International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 04 | Apr -2017 www.irjet.net p-ISSN: 2395-0072

A Study and Use of Recycled Aggregate with Fly Ash in Concrete

Mr. Aditya G. Kutwad[1], Mr. Manoj B. Nikam[2], Mr. Madhav T. Wagare[3], Mr. Vinay B. Birajdar[4], Mr. Gaurav C. Vispute[5].

[1]*Student,* Dept. of Civil Engg., *Dr.DY Patil School of Engg. and Technology, Lohgaon, Pune, Maharashtra, India.*
[2] *Student,* Dept. of Civil Engg., *Dr.DY Patil School of Engg. and Technology, Lohgaon, Pune, Maharashtra, India.*
[3] *Student,* Dept. of Civil Engg., *Dr.DY Patil School of Engg. and Technology, Lohgaon, Pune, Maharashtra, India.*
[4] *Student,* Dept. of Civil Engg., *Dr.DY Patil School of Engg. and Technology, Lohgaon, Pune, Maharashtra, India.*
[5]*Asst. Prof.,* Dept. of Civil Engg., *Dr.DY Patil School of Engg. and Technology, Lohgaon, Pune, Maharashtra, India.*

Abstract - *Waste get up from construction and demolition founds one of the biggest waste streams within the developed and developing nations. The rapid growth in construction and depleting natural resources demands the recycling and reusing technology to be adopted in construction field. The use of recycled coarse aggregate (RCA) and fly ash (FA) is one of the methods towards this necessity. Use of RCA and FA in concrete can be useful for environmental protection and economical terms. In this experimental study the natural coarse aggregate (NCA) is replaced with RCA at different percentage and the mechanical strength of concrete is tested. Also in addition the FA is introduced as replacement of Cement. The objective of present study is to determine the maintainability of RCA as an alternate material to NCA and to compare the workability, density and compressive strength result using FA. The mix designing is done for water cement ratio 0.55. Cubes are casted by replacing NCA and cement with 20% and 40% of RCA and 10% of FA respectively and then its compressive strength is calculated. Obtained results are then used to establish an experimental relationship between the strength of concrete by using percentage of RCA. Results show that RCA normally up to 40% can be used for making concrete.*

Key Words: Natural Coarse Aggregate, Recycled Coarse Aggregate, Fly ash, concrete, compressive strength.

1. INTRODUCTION

The problem of waste disposal has become a major problem in the developed countries as well as developing countries like India. This is due to the enormous increase in the quantity of disposable materials, the continuing storage of dumping sites, increase in the cost of transportation and its disposal. Therefore the concept of recycling the waste material and using it again in some form has gathered momentum. Also, recycling not only solves the problem of waste disposal but also reduces the cost and conserves the non-renewable natural sources.

Demolition waste generated in many places. Hence, recycling technology is making significant progress in the recycling of demolished concrete. The quantity of concrete discarded every year has reached figures of about 60 million tons in the U.S., 50 million tons in the European Economic Community, 11 million tons in U.K., and 13 million tons in France. These numbers will be increases continuously.

The reduction of the natural coarse aggregate, especially in the vicinity of the construction sites and the ever increasing demand for aggregate by the construction industry further inspire the adoption of this concept of recycling technology.

Also in India the same trade of reduction of the aggregate reserves, increase in the cost of demolition and transportation and lack of dumping sites due to the rapid urbanization are clearly discernible. The condition in India is not as serious similar that of in the west, yet there are some portions of Northern India, where no availability of crushed stone aggregate within several distance. However, the gravity situation in the future demands serious reconsidering on the measure of the Indian community.

The rate of growth of construction industry, urbanization develops rapid from the last three years which consumes lots of natural material resources. As a source is limited, recycling is better key on it. Recycled aggregate now a day's used in construction sector gaining interest.

1.1 Need of RCA

Recycled coarse aggregate is the alternative coarse aggregate for making concrete for various purposes. Recycled aggregate concrete has been successfully utilized for construction.

Many buildings and other concrete structures have cross their life span and need to be demolishing that type of structures. Even due to new requirements and necessities in various applications structure should be demolished.

For new recycled concrete production it has been shown that demolition waste is an excellent source of aggregate in some percentages. There are many lessons which prove that concrete made with this type of coarse aggregates can have mechanical properties like to those of conventional concretes and even high strength concrete is currently a possible goal for this environmentally sound practice. However the fine fraction of this type of recycled aggregates has not been the subject of through similar

studies since it is believed that their greater water absorption can jeopardize the final result.

Aggregates often represent a large proportion of a region's construction and demolition waste stream due to their weight and predominance in modern construction methods.

Recycled aggregate differs from the natural aggregates, due to the point that impurities like cement stone are still attached to the surface of the natural aggregate even after the procedure of recycling. These highly porous cement-stone and other impurities contribute to a lower particle density and high permeability, variation in the quality of the RCA and the higher value of the water absorption. Considering the impact of the RCA on the quality of the concrete based on particle density, permeability and absorption.

2. Objectives

1. To observe performance of the recycled aggregate concrete of various mix cases in its fresh and hardened state.
2. To examine the properties of the fresh recycled aggregate concrete and hardened recycled aggregate concretes.
3. To examine the mechanical properties of recycled aggregate.
4. To change the relationship between various properties of recycled aggregate concrete.

3. Methodology

Phase I:

It includes generation of Recycled aggregate from waste concrete and it should be done by crushing of concrete specimen, removal of fine particles, sieve analysis.

