International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)
Impact Factor: 5.22 (SJIF-2017), e-ISSN: 2455-2585
Volume 5, Issue 05, May-2019

PARTIAL REPLACEMENT OF DEMOLISHED CONCRETE WASTE AS FINE AND COARSE AGGREGATE IN CONCRETE

Sandeep T D

Civil Engineering Department & New Horizon College of Engineering,

Abstract*— This experimental study is deals with assessment of behavior of concrete by taking partial replacement of coarse and fine aggregate with demolished waste. M30 grade concrete mix is designed as per IS 10262: 2009. The compressive strength and flexural strength are carried out at 7 and 28 days of curing period to determine the compressive strength and flexural strength and results are compared with normal concrete. The compressive strength and flexural strength of recycled aggregate concrete is relatively lower than the natural aggregate concrete. The 7 Days and 28 Days compressive strength and flexural strength results shows that the replacement of demolished waste by 40% Coarse aggregate and 10 % fine aggregate with normal aggregate have good strength, further increasing the replacement of demolished waste both compressive strength and flexural strength is decreases. The compressive strength of recycled aggregate concrete is reduces by the average value of 7.90% with replacing every 20% of natural aggregate concrete.

Keywords — Flexural Strength, Compressive strength, Demolished Waste, Normal Concrete.

I. INTRODUCTION

Concrete is the prime construction material used in practice. Constituents of concrete are binding material (cement), fine aggregate and coarse aggregate and water. Aggregates are naturally available and depleting day by day due to over exploitation for the sake of development activities. Owing to growing demand aggregates will not be available in plenty in near future as their stack is limited. It is worthwhile to seek alternative for naturally available aggregate. Owing to growing construction activities and renovation of structures, demolition wastes are produced in large quantities which are kept in abundance in low lying area or at disposal sites. The land, over which the demolition wastes are disposed, deprives further land use forever for other purposes. This increased quantities of demolition debris, the continuing shortage of dumping sites, increase in the cost of disposal land transportation and above all the concern about environmental degradation

Recycled aggregates are the aggregates produced from the processing of previously used construction materials such as concrete or masonry, Recycled aggregates consists of hard, graduated fragments of inert mineral materials, including sand, gravel, crushed stone, slag, rock dust, or powder.

II. SCOPE OF RECYCLED AGGREGATES

Construction industry is one of the fastest growing industries in the world hence producing waste at a greater extent than expected. The waste so produced can be reused by converting it into usable form contributing directly or indirectly to the environment. Following are the scope of recycled aggregates

1. Decrease in the amount of disposal of demolished waste hence more availability of land
2. Recycled aggregate can be used as earth filling in road construction
3. Can be used in construction of rigid pavements
4. Recycled aggregates can be used as ballast in railways
5. Recycled aggregate with upgraded properties can be used as a replacement for natural aggregate

III. OBJECTIVE

1. To study the utilization of demolished and construction waste as a replacement of natural aggregates
2. To study the properties of demolished and construction waste aggregate
3. To use of the demolished and construction waste aggregate in the new concrete as the recycled concrete aggregate reduces the environmental pollution as well as providing an economic value for the waste material
4. To compare the compressive strength of normal concrete with recycled aggregate concrete by varying percentage of fine and coarse aggregate with recycled fine and coarse aggregate

IV. SCOPE

The Scope of study is a part of comprehensive program where in experimental investigations have been carried out to evaluate the effect of partial replacement of coarse aggregate and fine aggregate by demolished waste on compressive strength for the study 7 and 28 days. M30 grade of concrete was considered for the experimental study with specimens

prepared along with partial replacement of coarse aggregate and fine aggregate by demolished waste.

V. MATERIALS & PROPERTIES

A. Physical Properties of Materials

The ordinary Portland cement of 53 grade cement was used in the study. The physical properties of the cement are given in Table.1The fine aggregate and the coarse aggregate is procured from the local vendor and the properties of the aggregates are given in Table 2 and Table 3 respectively. All the materials are tested as per Indian standards.

