A.N.Dabhade, Dr.S.R.Choudhari, Dr.A.R.Gajbhiye / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com
Vol. 2, Issue 4, July-August 2012, pp.1387-1391

Performance Evaluation Of Recycled Aggregate Used In Concrete

***A.N.Dabhade ,**Dr.S.R.Choudhari, ***Dr.A.R.Gajbhiye**
*(Asst.Prof.K.I.T.S. Ramtek)**(Principal of VNIET, Nagpur)***(Prof. Y.C.C.E.,Nagpur)

ABSTRACT

This research presents a review of literature on recycling and reuse of waste concrete aggregate. As the raw materials obtained from the demolition activity takes place such as, building roads, bridges, and fly over, subway, remolding cylinder and block etc. Dumping of raw material has become a problem for many countries. Construction industry in India generate around 10-20 million tones of waste annually. This technique is still not use in India. In this paper the literature related to the recycling and reuse of waste concrete aggregate is presented and conventional coarse recycled aggregate is being replaced with recycled aggregate.

The investigation was carried out using workability test, compressive test, split tensile test and bulk density, water absorption, impact value test, crushing value test, Fineness modulus. There were total of sixth batches of concrete mixes, consists of every 20% increment of recycled aggregate replacement from 0% to 100%.Moreover, 100% of recycled aggregate mix batches included, different water/cement ratio of 0.5,0.6 and 0.7. The workability of concrete considerably reduced as the amount of recycled aggregate increased. For the strength of characteristics, the results showed that a gradually increasing in the compressive strength up to 20% of recycled aggregate and as well as for the tensile strength as the percentage of recycled aggregate.

Keywords: Compressive strength , Natural aggregate, Recycled coarse aggregate, Split tensile strength

INTRODUCTION

The Concrete Consist of Cement, Sand and Course and Fine Aggregate. Their proportion in the concrete is based on grade of concrete. Cement has two main functions, to fill voids between aggregate particles and water tightness and to give Strength to hardened concrete. The aggregate which comprises of 70 to 80 % of volume of concrete has Three main functions are to provide a cheap filler, to provide a mass of particles for resisting the action of applied loads and to reduce the volume changes resulting from the settling and hardening process.

Recycling is the act of processing the used material for use in creating new product. The usage of natural aggregate is getting more intense with the advanced development in infrastructure area. In order to reduce the usage of natural aggregate, recycled aggregate can be used as the replacement material. Recycled aggregate comprised of crushed, graded inorganic particle processed from the materials that have been used in the construction and demolition wastes. These materials are from building, roads, bridges etc.

Many researchers have come a crossed many benefits and barriers. Barriers like in some countries it is considered that low economic cost of natural aggregate than that of recycled aggregate, non-regular supply of waste. Benefits are like reduction in transportation cost, wastes generally present near the construction site, and it increased the demand of eco-friendly products and reuse of materials.

The objective of the research is to recycle and reuse the large amount of waste generated from construction and demolition due to increase in population and urbanization or natural disaster. These wastes constitute a major portion of total solid waste production in the world, and most of it is used in the landfills. Due to the shortage of dumping sites and increase in cost of transport, majority of developed/developing countries are facing problems in handling and disposal of such wastes. By considering all the aspect, it is beneficial to reuse the generated waste for effective utilization and to save environment.

In India very less progress in research on the reuse and recycling of construction and demolition waste has been made. This may be due to lack of awareness and standard on recycle and reuse of recycled aggregate in the construction industry. Hence this research will carry out a systematic study of recycling the construction and demolition waste by conducting the various experiments.

EXPERIMENTAL PROGRAMME

. **Cement**: Ordinary Portland cement of 53 grade conforming to IS-1489(pare 1)-1991.All the test are conducted as per IS 8112-1989 and result as shown.

Test on cement

Characters	Experimental values	As per IS : 8112-1989
Consistency of Cement	33.0%	_
Specific gravity	2.84	3.15
Initial setting time	125 mins	>30 mins
Final setting time	300 mins	<600 mins
Fineness of cement	1%	< 10 %

Fine aggregate: River sand locally available in nearby area.

Coarse aggregate: Machine crushed granite obtained from quarry was used as a coarse aggregate

Recycled aggregate: It is obtained from demolition of concrete.

