Effect of Shear Span to depth ratio (a/d) on Shear behaviour of Recycled Aggregate Based Self Compacting Concrete

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ABSTRACT:

Self-Compacting Concrete (SCC) is flow able and highly viscous which does not require any external compaction during casting and placing. Use of recycled aggregates as replacement up to 50% of natural coarse and fine aggregates is been widely used by many researches in past few years. In the present study an attempt is made to study the behavior of steel fiber reinforced self-compacting concrete under shear by using 100% recycled concrete aggregates as coarse and fine aggregates. The experimental programme consisted of 16 beams of which 8 beams each were cast with natural aggregates and remaining beams were cast using 100 % recycled aggregate. The size of the beam was fixed at 100x200x1200mm. Due to the use of recycled concrete aggregates as coarse and fine aggregates, compressive strength is reduced by 7.8% and 8% for SCC30 (30MPa) & SCC70 (70MPa) Concrete. Ultimate shear strength is reduced by 14% and 12% due to use of recycled concrete aggregates for SCC30 and SCC70 beams respectively. The shear strength obtained experimentally was compared with the existing models available in the literature, and the correlation is satisfactory.

1.0 INTRODUCTION:

The nature of the construction industry is not environmentally friendly and the need for sustainable methods in construction is very crucial to ensure that natural materials are not depleted for future needs [1-2]. Globally every year, more than 26.8 billion tonnes of normal concrete is used, which creates a very huge amount of construction and demolition waste [3]. The usage of natural aggregate has increased drastically over the past few years in the construction industry which leads to depletion of natural aggregates. The use of recycled concrete aggregate is well recognized as a sustainable material that offers solutions to this problem, but still it is considered as inferior to natural aggregate in terms of its structural properties [4-7]. Although the use of recycled concrete aggregate in place of natural aggregate has now received considerable attention as a sustainable method, its uses are still limited.

Self-compacting concrete is a highly flow able concrete which can fill every corner of form work without any external vibration effort. The preparation of SCC requires large amounts of binder content and relatively lesser amounts of coarse aggregates [8-10]. The large quantities of binder content can be achieved by using mineral admixture like fly ash and silica fume which will not only satisfy the requirement of SCC but also supports to achieve the required strength and durability which is a sustainable. By replacing the natural aggregates with recycled concrete aggregates in SCC, a sustainable concrete i.e. recycled aggregate based self-compacting concrete (RASCC). Recycled concrete aggregates are obtained by crushing waste concrete and then, the coarse fraction of crushed aggregates can be used to replace natural coarse aggregates and the remaining finer fraction can be used as fine aggregates in the concrete production process.

1.1 EXPERIMENTAL PROGRAMME:

Several researches studied the effect of recycled aggregates on mechanical, durability and structural properties by replacing up to about 50% of natural aggregates. In the present study, natural aggregates are completely replaced with recycled concrete aggregates and the mechanical properties and shear behaviour of self-compacting concrete are studied. The recycled aggregates are pre-soaked in water for 30 minutes before concreting was done, so that the recycled aggregates may not absorb excess water during mixing process of concrete. The parameters varied in the present study, are strength of concrete i.e. 30 MPa, 70 MPa, shear span to depth ratio (a/d=2 and 3) and type of aggregate i.e. Natural aggregate (NA) and Recycled aggregate (RA). A total of 16 beams were cast and tested under four point loading out of which 8 beams were cast with natural aggregate (NA) and remaining 8 beams were cast with recycled aggregate (RA). The details of the beams cast are shown in Table-1 and 2.

Table 1: Details of the specimens cast for NASCC beams

S.No.	Beam Designation	a/d	Stirrups Spacing , mm	Stirrup Diameter mm
1.	**SCC30-0**	2	-	-
2.	**SCC30-180**	2	180	6
3.	**SCC70-0**	2	-	-
4.	**SCC70-180**	2	180	6
5.	**SCC30-0**	3	-	-
6.	**SCC30-270**	3	270	6
7.	**SCC70-0**	3	-	-
8.	**SCC70-270**	3	270	6

Table 2: Details of the specimens cast for RASCC beams

S.No	Beam Designation	a/d	Stirrups Spacing , mm	Stirrup Diameter mm
1.	**RASCC30-0**	2	-	-
2.	**RASCC30-180**	2	180	6
3.	**RASCC70-0**	2	-	-
4.	**RASCC70-180**	2	180	6
5.	**RASCC30-0**	3	-	-
6.	**RASCC30-270**	3	270	6
7.	**RASCC70-0**	3	-	-
8.	**RASCC70-270**	3	270	6

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