Table 1: Properties of cement

Sl No	Properties	Test results	IS : 4013-1963
1	Standard consistency	28.5%	24% - 34%
2	Initial setting time	35 min	Minimum 30 min
3	Final setting time	480 min	Maximum 600 min
4	Specific gravity	3.02	3-4
	Compressive strength		
	3 days strength	29.2 Mpa	Minimum of 27 Mpa
	7 days strength	44.6 Mpa	Minimum of 40 Mpa
	28 days strength	56.6 Mpa	Minimum of 53 Mpa

Table 2: Properties of Fine aggregate

Sl No	Properties	Test results	IS Recommendation
1	M sand Zone	Zone III	I S 383 Table -3
2	Specific gravity	2.51	IS 2386 – 1963
3	Fineness Modulus	4	IS 2386 -1963
4	Water absorption	1.39 %	IS 2386 -1963

Table 3: Properties of Coarse aggregate

Sl No	Properties	Test results	IS Recommendation
1	Specific gravity	2.9	IS 2386 – 1963
2	Water absorption	0.15 %	IS 2386 -1963
3	Moisture content	0.1%	IS 2386 -1963

Table 4: Properties of Recycled Fine aggregate

Sl No	Properties	Test results	IS Recommendation
1	Specific gravity	3.37	IS 2386 – 1963
2	Fineness Modulus	4.1	IS 2386 -1963
3	Water absorption	0.24 %	IS 2386 -1963

Table 5: Properties of Recycled Coarse aggregate

Sl No	Properties	Test results	IS Recommendation
1	Specific gravity	2.9	IS 2386 – 1963
2	Water absorption	0.15 %	IS 2386 -1963
3	Moisture content	0.5%	IS 2386 -1963

B. Mix Proportion

The Concrete mix is designed as per IS 10262:2009 by considering the properties of the material. The mix proportion corresponds to 1:1.32:2.62 with w/c ratio of 0.45.In order to achieve a desired slump; a superplastcizer of 2% by the weight of the cement is used.

C. Experimental details

This deals with the various mix proportions adopted in carrying out the experiments and experimental results obtained with respect to their compressive strength, flexural strength. Different types of mixes were prepared by changing the percentage of replacement of coarse and fine aggregates with demolished waste. Total 7 types of mixes are prepared along with conventional mixes. The coarse aggregates are replaced by 0%, 20%, 40%, 50% and 60% of demolished waste of coarse aggregate and the fine aggregate is replaced by 10% and 20% of demolished fine aggregate along with the coarse aggregate. The table 6 gives details of mix designations are given below.

Table 6: Replacement of aggregate in percentage by volume

Sl No	Mix Designation	Replacement of aggregate in percentage by volume			
		NCA (%)	RCA (%)	M-SAND (%)	RFA (%)
1	A-0	100	00	100	00
2	A-1	80	20	100	00
3	A-2	60	40	100	00
4	A-3	50	50	100	00
5	A-4	40	60	100	00
6	B-1	50	50	90	10
7	B-2	60	40	90	10
8	B-3	60	40	80	20

VI. RESULTS AND DISCUSSION

The compressive strength of the concrete mixes with partial replacement of aggregate is tested at 7 and 28 days of curing period. It is depicted in Fig 1 and 2 respectively, whereas flexural strength with partial replacement of aggregate is tested at 7 and 28 days of curing period. It is depicted in Fig 3 and 4 respectively

Table 7: 7 and 28 Days Compressive strength

Sl No	Mix Designation	Aggregate replacements % (RCA + RFA)	Compressive Strength (N/mm^2)	
			7 days	28 days
1	A-0	0 + 0	34.50	53.07
2	A-1	20 + 0	33.3	51.23
3	A-2	40 + 0	30.20	45.75
4	A-3	50 + 0	27.10	41.06
5	A-4	60 + 0	24.40	36.07
6	B-1	50 + 10	23.90	35.70
7	B-2	40 + 10	26.50	40.20
8	B-3	40 + 20	23.20	35.20

