International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue IX, September 2017- Available at www.ijraset.com

Effect of Replacement of Natural Aggregates by Recycled Aggregates Used In Concrete

Rajveer Singh Dhakar[1], Rajeev Kansal[2]
[1] *Student M.E. (CTM),* [2]*Professor Civil Engineering Department, Madhav Institute of Technology & Science, Gwalior, M.P.*

Abstract: ***This experimental investigation is performed to investigate the used of demolished concrete for construction in concrete material. Demolished concrete occupies a large space and hence it's disposal is very important. Only a small quantity of this waste is recycled for beneficial use. The present investigation is focused on use of demolished concrete in order to reduce construction cost and resolve housing problems faced by the low income communities of the world. The demolished waste of concrete is segregated with the aid of sieving to achieve required sizes of aggregate various tests were conducted to determine the mixture properties of material before producing a new concrete. This investigation explained that the demolished concrete might be received from construction site used for making good quality concrete. The investigational analysis has been optimized to estimate the cause of compressive strength of recycled concrete for the study at 7^{th} and 28^{th} days. The compression strength concrete thus, examined was compared with strength of conventional concrete. The outcomes of investigation explained the compressive strength of concrete up to 50% coarse aggregate substitution with demolished concrete at the end of 28 days has been achieve to be comparable to the conventional concrete.***

Keywords: Demolished Concrete, conventional concrete, compressive strength, Slump test, M 20 Grade.

I. INTRODUCTION

A large quantity of solid waste is produced every year from development and disposing activities. This has prompt Development of waste recycling as a main issue to decrease waste and to moderate the unsafe effects of construction activities on the earth. So Recycling as a feature of ecological contemplations has shown a typical component in the development industry. Construction and demolition (C&D) waste is the waste material that outcomes from the development, remodel, or demolition of any building, including structures, streets, and bridges. Common waste elements incorporate Portland cement concrete, asphalt concrete, wood, drywall, asphalt shingles, metal, cardboard, plastic, and soil. This waste material has most effective currently received attention as concerns about its environmental effect have advanced. One of the matters developers, developers and contractors ought to consider all through creation, protection or demolition is where to place all the particles. As what most of the people do within the preservation of the environment and for financial purposes, research, researches and experiments are being done to discover new approaches on how to discover answer considering where else to place these waste and what can be finished to lower its disposal to landfills and due to the fact there is an growing environmental trouble regarding the waste disposal to landfills, it's far essential to think of possible methods on a way to keep away from these problems and on the same time cozy protection and convenience, and this is, to recycle. [9] Recycling is a main procedure that's used to provide a beneficial source of aggregate for the construction industry. Concrete recycling is step by step more becoming famous way of using combination left at the back of Recycled coarse aggregates systems, avenue creation substances and placement waste materials. In previous years, recycled coarse aggregates structural substance have been disposed into landfills and dumping pit very little interest being paid to environmental attention, concrete recycling lets in reuse of the rubble while moreover maintaining making prices down. As the Recycled coarse aggregates is lighter than the herbal combination so the concrete made from such combination possesses low density however the water absorption of the Recycled coarse aggregates is better than the natural aggregate. Concrete prepared from Recycled coarse aggregates may be consume where extra strength is not required e.g. in low rising structure, in reinforced concrete pavements and so on.

II. MATERIALS AND METHODOLOGY

A. Cement

O.P.C. 43 grade available from the local market was used and tested for physical l properties as per IS: 4031-Part 4 – 1988 and initiate to be confirming to various specifications as per IS: 8112 – 1989 explained in table 1.

Table 1: Tests on Cement

Sr. No.	Properties	Value
1.	Standard consistency	33%
2.	Initial setting time	45 min
3.	Final setting time	385 min
4.	Fineness	2%
5.	Specific gravity	3.15

B. Fine Aggregates

Fine aggregate is used in this experimental analysis is natural sand from local market. The fine aggregate are tested and results shown in Table 2.

Table 2: Tests on Fine Aggregate

Sr. No.	Properties	Value
1.	Zone	II
2.	Specific gravity	2.5
3.	Fineness	3.76
4.	Water Absorption	0.59%
5.	Surface texture	smooth

C. Coarse Aggregates

The properties of coarse aggregate are tested and shown in Table 3.

