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Performance of Recycled Demolished Concrete as Coarse & Fine Aggregate For Rigid Pavement

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Abstract - *Utilization of waste materials and byproducts is a partial solution to environmental and ecological problems. Use of these materials not only helps in getting them utilized in cement, concrete and other construction materials, it helps in reducing the cost of concrete manufacturing, but also has numerous indirect benefits such as reduction in landfill cost, saving in energy, and protecting the environment from possible pollution effects. To reduce this impact and achieve a more sustainable product, waste materials can be incorporated into concrete in the form of RA (Recycled aggregate). The most extensively researched material used in the production of RA is waste and demolished concrete, that is, fine and coarse debris from demolition sites. Concrete with RA as a component in the mixing process is referred to as recycled aggregate concrete (RAC).here we utilized recycled course and fine aggregate (RCA & RFA) by replacing natural course aggregate by0 %, 20%,40%,60% & 80% and fine aggregate by* 0%, 10%, 20%, 30% & 40% *to analyzed strength properties of concrete.*

Key Words: recycled aggregate; recycled aggregate concrete; mechanical properties; load test; structural concrete

1.INTRODUCTION

The recycled aggregate used are taken from the demolished concrete members. Most of the concrete wastes are taken form waste concrete members. These concrete wastes are crushed and Recycled coarse aggregates (RCA) were produced. The use of recycled aggregates in concrete proves to be valuable building materials in technical, environment and economical respect. Use of recycled aggregates in concrete can be useful for Environmental protection and economical aspects. Recycled aggregates are the materials for the future. Concrete is the premier construction material across the world and the most widely used in all types of civil engineering works, including infrastructure, low and high-rise buildings, defense installations, environment protection and local/domestic developments. Concrete is a manufactured product, essentially consisting of cement, aggregates, water and admixture. Among these, aggregates, i.e. inert granular materials such as sand, crushed stone form the major part. Traditionally aggregates have been readily available at economic price. 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 of quality primary aggregates and greater awareness of environmental protection. In light of this, the availability of natural resources to future generations has also been realized. In fact many governments throughout the world have now introduced various measures aimed at reducing the use of primary aggregates and increasing reuse and recycling, where it is technically, economically, or environmentally acceptable.

1.2 RCA AN OVERVIEW

A Need to use RCA Waste arising from Construction and Demolition constitutes one of the largest waste streams within the Asian and many other countries, the results of a recent study undertaken by the CSIR has revealed that nearly a million tone of C & D waste ends up. This is in addition to large quantities that are dumped illegally. Thus, construction demolition waste has become a global concern that requires sustainable solution. It is now widely accepted that there is a significant potential for reclaiming and recycling demolished debris for use in value added applications to maximize economic and environmental benefits. As a direct result of this, recycling industries in many part of the world, including South Africa, at present converts low value waste into secondary construction materials such as a variety of aggregate grades, road materials and aggregate fines. Often these materials are used in as road construction, backfill for retaining walls, low grade concrete production, drainage and brickwork and block work for low-cost housing. While accepting the need to promote the use of RCA in wider applications, it must be remembered that the aggregate for concrete applications must meet the requirements set in relevant specifications for its particular use.

1.3 OBJECTIVES

►To investigate the effect of recycled coarse aggregate on the strength of concrete.

►To reduce the impact of waste materials on environment.

►To carry out different tests on recycled aggregates & natural aggregates & compare their results.

1.4 RESEARCH METHODOLOGY

The following tasks are to be carried out in order to achieve the research objectives:

1. Collecting the required information and documents demolished concrete waste.

2. Undertaking a comprehensive literature review on relevant subjects focused on the usage demolished concrete waste.

3. Developing an adequate experimental program to study the use demolished concrete waste in the form of coarse & fine aggregate.