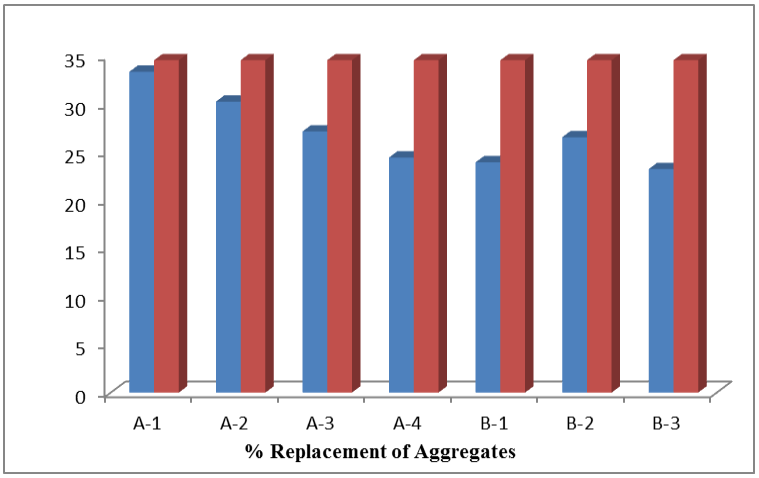

Figure 1 : 7 Days Compressive strength

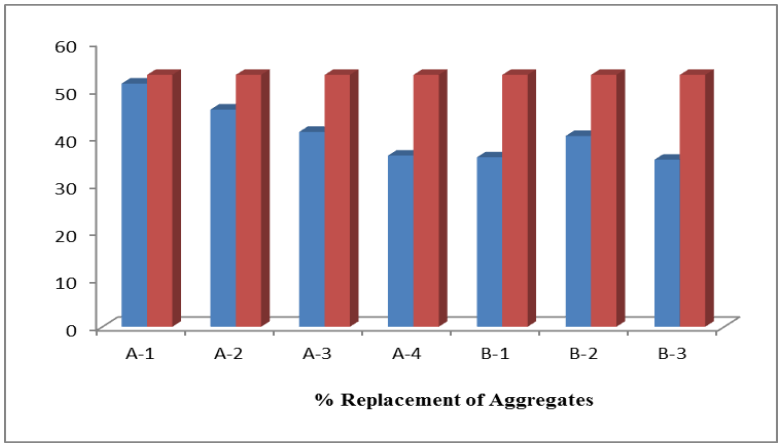

Figure 2: 28 Days Compressive strength

Table 8: 7 and 28 Days Flexural strength

Sl No	Mix Designation	Aggregate replacements % (RCA + RFA)	Flexural Strength (N/mm^2)	
			7 days	28 days
1	A-0	0 + 0	4.1	6.30
2	A-1	20 + 0	4.02	6.18
3	A-2	40 + 0	3.83	5.63
4	A-3	50 + 0	3.63	5.26
5	A-4	60 + 0	3.42	5.20
6	B-1	50 + 10	3.40	5.18
7	B-2	40 + 10	3.59	5.22
8	B-3	40 + 20	3.48	5.15

