International Journal on Applications in Civil and Environment Engineering
Volume 4: Issue 2: April 2018, pp 10 - 13 . www.aetsjournal.com ISSN (Online) : 2395- 3837

EXPERIMENTAL INVESTIGATION ON WASTE BUILDING MATERIAL RECYCIED IN CONCRETE TECHNOLOGY

AMUTHAN.S , JAGADISH.K

Abstract — In India, a huge quantity of construction and demolition wastes is produced every year. These waste materials need a large place to dump and hence the disposal of wastes has become a problem. And the continuous use of natural resources for making conventional concrete leads to the reduction in their availability and results in the increase of the cost of the coarse aggregate and fine aggregate. The possible use of recycling demolition waste as coarse aggregate in the construction industry is thus increasing importance. In addition to the environmental benefits in reducing the demand of land for disposing the waste, the recycling of demolition wastes can also help to conserve the natural resources. When recycled coarse aggregate is used in structural concrete, the assessment of physical, mechanical and durable characteristics of recycled coarse aggregate is very important. The physical and mechanical properties of concrete with the recycled coarse aggregate (RCA) are to be evaluated to assess its application as structural concrete. The present work is directed towards the evaluation of concrete using full replacement of natural coarse aggregate (NCA) with RCA and RCA has high compressive strength comparable to the natural coarse aggregate concrete.

Keywords — recycle coarse aggregate,M20 Grade concrete,fully Replacement.

I. INTRODUCTION

The objective of the present research work is to get the characteristics of the recycled coarse aggregate concrete for structural applications. Then properties of recycled coarse aggregate concrete are to be compared with the natural coarse aggregate concrete. The present investigation is focused on the compressive strength and durability characteristics of RCA concrete. The full replacement of natural coarse aggregate with RCA is investigated. Three grades of concrete M 20, are adopted in the present investigation.This paper includes the selection of materials, experimental program, tests on mechanical and durability properties of recycled coarse aggregate concrete, results and discussion and conclusions.

Amuthan.S , Department of civil engineering, New Prince Shri Bhavani college of engineering & technology , Gowrivakkam.

jagadish.k , Department of civil engineering, New Prince Shri Bhavani college of engineering & technology , Gowrivakkam.

II. OBJECTIVE

1. The main objectives of this project is to determine the effectiveness of recycle coarse aggregate(RAC) as a replacement of natural coarse aggregate in concrete.
2. To overcome the scarcity of natural coarse aggregate.
3. To reduce the depletion of natural coarse aggregate the recycle coarse aggregate comes into play as a alternatives for coarse aggregate.

III. EXPERIMENTAL PROGRAMME

1) Cement

Ordinary Portland cement 43Grade conforming to IS: 269 – 1976.Ordinary Portland cement, 53Gradewas used for casting all the Specimens. Different types of cement have different water requirements to produce pastes of standard consistence. Different types of cement also will produce concrete have a different rates of strength development. The choice of brand and type of cement is the most important to produce a good quality of concrete. The type of cement affects the rate of hydration, so that the strengths at early ages can be considerably influenced by the particular cement used.

2) Fine Aggregate

Locally available river sand conforming to Grading zone II of IS: 383 –1970. Clean and dry river sand available locally will be used. Sand passing through IS 4.75mm Sieve will be used for casting all the specimens.

3) Coarse Aggregate

Locally available crushed blue granite stones conforming to graded aggregate of nominal size 12.5 mm as per IS: 383 – 1970. Crushed granite aggregate with specific gravity of 2.77 and passing through 4.75 mm sieve and will be used for casting all specimens. Several investigations concluded that maximum size of coarse aggregate should be restricted in strength of the composite. In addition to cement paste – aggregate ratio, aggregate type has a great influence on concrete dimensional stability.

