



STRENGTH STUDY ON CONCRETRE BY USING FLY ASH & RECYCLED COARSE AGGREGATE

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ABSTRACT

Recycled aggregate is one of the most common materials for the construction and development of infrastructures in all the countries in the world. In the years to come there will be increase in the production of concrete which needs huge amount of natural aggregates, such huge requirement of natural aggregate may lead to the depletion of natural resources in turn the recourses will not be available for future generation. Recycle aggregate can be obtained from various sources like demolished concrete waste of buildings, roads ,bridges and catastrophes such as wars and earthquakes. Recycling of demolished concrete waste provides an opportunity for saving natural resources, energy, time, money and limited landfill space. The use of recycled aggregated weakens the quality of concrete due to shortcomings such as weaker interfacial bond between aggregate and cement paste. For improving the quality of recycled coarse aggregate, various surface treatment methods such as washing the recycled aggregates with water, diluted acid, enveloping with silica fume were investigated by various researchers. In India about 40% of coal is consumed for generating fly ash as a by-product. Fly ash molecules are spheroid in shape and less than 250 micrometers in size. Fly ash has been used in this work for improving of recycled aggregate concrete. In this project the findings of the mechanical and durability properties of concrete prepared with 0%, 50% and 100% recycled concrete aggregate that were cured in water. The recycled aggregate concrete (RAC) was prepared by using 0% 25%, 35% and 55% class-F fly ash, as cement replacement

Key words: Fly ash, Concrete, Recycled aggregate, Compressive strength, Split tensile strength.

1. INTRODUCTION

Concrete is the primary construction material in the world, It is widely used in all types of civil engineering works, like low and high-rise buildings, environment protection and local/domestic developments. Concrete is a manufactured product, essentially consisting of cement, aggregates, water and admixture(s). Among these, aggregates, i.e. inner granular materials such as sand, crushed stone or gravel form the major part. Traditionally aggregates have been readily available at economic price with the quality which is suitable for all the purposes. However, in recent years the wisdom of our continued wholesale extraction and use of aggregates from natural resources has been questioned at an international level. This is mainly because of the depletion in quality of primary aggregates and greater awareness of environmental protection. In spite of this, the availability of natural resource to future generations has also been realized. The concept of sustainable development put forward almost a decade ago, at the 1992 Earth Summit in Rio de Janeiro, and it has now become a guiding principle for the construction industry worldwide. In fact many governments throughout the world have now introduced various measures aimed at reducing the use of primary aggregates and increasing the use of recycling aggregates, because it is technically, economically, or environmentally acceptable. For example, the UK government has introduced a number of policies to encourage wider use of secondary and recycled concrete aggregate (RCA- defined as minimum of 95% crushed concrete) as an alternative to naturally occurring primary aggregates. These include landfill and future extraction taxes to improve economic viability, and support to relevant research and development work.

2. MATERIAL USED

2.1 Cement: The characteristic of cement is one of the most essential parameters governing the performance of the concrete. Chettinad OPC 43 grade cement used in the experimental investigation.



2.2 Fine aggregate: The sand used for experimental program was locally procured and confirming to zone II .The sand was first sieved through 4.75 mm sieve to remove any particles greater than 4.75mm.

2.3 Coarse Aggregate: Locally available coarse aggregate were used in this work. Aggregate passing through 20mm sieve and retained on 16mm sieve were sieved and tested as per Indian standard specifications IS: 383-1970.

2.4 Recycled Coarse Aggregate: Crushed concrete waste passing through 20mm and retained on 4.75mm I.S sieve were used as recycled coarse aggregate and they met the grading requirements IS 2386 - 1983.The recycled coarse aggregate was collected from demolished structures. 20 mm size aggregate was used.

2.5 Fly ash: A class 'F' fly ash obtained from Mettur Thermal Power Plant (Tamil Nadu) was used.

2.6 Water: Potable water is generally considered satisfactory for concreting purposes. The potable water available in the campus has been used.

