NATIONAL CONFERENCE ON INNOVATIVE TRENDS IN ENGINEERING & TECHNOLOGY – NITET-19
15-16th March 2019
NOVATEUR PUBLICATIONS
International Journal Of Innovations in Engineering Research And Technology [IJIERT]
ISSN: 2394-3696

COST COMPARISION OF RECYCLED COARSE AGGREGATE WITH NORMAL AGGREGATE

1. Kalyani Mamdyal
Assistant Professor,Department of Civil Engineering., A. G. Patil Institute of Technology, Solapur, India
** kalyani.mamdyal7@gmail.com*
2. Rajani Mudgundi
Assistant Professor, Department of Civil Engineering., A. G. Patil Institute of Technology, Solapur, India
** rmudgundi@gmail.com*
3. Ruqaiyya bano Adte
Assistant Professor, Department of Civil Engineering., A. G. Patil Institute of Technology, Solapur, India
** ruqaiyyaadte@gmail.com*

Abstract:
In this research study, Natural coarse aggregates are replaced by Recycled coarse aggregates (RCA) with various percentage of RCA i.e. 25%, 50%, 75%, 100%. Cost comparison is done on the basis of compressive strength result obtained from experiment work.

Keywords:
Concrete mix; compressive strength; Natural aggregates; Recycled aggregates; Different Grades i.e. M25, M30, M35; Cost Comparison.

INTRODUCTION

Demolition of old and deteriorated building and traffic infrastructure and their substitution with new ones, is a frequent phenomenon today in most of the part of world. The main reason for this situation are changes of purpose, structural deterioration, rearrangement of city, expansion of traffic directions and increase of traffic load, natural disasters like earthquake, flood fire etc. As per Times of India report, India generates 10-12 million tons of C& D waste annually. And 50% of it is Concrete and Masonry which is not recycled in India. The most common methods of disposing this material are land filling. In these way large amounts of construction waste is generated, consequently becoming a problem a special problem of human environment. For this similar reason in developing countries, laws have been bought into practice to restrict this waste in the form of prohibitions or special taxes existing for creating waste areas. To take care of the C& D waste in India Ministry of Environment and forests has mandated environmental clearance for all large construction projects. .

Sustainable construction rather than a fancy idea now is a necessity. It was introduced due to the growing concern about future of the planet, and it applies specifically for construction industry as, this being a huge consumer of natural resource. In addition to the 1.6 billion tons (1.5 billion tones) of cement used worldwide, the concrete industry is consuming 10 billion tons of sand and rock, and 1 billion tons of mixing water annually. In short the concrete industry, which uses 12.6 billion tons of raw materials each year, is the largest user of natural resources in the world. It's the world's most widely used construction material. But at the same time it is not an environmentally friendly material too.

The possible solution to these problems is to recycle demolished concrete and produce an alternative aggregate for structural concrete. Recycled Concrete aggregates (RCA) as popularly known can be used as aggregates in concrete as partial or total replacement. Concrete made with such recycled concrete aggregate is called as Recycled concrete aggregate (RAC).However before moving further with this concept it is very important to elevate the status of recycle material through research, development and performance data for the material as compared to virgin material.

EXPERIMENTAL WORK

A) OVERVIEW

For this experiment concrete was made with three different mix proportions which are M25, M30, and M35. For testing compressive strength four different percentage combinations made which are 25%, 50%, 75%&100%.

B) MATERIAL

The cement used is Ordinary Portland cement of 53 grade manufactured by J.K.Cement Company. Crushed granite stone of maximum size 20mm confirming to IS 383-1970 used as

coarse aggregates. The fine aggregate used in this investigation was passing through 4.75mm sieve. The grading zone of fine aggregate was zone II as per Indian standard specification. RCA used in this research is aggregates obtained from demolition structure, of old House on Vijapur road near R.T.O. office, Solapur.

C) MIX PROPORTION

For this investigation, the concrete Grade M25, M30 &M35 for the samples was used. The detailed mix designs of different grads of concrete are given below.

Table 1.Mix proportion for 1m^3 M25 Concrete

W/C ratio	Water	Cement	Sand	Aggregate
0.41	231.56 kg	480.87 kg	645.87 kg	1161.44 kg

Table 2.Mix proportion for 1m^3 M30 concrete

W/C ratio	Water	Cement	Sand	Aggregate
0.40	231.25 kg/m^3	492.9 kg	639.23 kg	1159.38 kg

Table 3. Mix proportion for 1m^3 M35 concrete

W/C ratio	Water	Cement	Sand	Aggregate
0.38	230.78 kg	518.42 kg	624.68g	1152.34g

D) PREPARATION OF TEST SPECIMEN

To compare the compressive strength of RCA with normal aggregates concrete cubes of size 150x150x150 mm was used.