Table 3: Tests on Coarse Aggregate

Sr. No.	Properties	Value
1.	Specific gravity	2.94
2.	Fineness Modulus	7.07
3.	Water absorption	0.40%
4.	Particle shape	angular
5.	Impact value	11.42%
6.	Los Angles abrasion value	8.32%

D. Recycled Coarse Aggregate

The crushed Recycled Coarse aggregates of 20mm size obtained from local available nearby construction. The properties of R.C.A. are tested and shown in Table 4.

Table 4: Tests on Recycled Coarse Aggregates

Sr. No.	Properties	Value
1.	Specific gravity	2.36
2.	Fineness Modulus	7.70
3.	Water absorption	2.40%
4.	Particle shape	angular
5.	Impact value	19.18%
6.	Los Angles abrasion value	25.55%

E. Water

Water plays an important role in the formation of concrete as it participates in chemical reaction with cement. Due to the presence of water the gel is form which helps in increase of strength of concrete. In this Experimental analysis Portable water used to mix concrete material and curing the casted cubes.

III. METHODOLOGY

The estimation of concrete with Recycled coarse aggregates used as alternative of coarse aggregate substances is completed through concrete specimen testing. Concrete consist cement, water, fine aggregate, coarse aggregate. Concrete is replaced with alternative Recycled coarse aggregates materials by variations of percentage of replacement. The Recycled coarse aggregates is used as partial substance for coarse aggregate within the series of 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90% and 100% by Coarse aggregates as indicated by its weight and its optimum level is to be achieved. For analyzing the Recycled coarse aggregates and different variation mix totally 66 cubes of size 150x150x150mm have been casted for compression test. Once 24 hours completed from casting the concrete cubes are opened and allowed for curing in a tank with portable water. The cubes are taken and tested at required 7^{th}day& 28^{th} day from curing for compression test at 28^{th} day. Then compare the Strengths of M20 design mixes control cubes.

IV. MIX DESIGN

The procedure of choosing appropriate parts of concrete and finding with their relative quantity with the objective of manufacturing a concrete of the necessary strength, durability and workability as inexpensively as achievable is termed concrete mix design. Table 5 shows the mix proportion (1:1.66:3.10) of concrete.

Table 5: Mix Proportions of Concrete Materials

Percentage Recycled coarse aggregates	Weight of Cement (kg/m^3)	Weight of C.A. (kg/m^3)	Weight of Recycled coarse aggregate(kg/m^3)	Weight of Water(kg/m^3)	Weight of F.A. (kg/m^3)
0%	384	1190.89	0	192	640.3
10%	384	1071.801	119.089	192	640.3
20%	384	952.712	238.178	192	640.3
30%	384	833.623	357.267	192	640.3
40%	384	714.534	476.356	192	640.3
50%	384	595.445	595.445	192	640.3
60%	384	476.356	714.534	192	640.3
70%	384	357.267	833.623	192	640.3
80%	384	238.178	952.712	192	640.3
90%	384	119.089	1071.801	192	640.3
100%	384	0	1190.89	192	640.3

V. WASTE MANAGEMENT

Demolished waste is mixed in the concrete as replacement material of natural coarse aggregates. The safe disposal of this waste requires sufficient area which is costly and will cause environmental pollution. The construction industry is the only area where the safe use of Recycled coarse aggregates is possible. When R.C.A. is introduced in concrete as a substituting material, it decreases the environmental pollution, space difficulty and also decreases the cost of concrete. Many researchers had already establish, Recycled coarse aggregates achievable use as a replacement material in concrete. In this Experimental study Recycled coarse aggregates is used in concrete in the form of replacement material of natural coarse aggregates. For this study, M20 grade of concrete is prepared and the test are conducted for various substitute of Coarse aggregates using demolition waste as 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90% and 100% in concrete ready with recycled coarse aggregates.

VI. RESULTS AND DISCUSSION

In this Study the casted cubes of concrete are investigated under various examinations, to estimate the strength and other properties of the casted concrete cubes. The primary intention of the investigation is to optimize the established strength achieved by the concrete at several testing days from curing.

