

Performance of Self Compacted Concrete With Steel Slag Replacing Coarse Aggregate

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Abstract:

Self-compacting concrete, also referred to as self-consolidating concrete, is able to flow and consolidate under its own weight. This makes SCC particularly useful wherever placing is difficult, such as in heavily-reinforced concrete members or in complicated work forms. The objective of this research was to check the mechanical properties of self-compacted high strength concrete using steel slag as partial replacement of coarse aggregate. Cube specimen (15x15x15)cm were tested for compressive strength, cylinder specimen (15x30)Cm were tested for tensile strength and beam specimen (50x10x10)cm were tested for flexural strength after 7 days, 28 days and 56 days of curing, in order to find out if self-compacting concrete would show an increase in these strength. The mix design used for making self-compacted concrete specimen was based on the previous research work on this topic and from literature. The water – cement ratio varied from 0.40 while the cement, fine aggregate and admixture were kept same, expect the coarse aggregate and steel slag were change for obtaining the best result.

Keyword - Difficult, Compacted, Consolidate, Complicated, Literature.

1 INTRODUCTION

The majority of the people might not know a lot about it or at least do not like it too much but, concrete is around us everywhere. There is no doubt that the concrete is of special importance in the buildings and constructions. Concrete technology has made marvelous stride in the past decade. The expansion of specifying a concrete according to its performance requirements, slightly than the constituents and ingredients has opened numerous opportunities for producers of concrete and users to design concrete to go with their particular necessities. The concept of self-compacting concrete was proposed in (1986) by Professor Hajime Okamura but the prototype was first developed in 1988 in Japan, by Professor Ozawa at the University of Tokyo. Self-compacting concrete was developed at that time to improve the durability of concrete structures. The hardened concrete is solid, uniform and has the same engineering properties and durability as that of

conventional vibrated concrete. The use of SCC eliminates the need for compaction thereby saves time, reduces labour costs and save energy. Furthermore use of SCC enhances surface finish characteristics.

2. OBJECTIVE OF THIS STUDY

The main objectives set for this research were to compare the mechanical properties of self-compacting and normal concrete specimens and. The criteria used were based on 7 days, 28- day and 56 days compressive, splitting tensile and flexure strength and of conventional and self-compacting concrete for five steel slag ratios.

The scope of this research included an examination of

- The effect of steel slag on SCC.
- The effect of chemical admixtures on splitting tensile, compressive strengths and

flexure strength of self-compacting concrete.

- The mineral admixtures, which have been used for this project, were comprised of steel slag have decided and silica fume. The super plasticizer Conplast SP430 admixture and viscosity- modifying were used in the study respectively.

3. LITERATURE REVIEW

S Girish (2010) presented the results of an experimental investigation carried out to find out the influence of paste and powder content on self-compacting concrete mixtures. Tests were conducted on 63 mixes with water content varying from 175 l/m³ to 210 l/m³ with three different paste contents. Slump flow, V funnel and J-ring tests were carried out to examine the performance of SCC.

Paratibha Aggarwal (2008) presented a procedure for the design of self-compacting concrete mixes based on an experimental investigation. At the water/powder ratio of 1.180 to 1.215, slump flow test, V-funnel test and L-box test results were found to be satisfactory.

Felekoglu (2005) has done research on effect of w/c ratio on the fresh and hardened properties of

SCC. According to the author adjustment of w/c ratio and super plasticizer. The results of this research show that the optimum w/c ratio for producing SCC is in the range of 0.84-1.07 by volume. The ratio above and below this range may cause blocking or segregation of the mixture.

Sri Ravindra rajah (2003) made an attempt to increase the stability of fresh concrete (cohesiveness) using increased amount of fine materials in the mixes. They reported about the development of self-compacting concrete with reduced segregation potential.

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 cementations materials was maintained constant (400 kg/m³), while the water/cementations material ratios ranged from 0.3 to 0.45.

Kasami (1978) Have investigated the pumpability of superplasticized concrete under field conditions. In their experiment, about 2000 m³ of normal and lightweight aggregate concrete, involving 14 mixes with and without superplasticizers were pumped horizontally. The pumping distance was 109 m and line diameter 125 mm.

4. EXPERIMENTAL PROGRAM

COMPRESSIVE STRENGTH TEST:-

In order to study the effect on compressive strength when Steel Slag is added into self- compacting concrete as cement replacement, the cube containing different proportion of Steel Slag were

prepared and kept for curing for 7, 28 and 56 days. The test was conducted on ASTM of capacity 3000 KN. it is concluded that the 56 days strength of all the mixes is invariably higher than corresponding 7 days and 28 days strength, this is due to continuous hydration of cement with concrete.

