UTILIZATION OF DEMOLISHED CONCRETE WASTE AS PARTIAL REPLACEMENT OF COARSE AGGREGATE IN CONCRETE

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ABSTRACT

Concrete waste is generated whenever any demolition activities take place. Recycling concrete waste as recycled aggregate is one of the methods adopted to reduce environmental impact. When the useful life of the structure is over it will be demolished and all the demolished wastes just find their way to landfills. Finding large areas for landfills is becoming very difficult. On the other hand continuous extraction and quarrying of natural aggregates for construction is causing depletion of natural resources. There cycling of demolished construction waste in to aggregates to be used in new engineering application provides a promising solution to both the problems. In this work the usability of demolished waste as coarse aggregates in new concrete is attempted. This experimental investigation involves evaluating the properties of the constituents of concrete including the demolished concrete wastes as coarse aggregate replacing by 0%, 10%, 20% and 30% in new concrete. The results of this experimental study is aimed at examining the properties and strength of recycled aggregate concrete made from different replacement ratios of recycled aggregates from natural aggregates.

Keywords: *Recycled aggregate concrete, Natural concrete aggregate, Super plasticizer Conplast SP 430*

1. INTRODUCTION

Construction and demolition wastes constitute one of the major components of wastes generated worldwide. Very large quantities of aggregates are used in concrete production and in construction. When the useful life of the structure is over it will be demolished and all the demolished wastes just find their way to landfills. Finding large areas for landfills is becoming very difficult. On the other hand continuous extraction and quarrying of natural aggregates for construction is causing depletion of natural resources. The recycling of demolished construction waste in to aggregates to be used in new engineering application provides a promising solution to both the problems. In this work the usability of demolished waste as coarse aggregates in new concrete is attempted. This experimental investigation involves evaluating the properties of the constituents of concrete including the demolished concrete wastes which shall be used as coarse aggregates in new concrete with the aim of producing high strength concrete. The results of this experimental study is aimed at examining the properties and strength of

ISSN (Print): 2204-0595
ISSN (Online): 2203-1731

recycled aggregate concrete made from different replacement ratios of recycled aggregates from natural aggregates and to evaluate the strength of recycled aggregate concrete to check its usability as structural concrete.

2. METHODOLOGY

The methodology will be adopted for the project work. It is shown in Figure 1.

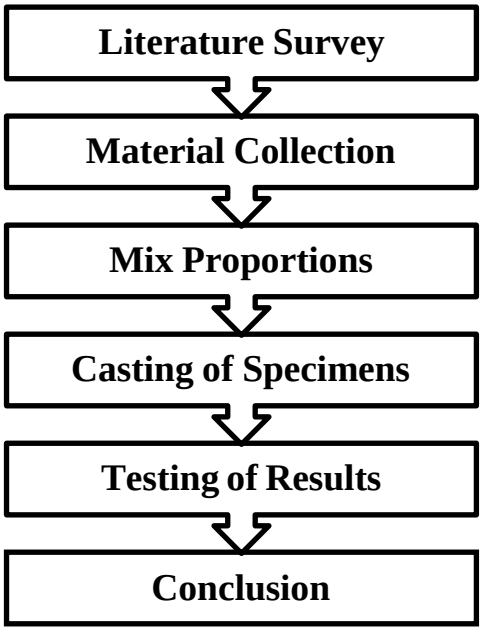

Fig 1 Methodology

3. MATERIALS AND METHODS

The materials used in concrete are subjected to various tests to ascertain their properties and to determine their usability in concrete. Concrete is an artificial material, which is made up of cement, fine aggregates, coarse aggregate and water. In this project additionally I have add an artificial admixture (super plasticizer) to improve some of the properties of concrete. The materials used are cement, M-sand, coarse aggregate, recycled aggregate and artificial admixture.

In order to confirm the use of demolished waste as coarse aggregates in concrete in newly constructed project, the mechanical properties for the recycle aggregate were determined, including specific gravity, water absorption, abrasion resistance, Aggregate Crushing Value and Aggregate Impact Value.