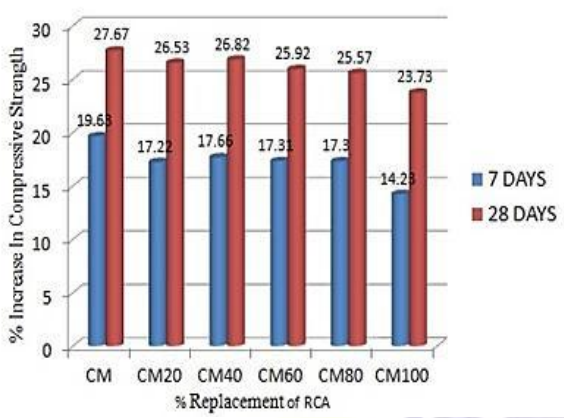
Property of aggregate	Experimental value of Fine Aggregate	Experimental value of Natural aggregate	Experimental value of Recycled aggregate
Specific gravity	2.22%	3.47	2.77
Bulk Density kg/m3	1470kg/m³	1448kg/m³	1370kg/m3
Fineness modulus	3.70	6.24	5.55
Water absorption	5%	2.4%	4.3%
Imapact value test	-	16.66%	26.66%
Crushing value test	-	12.50%	25.6%

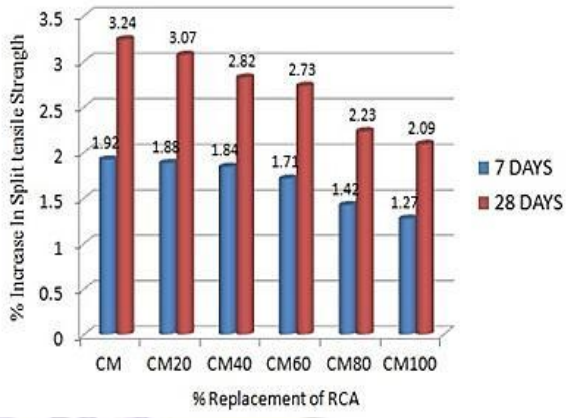
RESULTS AND CONCLUSIONS

From the study of test result it was found that 40% of recycled aggregate can be effectively used in conventional coarse aggregate for making the M20 grade concrete for 0.5 water cement ratio and 20% replacement is efficient for 0.6 and 0.7 water cement ratio. It is observed that in all the tests, strength of concrete is gradually decreased as percentage of recycled aggregate increased. The comparison of 7 days and 28 days compressive as well as split tensile strength for various water cement ratio is shown below.

Compressive strength and Split tensile strength
For 0.5 W/C

Sr. no.	Specimen designation	Compressive strength (N/mm2)		Split Tensile strength (N/mm2)	
		7days	28days	7days	28 days
1	CM	16.63	27.67	1.92	3.24
2	CM20	17.22	26.53	1.88	3.073
3	CM40	17.66	26.82	1.84	2.82
4	CM60	17.31	25.92	1.71	2.73
5	CM80	17.30	25.57	1.42	2.23
6	CM100	14.23	23.73	1.22	2.09

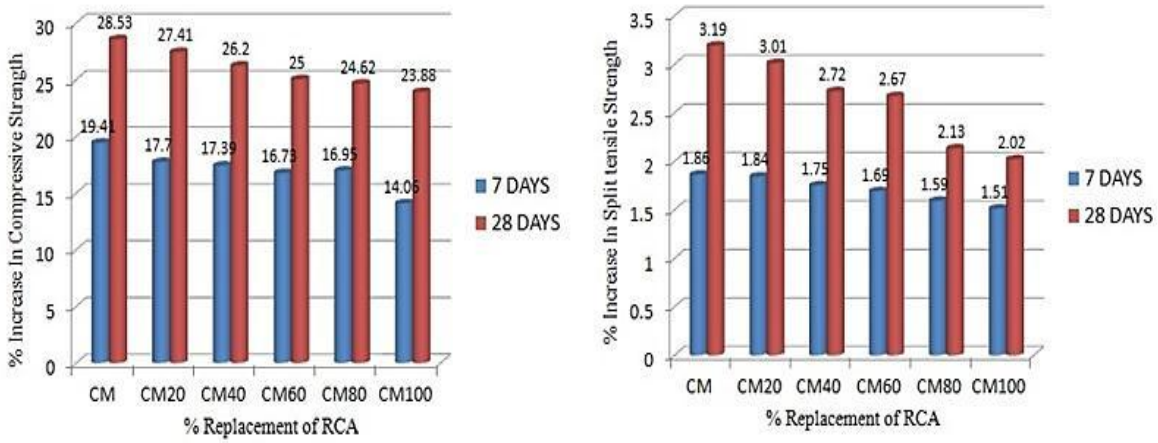




Comparative graph for 7 and 28 days at 0.5 W/C.