TEST RESULT

A) Test Result of Compressive Strength of Grade M25

From above table, it is observed that result of 100% RCA is not showing appropriate compressive strength. Therefore cost comparison is not been considered for 100% RCA. Following table shows cost comparison between 0%, 25%, 50% and 75% RCA for 1m^3 Concrete.

Table 4. Compressive Strength of Grade M25

	Sample	Replacement				
		0%	25%	50%	75%	100%
Cube Strength (Mpa)	7Days	20.60	17.78	18.89	16.20	15.06
	14Days	28.33	23.47	24.12	22.32	20.54
	28Days	31.70	27.89	29.37	26.41	24.56

Table 5. Cost Comparison of M25 Grade for 1m^3 Concrete

Sr. No.	Materials	0% RCA		25% RCA		50% RCA		75% RCA	
		Qty kg	Amt Rs.	Qty kg	Amt Rs.	Qty kg	Amt Rs.	Qty kg	Amt Rs.
1	Cement	481	3079	481	3079	481	3079	481	3079
2	Fine Aggregates	646	853	646	853	646	853	646	853
3	Course Aggregates (Natural)	1162	900	872	675	581	450	290	225
4	Course Aggregates (Recycled)	-	-	290	50	581	75	872	100
Total		-	4832	-	4657	-	4457		4257
% cost Reduction				3.62%		7.76%		11.89%	

B) Test Result of Compressive Strength of Grade M30

Table 6. Compressive Strength of Grade M30

Sample		Replacement				
		0%	25%	50%	75%	100%
Cube Strength (Mpa)	7Days	22.6	19.20	20.16	17.59	15.88
	14Days	30.47	26.6	26.94	24.78	22.13
	28Days	34.96	30.08	31.17	27.25	25.69

From above table, it is observed that result of 75% and 100% RCA is not showing appropriate compressive strength. Therefore cost comparison is not been consider for 75% and 100% RCA. Following table shows cost comparison between 0%, 25% and 50%RCAfor 1m^3 concrete.

Table 7. Cost Comparison of M30 Grade for 1m^3 Concrete

Sr. No.	Materials	0% RCA		25% RCA		50% RCA	
		Qty kg	Amt Rs.	Qty kg	Amt Rs.	Qty kg	Amt Rs.
1	Cement	493	3156	493	3156	493	3156
2	Fine Aggregates	640	845	640	845	640	845
3	Course Aggregates (Natural)	1160	898	870	673	580	449
4	Course Aggregates (Recycled)	-	-	290	50	580	100
Total		-	4899	-	4724	-	4550
% cost Reduction				3.57%		7.12%	

C) Test Result of Compressive Strength of Grade M35

Table 8. Compressive Strength of Grade M35

Sample		Replacement				
		0%	25%	50%	75%	100%
Compressive strength (Mpa)	7 Days	22.70	19.17	20.02	18.21	16.77
	14 Days	32.63	27.49	28.36	25.16	23.76
	28 Days	35.78	29.78	29.98	26.32	25.54

From above table, it is observed that result of 25%, 50%, 75% and 100% RCA is not showing appropriate compressive strength. Therefore cost comparison is not been consider for 25%, 50%, 75% and 100% RCA. Therefore cost comparison is not done for various percentage of RCA.

CONCLUSION

1. For M25 grade, replacement of 75% RCA shows 11.89% cost reduction for $1m^3$concrete.
2. For M30 grade, replacement of 75% RCA shows 7.12% cost reduction for $1m^3$concrete.

REFERENCES

1) "A Guide to Recycled Concrete for the 2012 Olympic Village" *Business Magazine The Magazine for Business People*, December 30th 2009.
2) *Andres Salas, Postdoctoral Researcher, University of Illinois at Urbana-Champaign*, "Batching Effects on Properties of Recycled Concrete Aggregates"
3) Cheolwood Park, Ph.D., P.E. Research Professor Department of Civil and Environmental Engineering, Hanyang University, Ansan, Korea Da Jongsung Sim, Ph.D. Professor Department of Civil & Environmental Engineering, Hanyang University: Jul. 27 2005), "Fundamental Properties of Concrete using Recycled Concrete Aggregate produced through Advanced Recycling Process".
4) Keith W. Anderson, Jeff S. Uhlmeyer, Mark Russell, "Use of Recycled Concrete Aggregate in PCCP", June 2009.M C Limbachiya, A Koulouris, J J Roberts and A N Fried, "Performance of Recycled Aggregate Concrete", Kingston University, UK, 2004.
5) M.S.Shetty, College of Military Engineering Pune, "Concrete Technology"