

Strengthening the Self Compacting Concrete by Recycled Aggregate

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Abstract: Concrete is the most generally utilized substance after water and more than six billion tons of cement is created every year. At present study for new development of concrete and also to reduce aggregate waste, an experimental investigation was conducted on self-compacting concrete with different percentages of coarse recycled concrete aggregate. The main objective was to study suitability and effect of coarse recycled aggregate in new generation concretes. In the recent years the demand for construction materials has grown tremendously, so has the amount of construction and demolition waste, putting huge pressure on the environment. This has encouraged the use of recycled aggregate in concrete which not only allows for a more efficient life cycle of natural resources but also contributes to environmental protection leading to sustainable development. In this study coarse recycled aggregate (RCA) are used in the production of self-compacting concrete (SCC) of 50 grade in varying percentage replacements of natural coarse aggregate (NCA) from 0% to 100% with increment of 20%. To achieve flow characteristics of SCC Super-plasticizer is added at a dosage by cement weight. The various tests performed were compressive strength, split tension test at the age of 28, 56, 90 days. It is observed that up to 40% recycled aggregate can be effectively used in the production of SCC without any significant reduction in strength and durability.

Keywords: Recycled aggregate Self-compacting concrete, super plasticizer

I. INTRODUCTION

Concrete Technology has made a colossal step in the previous decade. Concrete is presently no more a material comprising of cement, aggregate, water and admixtures yet it is a designed material with a few new constituents performing satisfactorily under diverse conditions. Concrete today can be perfectly customized for various applications, and it contains distinctive materials like metakaolin, micro silica and numerous different fillers, fillers and pozzolanic materials. The improvement of deciding a concrete as indicated by its execution wants rather than the constituents and fixings has opened myriad open doors for manufacturers and shoppers to set up concrete to suit to their explicit conditions. The sort of concrete that is intended to a particular application is known as high performance concrete (HPC). HPC can be defined as "concrete that meets exceptional execution and consistency necessities that can't generally be acquired by utilizing customary ingredients, typical blending technique and curing practices." HPC ought to have no less than one remarkable property viz. compressive strength, high workability improves imperviousness to compound or mechanical burdens, lower penetrability and high durability.

II. OBJECTIVES

The main objective was to study suitability and effect of coarse recycled aggregate in new generation concretes.

1. Compressive, split strength parameters were considered.
2. The strengths are studied at 7 and 28 days of curing.

III. MATERIALS

Different ingredients used in this work are Cement, Fine aggregate, Coarse aggregate, Normal coarse aggregate & Recycled coarse aggregate, Water, Super Plasticizer.

The properties of cement are presented in Table 1.

Table 1: Physical properties of cement

S.NO	DESCRIPTION	VALUES
1	Specific Gravity	3.12
2	Fineness of cement	7.13

Table 2: Chemical Composition of Cement of 53 grade

S.NO	DESCRIPTION	COMPOSITION	PERCENTAGES
1	Lime	CaO	60-67%
2	Silica	SiO ₂	18-25%
3	Ironoxide	Fe ₂ O ₃	0.5-6%
4	Alumina	Al ₂ O ₃	5-9%

IV. EXPERIMENTAL INVESTIGATIONS

4.1 Compressive Strength Results

The cube specimens of 150mm x 150mm x 150mm were cast and tested in compression testing machine for 7, 28 days of curing period for different proportions of concrete mix and presented in table.

Table 3: Compressive strength of concrete with recycled aggregates as partial replacement of coarse aggregate in concrete

Sl. no	MIX TYPE	7 days	28 days
1	R0	41.78	62.84
2	R20	41.11	61.09
3	R40	38.92	59.34
4	R60	36.03	57.84
5	R80	33.07	53.86
6	R100	31.98	52.69

4.2 Split Tensile Strength Test

At the age of 28, 56 and 90 days, the cylindrical specimens (150mm diameter x 300mm height) were tested for evaluating the split tensile strength. The experiment is performed by putting a cylindrical sample horizontally between a compression-testing machines loading surface and the load is applied until the cylinder fails along the vertical diameter.

Table 4: Split tensile strength of concrete with recycled aggregates as partial replacement of cement in concrete

Sl. No	MIX TYPE	7 days	28 days
1	R0	4.05	6.10
2	R20	3.95	5.99
3	R40	3.87	5.90
4	R60	3.72	5.77
5	R80	3.42	5.49
6	R100	3.21	5.22

V. CONCLUSION

- In this study the concrete ingredients like coarse aggregates are replaced by recycled aggregates Varied with different percentages of 20%,40%,60%,80% and 100%.
- The Compressive strength of normal concrete at the age of 7 days and 28 days are N/mm^2 are 41.78 & 62.84 N/mm^2 .
- We got the optimum compressive strength value for 20% replacement of coarse aggregate with recycled aggregates.
- At 20% partial replacement of coarse aggregate with recycled aggregate the compressive strength of concrete at 7 days and 28 days are 41.11 & 61.09 N/mm^2 .
- We got minimum compressive strength values for 100% replacement of coarse aggregate with RCA 7 days and 28 days are 31.98 & 52.69 N/mm^2 .
- We observed the decrement of strength for 40% replacement of RCA at 7 days and 28 days are 38.92 & 59.34 N/mm^2 .
- The compressive strength decreased with the increase in replacement percent of recycled coarse aggregate beyond 40%.
- The split tensile strength of 20% replaced recycled aggregate Self compacting concrete is nearly equal to Natural aggregate Self Compacting Concrete at 7 & 28 days age of concrete.

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