Compressive strength and Split Tensile strength For 0.6 W/C

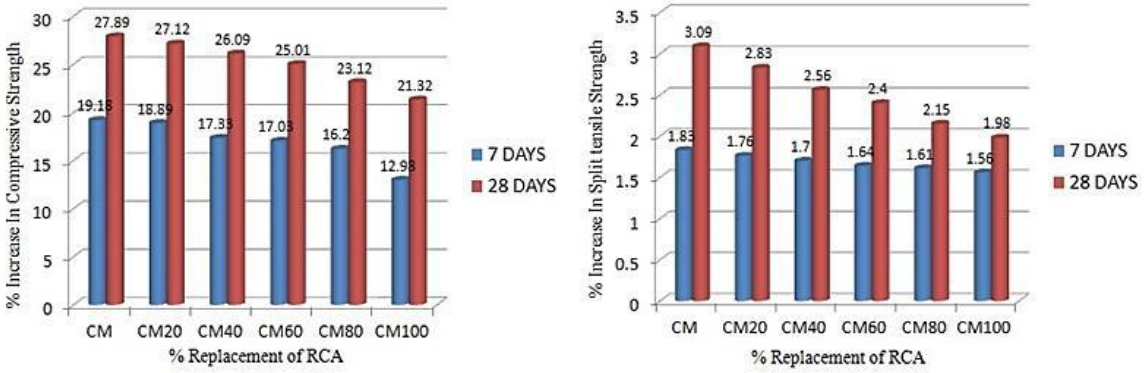
Sr. no.	Specimen designation	Compressive strength (N/mm2)		Split tensile strength (N/mm2)	
		7days	28days	7days	28 days
1	CM	19.41	28.53	1.86	3.19
2	CM20	17.70	27.41	1.84	3.01
3	CM40	17.31	26.20	1.75	2.73
4	CM60	16.73	25.00	1.69	2.67
5	CM80	16.95	24.62	1.59	2.13
6	CM100	14.00	23.88	1.51	2.02



Comparative graph for 7 and 28 days at 0.6 W/C.

Comparison of Compressive strength and plit tensile strength For 0.7 W/C

Sr. no.	Specimen designation	Compressive strength (N/mm2)		Spilt tensile strength (N/mm2)	
		7days	28days	7days	28 days
1	CM	19.18	27.89	1.83	3.09
2	CM20	18.89	27.12	1.76	2.83
3	CM40	17.33	26.09	1.70	2.56
4	CM60	17.03	25.01	1.64	2.40
5	CM80	16.20	23.12	1.61	2.15
6	CM100	12.98	21.32	1.56	1.98



Comparative graph for 7 and 28 days at 0.7 W/C.

CONCLUSION

The various experiments on the concrete have been performed. From the experiments it was found that the replacement of 100% NA by RCA can be possible. The replacement of aggregate was carried out by 0, 20,40,60,80 and 100%. The different ratios of the water-cement ratio were used. Significant potential is required for growth of recycled aggregate. It's a 'green' solution for anticipated world. From the various experiments and results the following conclusion were made.

1. It is found that as the natural aggregate replace the strength of the concrete decreases.
2. Natural resources are not unlimited. There is a global need to protect our environment and preserve our scarce natural resources for next generations. Recycling of Construction & Demolition materials can help reserve our public fill capacity and precious landfill space.
3. It can also help reduce the need for quarrying and damage to our natural landscape.
4. The replacement of more water is required as compare to that of the natural aggregate, for which the admixture has to be used.
5. Usage of recycled aggregates can not only preserve the finite raw materials, but Also reduce energy consumption and overall construction costs.
6. Use of the 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.
7. The higher water/cement ratios, the compressive strength of recycled concrete is similar to that of normal concrete. At lower water/cement ratios, the compressive strength of recycled concrete is much lower than that of normal concrete.

REFERENCES

1. Cervantes V., Dr. Roesler J., Bordelon A., **(2007**), 'Fracture and Drying Shrinkage Properties of Concrete Containing Recycled Concrete Aggregate', Technical Note no: 34, 1-23.
2. Etxeberria M., Vazquez E., Mari A., Barra M., Hendriks Ch. F., Maasakkers M.H.J. van, **(2001)**, 'the role and influence of recycled aggregate, in "recycled aggregate concrete', 1-10.
3. Evangelista Luís R., de Brito Jorge C., **(2005),** 'Criteria for the Use of Fine Recycled Concrete Aggregates in Concrete Production', 1-8.
4. Fernando Martínez , Belén González ,**(2005),** 'Shear Strength Of Concrete With Recycled Aggregates, national conference, 1-10.
5. Fong, Winston F.K., Yeung Mr. Jaime S.K., (**2002**), 'Production and application of recycled aggregate', 1-12.
6. Fong, Ir Winston F.K., Jaime S. K. Yeung, Poon C. S., **(2002)**, 'Hong Kong Experience Of Using RecycledAggregates From Construction And Demolition Materials In Ready Mix Concrete', International Workshop on Sustainable Development and Concrete Technology, 267-275.
7. Gupta S. M., Setiea B., **(1988),** 'Concrete Aggregate from Demolition Waste', Thesis, 208-216.
8. Gutierrez, Pilar Alaejos, Jaun, Marta Sanchez de, **(2001)**, 'Utilization of recycled concrete aggregate for structural concrete' National Programme of Construction and Demolition Waste, 1-11.
9. Gambhir M.L., (**1996**), Second edition, 'Concrete technology', 161-166.
10. Hasbi Yaprak, Huseyin Yılmaz Aruntas, Ilhami Demir, Osman Simsek and Gokhan Durmus, **(2011)** Vol.6, 'Effects of the fine recycled concrete aggregates on the concrete properties', International Journal of the Physical Sciences, 2455-2461.