4) Material Test

A. Specific Gravity Test Result

SAMPLES TAKEN	W1 IN KG	W2 IN KG	W3 IN KG	W4 IN KG	SPECIFIC GRAITY G
SOIL	0.62	0.82	1.54	1.42	2.5

SPECIFIC GRAVITY OF SAND

Weight of empty pycnometer (W1) = 632 g
Weight of pycnometer + sample (W2) = 820 g
Weight of pycnometer + Sample + water (W3) = 1540 g
Weight of pycnometer + Water (W4) = 1420 g

$$\text{Specific gravity} = \frac{[820-632]}{[820-632]-[1540-1420]}$$

Specifi gravity of sand = 2.5

B. Mix design

The following mix propotion is arrived:

WATER	CEMENT	FINE AGGREGATE	COARSE AGGREGATE
186Kg	372Kg/m^3	554kg/m^3	1203kg/m^3
0.50	1	1.49	3.2

Mix ratio=1:1.49:32

C. CONTENT FOR ONE CUBE

0.15 x 0.15 x 0.15 = 0.003375m3

Cement = 0.003375 X 372	= 1.25 kg/cube
sand = 0.003375 X 554	= 1.86 kg/cube
Aggregate = 0.003375 X 1203	= 4.00 kg/cube

SIEVE ANALYSIS TEST OBSERVATION

Weight of the fine aggregate + Pan = 1349.2g
Weight of the pan = 349.2g
Weight of the fine aggregate (Wt) = 1000

Sieve Analysis of sand

S.No	size of sieve (mm)	Weight of Sand Retained (gm)	Percentage of weigh Retained (%)	Cumulative Percentage Retained (%)	Percentage Finer (%)
1	4.75	5	1	1	99
2	2.36	12	2.4	3.4	96.6
3	1,18	20	4	7.4	92.6
4	0.6	306	61.2	68.6	31.4
5	0.3	25	5	73.6	26.4
6	0.125	122	24.4	98	2
7	0.075	-	-	-	-
8	PAN	-	-	-	-

IV. RESULT AND DISSCUSSION

COMPRESSIVE STRENGTH VALUES OF SAMPLES

TYPE 1

The details of crushing load for the given sample type 1 for 100% of natural coarse aggregate is tabulated in the given table.

CRUSHING LOAD VALUES FOR NORMAL CONCRETE

S.NO	DAY	CRUSHING LOAD (KN)			AVERAGE (KN)
		SAMPLE 1	SAMPLE 2	SAMPLE 3	
1	3	205.42	212.5	199.6	205.84
2	7	270.67	279.4	268.36	272.81
3	28	410	399.1	415	408

TYPE 2

The details of crushing load for the given sample type 2 for 100% of recycle coarse aggregate is tabulated in the given table.

CRUSHING LOAD VALUE FOR MODIFIED CONCRETE

S.NO	DAY	CRUSHING LOAD (KN)			AVERAGE (KN)
		SAMPLE 1	SAMPLE 2	SAMPLE 3	
1	3	234.61	230.2	229.17	231.3
2	7	302.61	307.2	300.71	303.5
3	28	433.74	437.1	435.5	435.4

COMPRESSIVE STRENGTH VALUE OF THE NORMAL CONCRETE SAMPLES (3TH DAY)

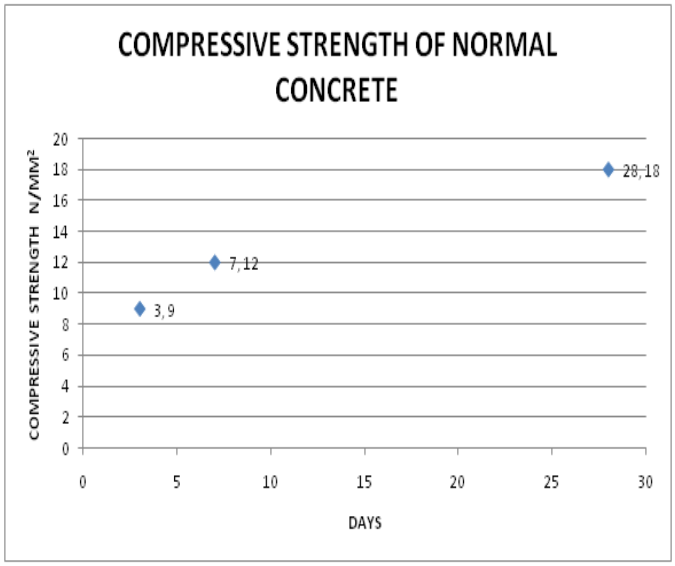
SAMPLES	COMPRESSIVE STRENGTH (N/mm^2)
1	9.12
2	9.42
3	8.8

