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An Experimental Investigation on Self Compacting Concrete by using Recycled Aggregate by using M40 Grade of Concrete

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Abstract:
Concrete is the second-most-used substance after water, and more than six billion tons of cement are produced each year. As part of the current investigation for new innovations in concrete as well as to decrease aggregate waste, an experimental assessment on self-compacting concrete with varied percentages of coarse recycled concrete aggregate was conducted. The major objective was to investigate the use and effects of coarse recycled aggregate in next generation concretes. The environment is under a great deal of stress as a result of the considerable increase in trash produced during construction and demolition over the past few years, together with the rise in demand for building materials. As a result, the use of recycled aggregate in concrete has been encouraged, which not only enables a more efficient use of natural resources throughout their life cycles but also contributes to environmental protection. This study employs coarse recycled aggregate (RCA) in varying percentage replacements of natural coarse aggregate (NCA) from 0% to 100% with increments of 20% for the production of self-compacting concrete (SCC) of grade 40. Super-plasticizer is applied in order to achieve SCC flow properties at a dose dependent on cement weight. At 28, 56, and 90 days old, testing for split tension and compressive strength were performed on the animals. It has been shown that up to 40% recycled aggregate may be used to create SCC without noticeably decreasing strength and durability.

Keywords: Self Compacting Concrete, Super Plasticizer, Recycled Aggregate, Compressive Strength, Split Tensile Strength

1. Introduction

In the past ten years, concrete technology has advanced significantly. Concrete is now an engineering material with a number of novel components that perform well in a range of environments, rather than a substance made of cement, aggregate, water, and additives. Modern concrete incorporates characteristic components including metakaolin, micro silica, a range of foils, fillers, and pozzolanic ingredients that are specifically tailored for a variety of purposes. A wide range of opportunities have been created for makers and purchasers to modify concrete to satisfy specific requirements by enhancing the definition of concrete, which is now defined by design choices rather than components and fasteners. High

performance concrete is a kind of concrete created for a particular use (HPC). "Concrete that fulfils extraordinary performance and consistency standards that are normally not possible with common ingredient use, common mixing processes, and common hardening methods" is what high performance concrete (HPC) is referred as. One or more significant qualities are necessary for HPC. Good workability, decreased permeability, better impermeability to material or mechanical stresses, and great durability.

2. Objectives

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

1. Split strength and compressive characteristics were taken into account.
2. At 28, 56 and 90 days after cure, the strengths are examined.

3. 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

Sr. No	Description	Values
1	Specific Gravity	3.16
2	Fineness of cement	7.15

Table 2: Chemical Composition of Cement of 53 Grade

Sr. No.	Description	Composition	Percentages
1	Lime	Cao	60-67%
2	Silica	Sio_2	18-25%
3	Iron Oxide	Fe_2o_3	0.5-6%
4	Alumina	Al_2o_3	5-9%

4. Experimental Investigations

4.1. Compressive strength results

The cube specimens of 150 mm × 150 mm × 150 mm were cast and tested in compression testing machine for 28, 56 and 90 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

Sr. No.	Mix Type	28 Days	56 Days	90 Days
1	R0	49.15	53.55	57.45
2	R20	48.41	52.71	56.53
3	R40	47.02	50.90	54.91
4	R60	45.72	49.71	53.48
5	R80	42.27	45.92	49.40
6	R100	41.51	45.12	48.43

4.2. Split Tensile Strength Test

At the age of 28, 56 and 90 days, the cylindrical specimens (150 mm diameter × 300 mm height) were tested for evaluating the split tensile strength.

Table 4: Split Tensile Strength of Concrete with Recycled Aggregates as Partial Replacement of Cement in Concrete

Sr. No.	Mix Type	28 Days	56 Days	90 Days
1	R0	4.77	5.19	5.56
2	R20	4.75	5.17	5.55
3	R40	4.67	5.08	5.44
4	R60	4.56	4.95	5.32
5	R80	4.33	4.71	5.05
6	R100	4.11	4.47	4.80

5. 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 28, 56 and 90 days are 49.15, 53.55 and 57.45 N/mm^2.
- The Split Tensile Strength of normal concrete at the age of 28, 56 and 90 days are 4.77, 5.19 and 5.56 N/mm^2.
- At 20% partial replacement of coarse aggregate with recycled aggregate, the Compressive Strength of concrete at 28, 56 and 90 days are 48.41, 52.71 and 56.53 N/mm^2.
- At 20% partial replacement of coarse aggregate with recycled aggregate, the Split Tensile Strength of concrete at 28, 56 and 90 days are 4.75, 5.17 and 5.55 N/mm^2.

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