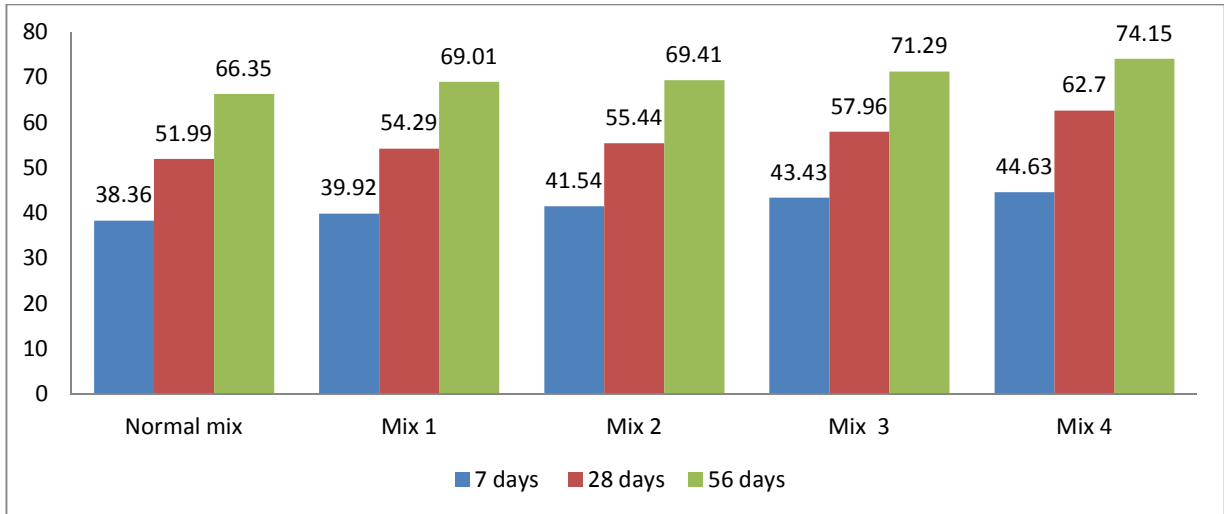


FIG 4.1 COMPRESSIVE STRENGTH BAR CHART

FLEXURAL STRENGTH TEST

The flexural strength of the concrete mix was measured at 7 days 28 days &56 days by using

universal testing machine on standard beams of size (100mmx100mmx500mm). The flexural strength was found to increase for all mixes at all days in comparison to control mix

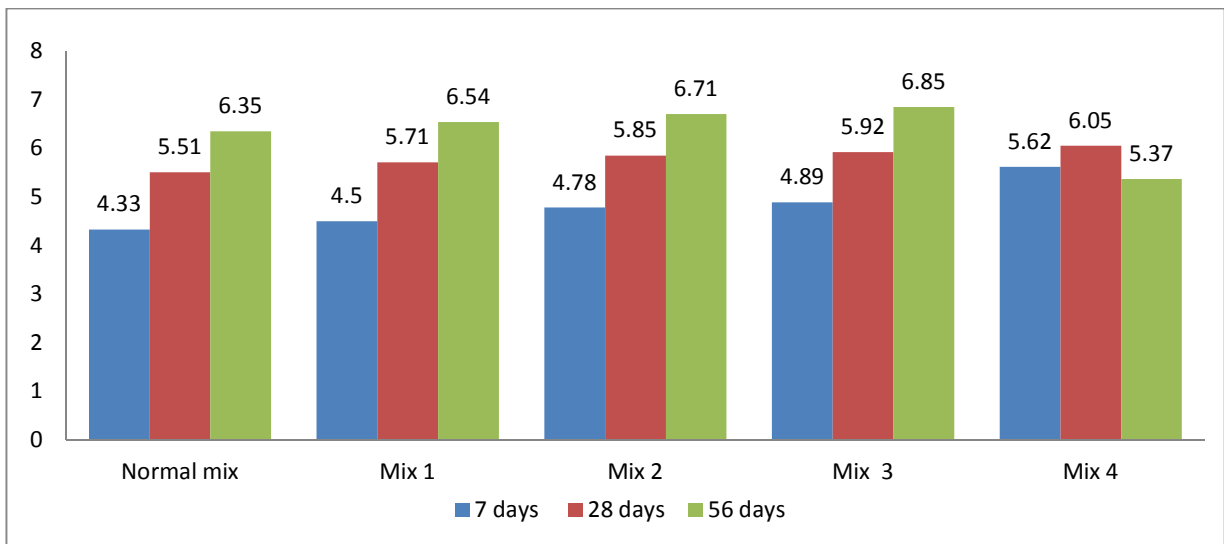


FIG 4.2 FLEXURAL STRENGTH BAR CHART

SPLIT TENSILE STRENGTH TEST

Due to the usage of mineral and chemical admixtures in the concrete mixtures, as explained