A. Slump Cone Test

The workability test outcomes as calculated from slump test obtained with various percentage substitutions of natural coarse aggregates by recycled aggregates of demolition waste. From the slump outcomes, it was obtained that as the percentage substitution

of natural coarse aggregates by recycled aggregates is augment there is marginal decrease in workability. Slump values with respect to the replacement percentages of Recycled coarse aggregates explained in Table 6 and Figure 1.

Table 6: Slump value of Concrete Mix

Percentage Replacement	Slump Value
0%	93
10%	92
20%	92
30%	90
40%	87
50%	86
60%	85.5
70%	82.8
80%	82
90%	81
100%	80

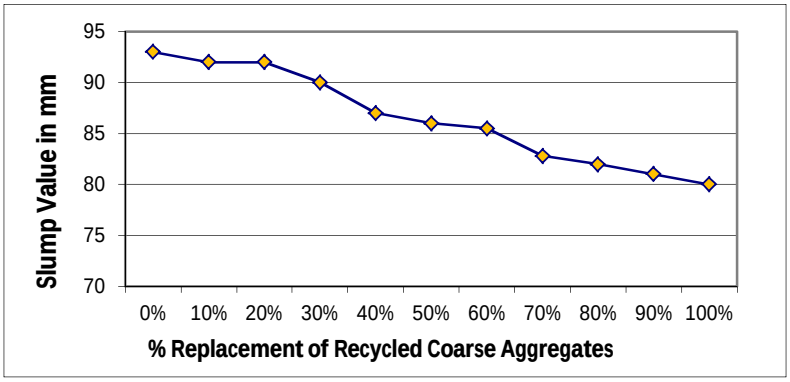

Figure1: Slump values Variations

B. Compressive Strength Test

The overall outcomes of compressive strength test of concrete with various percentage substitution of natural coarse aggregates by recycled aggregates shows in table 7. Variation of compressive strength at various percentage substitutions of natural coarse aggregates by recycled aggregates can be described in the form of graph as shown in Graph. The results of compressive strength at the age 7thday& 28th day are shown in Table 7 and Figure 2.

Table 7: Compressive Strength on Concrete M20 Cubes

Percentage Recycled coarse aggregates	7- days	28- days
0%	19.55	29.18
10%	19.52	29.03
20%	19.44	28.84
30%	19.34	28.4
40%	18.92	27.92
50%	18.4	26.58
60%	17.44	25.33
70%	16.99	24.47
80%	15.84	23.44
90%	14.5	22.5
100%	14.29	22.4

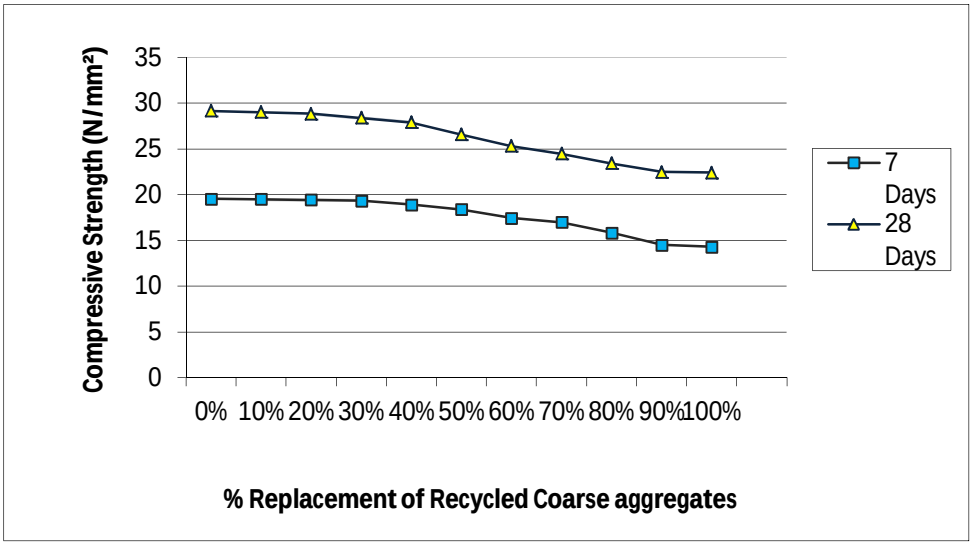

Figure 2: Compressive Strength Variations

VII. COST ANALYSIS

This Investigation for $1m^3$ of M20 grade of concrete with O.P.C. 43 grade made from conventional material and modified concrete made by substituting materials with 10% to 100% replacement of Natural coarse aggregates with Recycled coarse aggregates. Proportions of materials for mix 1:1.66:3.10 and cost of production for all concrete mix are given in Table 8.