- Cement
- Fine aggregate
- Coarse aggregate
- Recycled aggregate
- Admixture – Super plasticizer Conplast SP 430
- Water

In this study, control mix was designed as per IS 10262:1986 to achieve a target compressive strength of 30 MPa. The casted cubes are test for 7, 14, 28 days Compressive strength, Split tensile strength and 14, 21, 28 days Flexural strength test. The wet mixture was filled into the mould in 3 layers with the help of solve the mix is compacted with twenty five blows of 4.5 kg rammer on level and rigid platform. The number and size of samples are determined by the specific of the tests.

The excess mixture was scraped off and the mould levelled using a straight edge. The mould and its content were left for 24 hours before the removal of the mould. Identification marks were inscribed on the specimen for easy referencing.

ISSN (Print): 2204-0595
ISSN (Online): 2203-1731

4. MIX DESIGN

The design mix for concrete grade M30 is used and various replacement ratios of recycled aggregate by natural aggregate is considered. The water cement ratio is kept constant. The super plasticizer considered was Conplast SP 430.

Table 1 Mix Design for Conventional Concrete

Description	Cement	FA	CA	Water
	(kg/m^3)	(kg/m^3)	(kg/m^3)	(lit/m^3)
Conventional Concrete	437	850	1081	197
	1	1.94	2.47	0.45

Table 2 Mix Design for Recycled Aggregate Concrete

	Cement	FA	CA	RCA	Water
	(kg/m^3)	(kg/m^3)	(kg/m^3)	(kg/m^3)	(lit/m^3)
RCA 10%	437	850	972.9	108.1	197
RCA 20%	437	850	864.8	216.2	197
RCA 30%	437	850	756.7	324.3	197

5. TESTS ON CONCRETE

The obtained demolished concrete was crushed manually using rammers to the required aggregate size. Workability of the concrete is calculated using compaction factor test from which the equivalent slump is found. As it is high strength concrete slump test will give no slump.

Compressive strength test

The casted specimens of size 150mm*150mm*150mm cubes were tested to determine the compressive strength at the age of 7, 14 and 28 days.

Fig 2 Compressive strength

Tensile strength test

The casted specimens of size 150mm*300mm cylinders were tested to determine the tensile strength at the age of 7, 14 and 28 days.

Fig 3 Split tensile strength

ISSN (Print): 2204-0595
ISSN (Online): 2203-1731

Flexural strength test

The casted specimens of size 1m*0.15m*0.15m beams were tested to determine the flexural strength at the age of 28 days.

Fig 4 Flexural strength

6. RESULTS AND DISCUSSION

The various results obtained from the compressive strength tests, tensile strength tests and flexural strength tests were discussed and tabulated. The table 3, 4, 5 and the figure 5, 6, 7 indicates the results of the compressive strength, split tensile strength and flexural strength respectively.

Table 3 Compressive Strength Test Results

% of replacement	Compressive Strength (N/mm^2)		
	7 Days	14 Days	28 Days
0%	16.53	25.76	32.45
10%	14.72	23.34	31.34
20%	15.86	25.85	31.86
30%	17.24	26.92	33.87

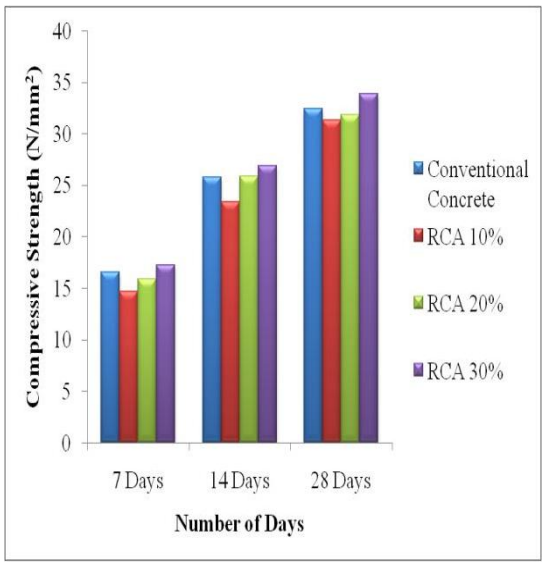

Fig 5 Compressive Strength Test Results

Table 4 Split Tensile Strength Test Results

% of replacement	Split Tensile Strength (N/mm^2)		
	7 Days	14 Days	28 Days
0%	2.83	3.1	3.8
10%	2.6	3.15	3.62
20%	2.47	3.0	3.5
30%	2.75	3.2	3.79