3. EXPERIMENTAL STUDY

3.1. Mix design: In this study, control mix was designed as per IS code 10262:2009 to achieve a target compressive strength of 38.25 Mpa for M30 Mix Design. Fly ash was used to replace cement at various levels of 0%, 25%, 35%, and 55% by mass of binder content. Recycled aggregate was used to replace coarse aggregate at various levels of 0%, 50%, and 100%. The details of the Control Mix for M30 are given in Table 1.

TABLE 1 MIX PROPORTION OF M30 DESIGN MIX

Mix type	Cement kg/m ³	FA kg/m ³	CA kg/m ³	Water kg/m ³	W/C
Control	360	670	1353	144	0.40

4. RESULT AND DISCUSSION

4.1 Compressive Strength on Cubes: The average compressive strength values due to replacement of cement with fly ash and sand with Recycled Coarse Aggregate at varies replacement of concrete in table 2 and fig 1&2

TABLE 2 COMPRESSIVE STRENGTH TEST RESULTS AT 7 & 28 DAYS

Mix No.	Mix type	Average Compressive strength (N/mm ²)	
		7 days	28 days
1	Control	28.8	37.33
2	0% FA + 0% RCA	28.8	37.33
3	0% FA + 50% RCA	24.44	32.00
4	0% FA +100% RCA	21.32	28.40
5	25% FA + 0% RCA	25.34	33.34
6	25% FA +50% RCA	23.12	31.11
7	25% FA + 100%RCA	20.42	26.71
8	35% FA + 0% RCA	23.64	30.22
9	35% FA + 50% RCA	20.90	27.1
10	35% FA + 100% RCA	18.67	23.56
11	55% FA + 0% RCA	21.34	25.33
12	55% FA + 50% RCA	18.20	22.21

13	55% FA + 100% RCA	16.14	19.56
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4.2 Split Tensile Strength of cylinder

Concrete cylinder of size 150 mm diameter and 300 mm height were cast using the control concrete mix with a w/c ratio of 0.40 the maximum load at failure reading was taken and average split tensile strength is calculated and tabulated as follows.

TABLE 3 SPLIT TENSILE STRENGTH TEST RESULT OF CYLINDER

Mix No.	Mix type	Average split Tensile strength N/mm ²
1	Control	2.82
2	0% FA + 0% RCA	2.82
3	0% FA + 50% RCA	2.68
4	0% FA +100% RCA	2.54
5	25% FA + 0% RCA	2.75
6	25% FA +50% RCA	2.61
7	25% FA + 100%RCA	2.45
8	35% FA + 0% RCA	2.33
9	35% FA + 50% RCA	2.26
10	35% FA + 100% RCA	2.12
11	55% FA + 0% RCA	2.19
12	55% FA + 50% RCA	1.98
13	55% FA + 100% RCA	1.69

TABLE 4 YOUNG'S MODULUS TEST RESULTS OF CYLINDER

Mix No.	Mix type	Average Young's modulus values
1	Control	29.4
2	0% FA + 0% RCA	29.4
3	0% FA + 50% RCA	25.6
4	0% FA +10 0% RCA	21.8
5	25% FA + 0% RCA	28.4
6	25% FA +5 0% RCA	27.1
7	25% FA + 100%RCA	23.2
8	35% FA + 0% RCA	27.8
9	35% FA + 50% RCA	24.1
10	35% FA + 100% RCA	20.9
11	55% FA + 0% RCA	25.7
12	55% FA + 50% RCA	21.4
13	55% FA + 100% RCA	19.7

5. CONCLUSION

- The replacement of NCA by RCA the Compressive, Tensile strength capacity decrease.
- The partially replacement of Cement by Fly ash the Compressive, Tensile strength value decrease slightly.
- The Mix proportion of 50% RCA &25% Fly ash replacement, the compressive, Tensile strength result at 28 days is nearly equal to the Conventional Concrete.
- The Mix proportion of 100% RCA &55% Fly ash replacement, the compressive strength result at 28 days is 40% low to the Conventional Concrete.



- The utilization of fly ash in concrete is a productive way of disposal of industrial waste.
- Considering the reduction of cost, fly ash blended cement can be employed.
- The wastage of demolished concretes was utilized

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