Table 8: Cost Analysis of Recycled Coarse Aggregates

Sr. No.	Concrete Mix	Coarse Aggregates (Rs.)	Recycled Coarse Aggregates (Rs)	Fine aggregates (Rs.)	Cement (Rs.)	Total cost for $1m^3$ concrete (Rs)
1.	0%	893.17	0	1280.60	2457.6	4621.11
2.	10%	803.85	21.20	1280.60	2457.6	4553.00
3.	20%	714.53	42.40	1280.60	2457.6	4484.87
4.	30%	625.22	63.59	1280.60	2457.6	4416.75
5.	40%	535.90	84.79	1280.60	2457.6	4348.63
6.	50%	446.58	105.99	1280.60	2457.6	4280.51
7.	60%	357.27	127.19	1280.60	2457.6	4212.40
8.	70%	267.95	148.38	1280.60	2457.6	4144.27
9.	80%	178.63	169.58	1280.60	2457.6	4076.15
10.	90%	89.32	190.78	1280.60	2457.6	4008.04
11.	100%	0	211.98	1280.60	2457.6	3939.92

VIII. CONCLUSION

A. The present Experimental study shows that demolition waste can be effectively utilized as an alternative for partial replacement of natural aggregates in construction sector.

B. Due to utilization of recycled aggregate in construction, energy and rate of transportation of natural resources and excavation is considerably saved. This in turn directly reduces the impact of waste material on environment.

C. A demolished concrete is a type of waste mixed as a substitute to Natural coarse aggregates in concrete.

D. use of demolished concrete waste for concrete results in 50% saving of natural aggregate for M 20 grade of concrete in comparison to conventional concrete. It results in saving of rupees 340.60 per m^3 of concrete.

E. Using demolished aggregates concrete as a base material for roadways reduce the contamination involved in trucking material.

F. Test performed on demolished concrete aggregates and outcomes compared with natural coarse aggregates are acceptable as per IS: 2386.

REFERENCES

[1] B. Damodhara Reddy "Experimental Investigation on Concrete by Partially Replacement of Ware Aggregate with Junk Rubber" The International Journal of Engineering and Science 2013.
[2] D.V. Prasada Rao "Experimental Investigations of Coarse Aggregate Recycled Concrete" International Journal of Advances in Engineering & Technology, Nov., 2014.
[3] Fathei Ramadan salehlamein "Effect of Recycled Coarse Aggregate on Concrete Properties", International Journal of Innovative Research in Science Engineering and Technology, January 2015.
[4] Gargi Kushwah "Experimental Study of Recycled Aggregate Concrete" International Journal for Research in Applied Science & Engineering Technology (IJRASET), 2013.
[5] M A Salau "Effects of Elevated Temperature on Concrete with Recycled Coarse Aggregates", International Conference on Innovative Materials, Structures and Technologies, 2015.
[6] Sandeep Singh "Specifications and recommendations for recycled materials used for various applications" International Journal of Enhanced Research in Science Technology & Engineering, June-2014.
[7] Sepani Senaratne "Recycled concrete in structural applications for sustainable construction practices in Australia" Elsevier 2016.
[8] Sherif Yehia "Strength and Durability Evaluation of Recycled Aggregate Concrete" International Journal of Concrete Structures and Materials, April 6, 2015.
[9] Tomas U. Ganiron Jr "Effect of Sawdust as Fine Aggregate in Concrete Mixture for Building Construction" International Journal of Advanced Science and Technology, 2014.
[10] Valerie Spaeth "Improvement of recycled concrete aggregate properties by polymer treatments" International Journal of Sustainable Built Environment 2013.
[11] Yadav S P "Replacement of artificial sand and recycled aggregate by using of crumb and shredded rubber" International Research Journal of Engineering and Technology, Feb 2016.
[12] Zaineb Aamer Shamsulddin "Behavior of Recycled Construction Material Concrete against Elevated Temperatures" International Conference on Sustainable Construction Materials and Technologies, August 2016.