4. Analyzing the experimental output test results to draw conclusions.

1.5 EXPERIMENTAL DETAIL

The RCA contents are calculated as weight percent of coarse aggregate in the control mix. The fineness modulus of coarse aggregate with various RCA content is between 5.34 to 5.75 and RFA is between 2 to4 The RCA can be considered as partial coarse aggregate substitute and RFA as a fine aggregate Substitute retaining the mix ratio as the same. The divided particle size is assumed to be 20mm for coarse aggregate. it is considered as replacement to coarse aggregate and fine aggregate in natural coarse and fine aggregate in various percentages.

Table-1: Physical properties of RCA, RFA and natural coarse & fine aggregate

Properties	RCA	Natural Coarse aggregate	RFA	Natural Fine aggregate
Specific gravity	2.79	2.89	2.60	2.65
Absorption (%)	2%	0.5%	1.2%	0.5%
Color	Pale white	Dark	Pale white	Dark
Shape	angular	Angular	Rounded	Rounded

Concrete Mix

Control mix concrete and modified with various RCA and RFA contents as listed in Table-2 are prepared. By considering the use RCA and RFA in the mixes as much as possible and achieve suitable workability was attempt and strength criteria of Grade M20 concrete mix is analyze.

Table -2: Mix Specifications

Mix Specification	Proportion of RCA	Proportion of RFA
Control Mix A	0%	0%
A1		10%
A2		20%
A3		30%
A4		40%
A5	20%	0%
A6		10%
A7		20%
A8		30%
A9		40%
A10	40%	0%
A11		10%
A12		20%
A13		30%
A14		40%
A15	60%	0%
A16		10%
A17		20%
A18		30%
A19		40%
A20	80%	0%
A21		10%
A22		20%
A23		30%
A24		40%

Tests on concrete

Compressive strength test-For the testing program, a series of standard compressive tests are conduct with variable controlling factors: water-cement ratio, RCA & RFA content. All the tests will done for 28-days compressive strength accompanied by a slump flow test for each case sample.

1.5 LABORATORY TESTING RESULTS AND DATA ANALYSIS

This main aim of this is to obtain the fresh concrete workability and the hardened concrete compressive strength as the essentials for the analyses following the methodology targeting to highlight the usefulness of considering RCA & RFA as a main component within the concrete mix. Proper treatment of uncertainties within the data analysis process required understanding the sources of errors for determining the final output results.

It is worthy to mention that for the sake of simplicity, some of the variables that may actually influence the hardened concrete compressive strength such as various combinations of RCA & RFA mix . Content and the mixing water cement ratio. As it can be seen, the fresh concrete workability is inversely affected by the increase of water-cement ratio.

We test the specimen for compressive strength test for14 & 28 days following results are obtained

Table - 3: Compressive strength test

Mix	RFA (%)	RCA (%)	Average compressive strength (N/mm2) of concrete for 14 Days	Average compressive strength (N/mm2) of concrete for 28 days Days
S1	0	0	24.6	27.3
S2	5		24.55	27.25
S3	10		24.5	27.01
S4	15		24.33	26.86
S5	20		23.84	26.55
S6	0	10	23.87	27.1
S7	5		23.51	26.85
S8	10		23.4	26.7
S9	15		23.21	26.6
S10	20		23.1	26.45
S11	0	20	23.43	26.55
S12	5		23.35	26.45
S13	10		23.33	26.19
S14	15		23.14	26.11
S15	20		23.05	26.05
S16	0	30	22.65	25.79
S17	5		22.25	25.68
S18	10		22.15	25.45
S19	15		21.05	25.28
S20	20		20.95	25.15
S21	0	40	20.14	24.8
S22	5		20	24.7
S23	10		19.85	24.5
S24	15		19.7	24.27
S25	20		19.55	24.15

1.6. CONCLUSION

This study intended to find the effective ways to reutilize the RCA particles as concrete aggregate. Analysis of the strength characteristics of concrete containing e-waste gave the following results.

1. It is identified that RCA & RFA can be disposed by using them as construction materials..

2. The compressive strength of concrete containing RCA aggregate is retained less in comparison with controlled concrete specimens. However strength noticeably decreased when the RCA content was more than 80%.

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