ability, particularly when it comes to reinforcing.
- Eliminates blood circulation issues that create & quot; white fingers& quota; caused by compacting equipment, resulting in what is known as healthy concrete.
- Reduces construction time by speeding the construction process, particularly in the precast industry.
- Its ease of deployment increases production and reduces costs by using less equipment and labour.
- As a result of the reduction in form wear and tear, the service life of forms is extended. Shows a narrow variance in site features.
- Even with a greater price per cubic metre for the concrete, it reduces resource consumption and costs.

Disadvantages

listed below;

- In comparison to traditional concrete, the manufacture of SCC imposes more severe material selection requirements.
- The rheology of SCC will be significantly more affected by an unregulated variation of even 1% moisture content in the quarry dust at very low W/C (0.3) ratios. SCC mixture demands proper aggregate stock piling, constancy of moisture during batching, and sound sampling procedures.
- A vast number of experimental batches are required for the creation of an SCC. Aside from the laboratory trial batches.
- SCC is initially more expensive than traditional concrete due to increased chemical additive dose, ultra high liquid reducer and additive that increases. stickiness (VMA). Increased material costs can be easily offset by increased production, reduced vibration costs and maintenance, and optimum mineral additive use.

CONCLUSIONS- The advent of SCC is a huge boon to both the concrete and precast industries. The usage of SCC in construction can reduce construction time by 25%. SCC is a popular material due to its superior finishing quality, faster building rate, energy savings, and so forth.

Based on the research work conducted the following broad conclusions are drawn

1) The SCC generated with the admixture combination performed better at1000C and 2000C than other combinations of admixtures such as When SCC with any of the foregoing admixtures is subjected to a high temperature of 8000C or 9000C, the strength qualities are severely compromised.

2) The freezing and thawing resistance of SCC including admixtures such as is found to be good. The freezing and thawing resilience of SCC with admixture combination is shown to be superior to other mixture combinations.

3) Red mud, an industrial waste, can be used advantageously in the production of SCC, along with combinations of mixtures.

4) In specific circumstances, the use of diverse combinations of commixtures in the manufacture of SCC is encouraged since it induces some special qualities in SCC, resulting in higher strength and durability characteristics.

5) SCC formed with the admixture combination is more resistant to high temperatures.

6) When SCC formed with the combination of admixtures is heated to 8000C or 9000C, the strength qualities are severely impacted.

7) The features of S.C.C created with above combined of commixtures grow as the dosage of the last admixture increases.

8) At 1000 and 2000 degrees Celsius, the SCC produced by the mixtures remained nearly stable.

9) When compare to other combinations of mixtures, the SCC created with combination of admixtures performed better. The performance are both satisfactory.

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