COMPRESSIVE STRENGTH VALUE OF THE NORMAL CONCRETE SAMPLES (7TH DAY)

SAMPLES	COMPRESSIVE STRENGTH (N/mm^2)
1	12.1
2	12.4
3	11.9

COMPRESSIVE STRENGTH VALUE OF THE NORMAL CONCRETE SAMPLES (28TH DAY)

SAMPLES	COMPRESSIVE STRENGTH (N/mm^2)
1	18.2
2	17.73
3	18.4



COMPRESSIVE STRENGTH VALUE OF THE MODIFIED CONCRETE SAMPLES (3TH DAY)

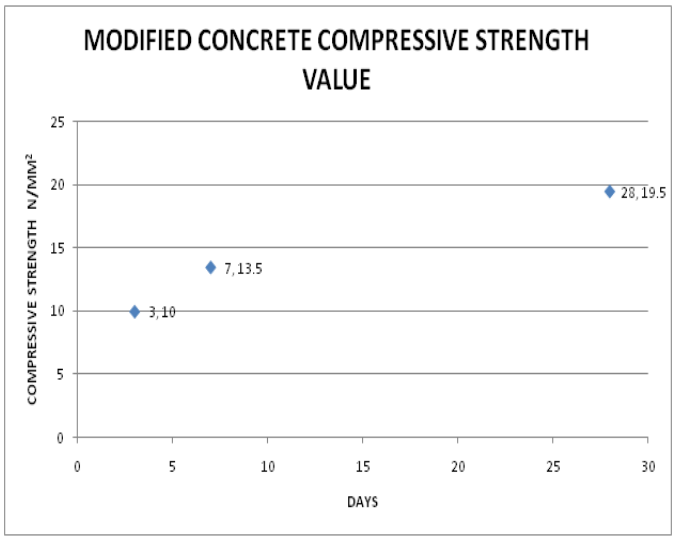
SAMPLES	COMPRESSIVE STRENGTH (N/mm^2)
1	10.42
2	10.2
3	10.01

COMPRESSIVE STRENGTH VALUE OF THE MODIFIED CONCRETE SAMPLES (7TH DAY)

SAMPLES	COMPRESSIVE STRENGTH (N/mm^2)
1	13.4
2	13.6
3	13.36

COMPRESSIVE STRENGTH VALUE OF THE MODIFIED CONCRETE SAMPLES (28TH DAY)

SAMPLES	COMPRESSIVE STRENGTH (N/mm^2)
1	19.2
2	19.4
3	19.35



V. CONCLUSIONS

Based on the test results of the present investigation, the following conclusions are drawn. Recycled coarsed aggregate concrete (RCA) has compressive strength comparable to the natural coarse aggregate concrete compressive strength for M_{20} grades of concrete at 3, 7, 28 days.

This can be attributed to the cement mortar coat of RCA participates in hydration process and contribute additional strength. Along with strength, concrete should also be durable Based on the test results, it can be recommended for the full replacement of NCA concrete with RCA concrete in structural concrete.

RCA concrete can be effectively used to meet the objective of disposal of waste and also to meet the replacement for the depleting natural coarse aggregate**.** The compressive strength of normal concrete for 28 days is $18N/mm^2$ and the compressive strength of modified concrete for 28 days is $20N/mm^2$.

Hence the comparative test result of compressive strength are the modified concrete is greater than normal concrete.

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