ISSN (Print): 2204-0595
ISSN (Online): 2203-1731

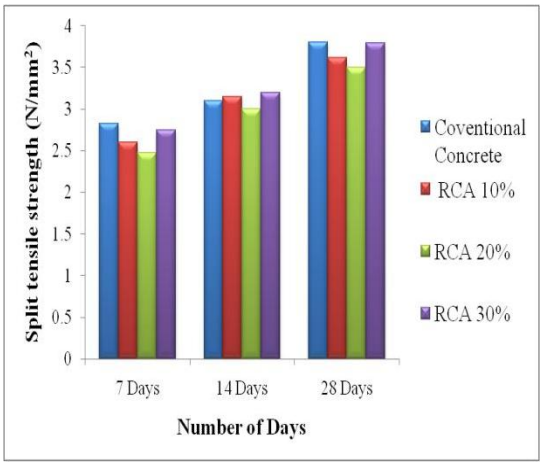

Fig 6 Split Tensile Strength Test Results

Table 5 Flexural Strength Test Results

% of replacement	Flexural Strength (N/mm^2)		
	7 Days	14 Days	28 Days
0%	2.4	2.85	3.2
10%	2	2.4	2.85
20%	2.25	2.56	2.9
30%	2.36	2.9	3.15

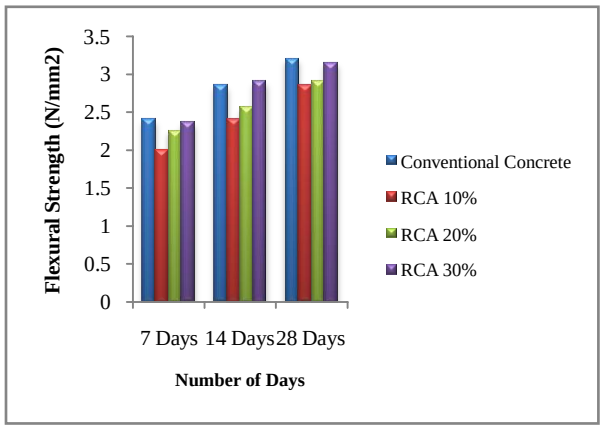

Fig 7 Flexural Strength Test Results

7. CONCLUSION

Research on recycling and reuse of construction and demolition wastes is very important because with the increase in modernization and urbanization there is an increased demand on natural resources while on the other hand the existing demolished wastes have no proper means of disposal.

Hence to use these wastes in new concrete production is not only a promising solution to both the problems, but also that these demolished wastes are easy to obtain and are available at cheaper prices than the virgin aggregates.

The following conclusions can be drawn from the above experimental studies:

- The specific gravity and bulk density of recycled aggregates is lower than that of conventional aggregates. This is because of the attached mortar present on the aggregate surface.
- From the compressive strength results of recycled aggregate concrete it can be concluded that the recycled aggregate concrete though ha slower strength development than the conventional concrete, it can still be used in construction by electing the optimum replacement ratio.
- Further it can also be concluded that the split tensile strength also follows the same trend of reduction in strength with increased replacement. But they still lie within the range

ISSN (Print): 2204-0595
ISSN (Online): 2203-1731

required to be used in structural concrete and hence are satisfactory.

- Similar trends are observed in case of flexure results. And the results are found to be satisfactory.

From the above investigations it can be hence concluded that the optimum replacement for this particular mix for high strength concrete is 30%. Up to this replacement good compressive strength can be achieved using recycled aggregates.

Beyond this replacement the strength acquired reduces gradually and does not cross the target strength and in order to overcome this problem, suitable adjustment in mix design is required.

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ISSN (Print): 2204-0595
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ISSN (Print): 2204-0595
ISSN (Online): 2203-1731