in the previous chapters, an increase in the tensile strength of the self-compacting concrete could be observed, compared to the strength of conventional

concrete. the splitting tensile strengths for normal and self-compacting concrete specimens, as they

were tested after being cured for 7 days, 28 days and 56 days.

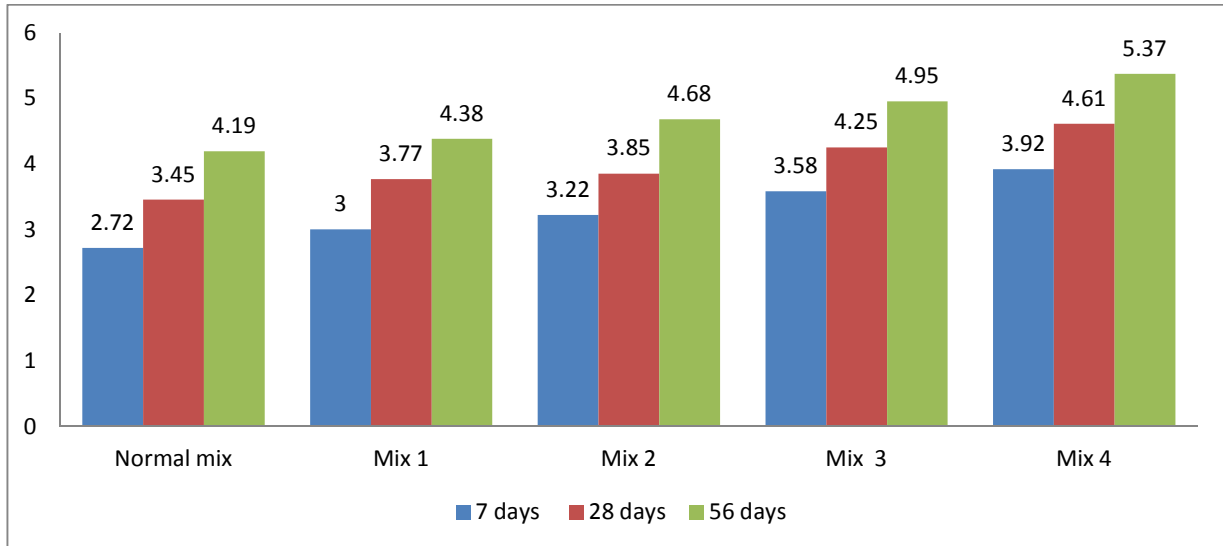


FIG 4.3 SPLIT TENSILE STRENGTH BAR CHART

5. CONCLUSION

It has been verified, by using the slump flow and U-tube tests, that self-compacting concrete (SCC) achieved consistency and self-compactability under its own weight, without any external vibration or compaction. Also, because of the special admixtures used, SCC has achieved a density between 2400 and 2500 kg/m³, which was greater than that of normal concrete, 2370-2321 kg/m³. Self-compacting concrete can be obtained in such a way, by adding chemical and mineral admixtures, so that its splitting tensile and compressive strengths are higher than those of normal vibrated concrete. An average increase in compressive strength of 40% has been obtained for SCC, whereas 20% was the increase in splitting tensile strength. Also, due to the use of chemical and mineral admixtures, self-compacting concrete has shown smaller interface micro cracks than normal concrete, fact which led to a better bonding between aggregate and cement paste and to an

increase in splitting tensile and compressive strengths. A measure of the better bonding was the greater percentage of the fractured aggregate in SCC (20-25%) compared to the 10% for normal concrete. The presence of silica fume in the Portland cement concrete mixes causes considerable reduction in the volume of large pores at all ages. It basically acts as filler due to its fineness and because of which it fits into spaces between grains in the same way that sand fills the spaces between particles of coarse aggregates and cement grains fill the spaces between fine aggregates grains.

6. REFERENCES

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