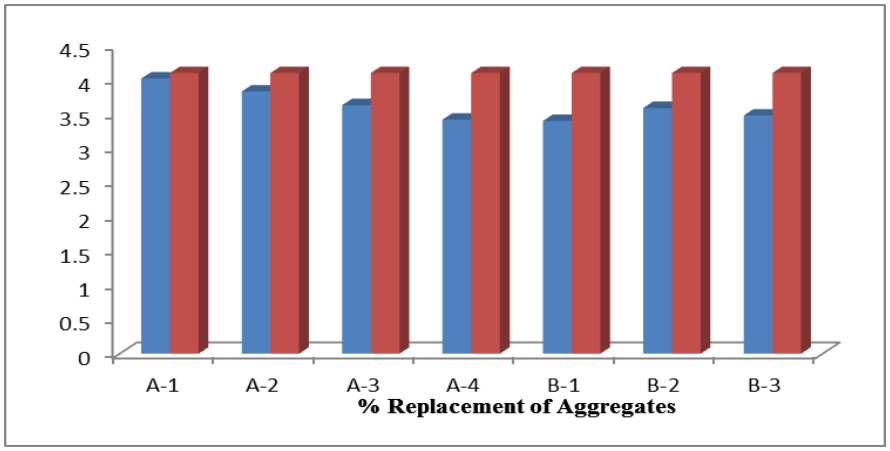

Figure 3: 7 Days Flexural strength

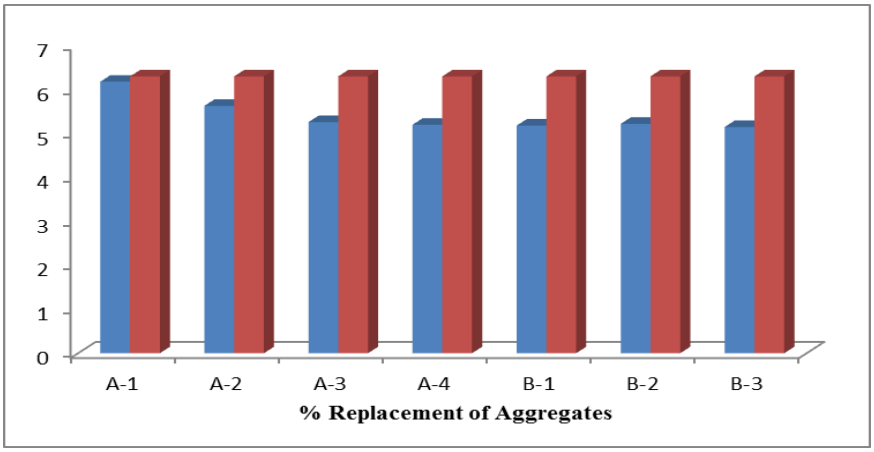

Figure 4: 28 Days Flexural strength

VII. CONCLUSION

The following conclusions are made based on the experimental investigations on compressive strength and flexural strength.

1) The use of recycled aggregates from construction and demolition wastes is showing prospective application in construction as an alternative to primary (natural) aggregates. Recycled aggregates are found to possess relatively lower bulk density, higher crushing and impact values and higher water absorption as compared to natural aggregate.
2) The compressive strength and flexural strength of recycled aggregate concrete is relatively lower than natural aggregate concrete.
3) The compressive strength of recycled aggregate concrete is reduces by the average value of 7.90% with replacing every 20% of natural aggregate concrete.
4) The replacement of coarse aggregate by 40% and fine aggregate by 10% of demolished waste having good compressive strength and flexural strength compared to normal concrete.
5) The replacement of coarse aggregate by more than 40% and fine aggregate by more than 10% of demolished waste decreasing the compressive strength and flexural strength compared to normal concrete.
6) Use of demolished waste aggregate in concrete can be an alternative to the conventional concrete.
7) Usage of recycled concrete aggregate can not only preserve the finite raw material, but also reduce energy consumption and overall construction cost.
8) Use of Demolished waste aggregate in the concrete as the recycled aggregate reduces the environmental pollution as well as providing economic value for the waste material.

VIII. REFERENCES

[1] Manish Kumar Singh, Dilip Kumar (2014):-″Utilization of demolished concrete and construction waste as coarse aggregate in concrete". ISSN: 2277-9655 Scientific Journal Impact Factor: 3.449 (ISRA)
[2] Vikas Srivastava, Mohd Monish, Raushan Ranjan and P.K.Mehta (2015):- ″Demolished waste in Concrete".
[3] Angha Kalpavalli, Dr.S.M.Naik (2015):-″use of demolished concrete waste as coarse aggregate in high strength concrete production". ISSN: 2278-0181 ,Vol. 4 Issue 07, July-2015
[4] Prakash Somani, Brahmtosh Dubey, Laukesh Yadav, Jitendra Kumar, Abhishek Kumar, Manipal singh (2016): ″Use of demolished concrete waste in partial replacement of coarse aggregate in concrete".
[5] V.Sai Kiran Kumar, B.Ravi Kumar, K.Ravi Reddy, V.Subhashini, S.K.Ayesha, Pragada Rambabu (2017): ″Demolished waste as coarse aggregate".
[6] Mukai T, Kikuchi M, Ishikawa N (1978) Study on the properties of concrete containing recycled concrete aggregate. Cement Association of Japan, 32nd review
[7] Hansen TC, Narud H (1983) Strength of recycled concrete coarse aggregate. Concrete Int –Design constr. 5(1):79-83
[8] Hansen, T.C, and Marga, M (1992), Strength of recycled concrete made from coarse and fine recycled concrete aggregate. Ibid 135, pp.605-612.
[9] Karaa, T, (1986) Evalution techniques.
[10] Fouad M. Khalaf and Alan S. DeVenny (2004) Performance of Brick Aggregate Concrete at High Temperatures, (ASCE)0899-1561 .
[11] IS: 456-1978, “Code of practice for plain and reinforced concrete.”Indian Standard Institute,New Delhi.
[12] IS: 6461-1973,“Properties of concrete”, (part VIII), Indian Standard Institute, New Delhi.
[13] IS: 8112-1989,“43 Grade ordinary Portland cement”, Indian Standard Institute, New Delhi.
[14] IS: 6461 – 1973, “Glossary of terms relating to Cement concrete”, Indian Standard Institute, New Delhi.
[15] IS 10262:2009 guidelines for concrete mix proportioning.
[16] IS 2386:1963 Methods of test for aggregate for concrete
[17] IS 1199:1959 Methods of sampling and analysis of concrete.
[18] IS 4031:1988 Methods of physical tests for hydraulic cement.
[19] IS 516:1959 Method of test for strength of concrete.