Phase II:

It includes Selection of Natural aggregate and recycled aggregate by using various test like Specific gravity, sieve analysis, fineness modulus, water absorption and mechanical properties as per IS recommendation.

Following test are carried out as per IS code procedure

Table 1: Physical properties of Fine Aggregate (FA)

Sr. No.	Properties	F.A.
1	Specific gravity	2.63
2	Size in mm	Below 4.75
3	Fineness modulus	2.54
4	Water absorption	0.97%

Table 2: Physical properties of N.C.A.

Sr. No.	Properties	N.C.A.
1	Specific gravity	2.77
2	Size	20mm
3	Crushing value	17.15%
4	Impact value	16.8%
5	Fineness modulus	4.21
6	Water absorption	2.96%

Table 3: Physical properties of R.C.A.

Sr. No.	Properties	R.C.A.
1	Specific gravity	2.45
2	Size	20mm
3	Crushing value	32.83%
4	Impact value	34.97%
5	Fineness modulus	3.28
6	Water absorption	7.64%

Phase III:

Mix design of various grades of concrete mixes by varying percentage of RCA.

M25 grade are taken in mix design and it is modified 0%, 20% and 40% of NCA replaced by RCA and 10% of cement replaced by fly ash.

Table 4: Batching of concrete mixes.

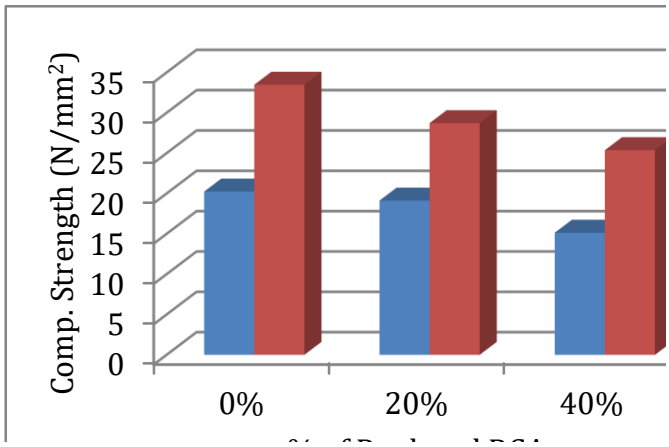
Design ation	Cement Kg	FA Kg	NCA kg	RCA kg	FA kg	Water Kg
M1	334	60	1096	0	727	197
M2	334	60	876	220	727	213
M3	334	60	658	438	727	228

Phase IV:
Casting of Cubes as per mix design with proper proportion of cement, fine aggregate, fly ash, water, N.C.A. and R.C.A. and before concrete pouring in the mould workability is checked. After pouring concrete mould is placed over electronic vibrator for proper compaction. After 24 hour mould is removed and cube are placed in water tank for curing.

Phase V:
Testing of cubes using compressive testing machine, for calculate compressive strength of various designed cubes.

Table 5: Compressive Strength of cubes after 7 days & 28 days. Cube size: 150mm X 150mm X 150mm

Designation	Percentage of Recycled RCA	Compressive Strength (N/mm^2)	
		7 Days	28 Days
M1	0	20.24	33.48
M2	20	19.12	28.72
M3	40	15.14	25.37



Graph 1: Variation in compressive strength due to replacement of R.C.A.

3. CONCLUSIONS

- R.C.A. has shown low specific gravity and high water absorption than N.C.A. because of mortar is attached to the surface of RCA.
- Recycled aggregate have exhibited low resistance to mechanical action like impact, crushing and abrasion than conventional aggregate.
- The above properties decrease with increasing the percentage of Recycled coarse aggregate in concrete.
- Recycled aggregate concrete workability is more than the natural aggregate concrete because of the extra amount of water is added according to the of water absorption of RCA.
- By using fly ash in concrete we can replace natural coarse aggregate upto 40% by Recycled coarse aggregate without disturbing the properties of concrete in plastic as well in hardened stage.

ACKNOWLEDGEMENT

First of all we are highly grateful to our Principal Dr. Ashok Kasnale for making available through the department the help needed in the form of facilities and guidance.

We are also thankful to Dr. Sanjay Kulkarni, Head of Civil Engineering Department permitting us to work on this topic and for his continuous support and inspiration throughout our academic project.

We also thankful to guide Asst. Prof. Gaurav Vispute and Project co-ordinator Asst. Prof. Vidya Sujitha and Mr. Suraj (Sinner Engineer of Silver Mist construction, Pune.) and Metropolis construction Pune, for their inspirational support and suggestions to improve the quality of work.

REFERENCES

1) Parekh D. N. and Dr. Modhera C. D., Assessment of recycled aggregate concrete, *Journal of Engineering Research and Studies,* E-ISSN 0976-7916, Vol. 2, January-March 2011/1-9.
2) Shri Ravindrarajah, R. and Tam, C. T.., "Properties of concrete made with crushed concrete as coarse aggregate", *Magazine of Concrete Research*, Vol 37, No. 130, 1985, pp.29-38
3) B.C.S.J., "Study on Recycled Aggregate and Recycled Aggregate Concrete", Building Contractors Society of Japan, committee on Disposal and Reuse of Concerete Construction waste. *Summary in Concrete Journal* , Japan , Vol. 16, No.7 July 1978 pp.18-31
4) Rasheeduzzafer and Khan, A., "*Recycled Concrete –A Source of New Concrete* " Cement, Concrete and Aggregate (ASTM) 6, No.1 1984, pp 17-27
5) Mukai , et al., "*Study on Reuse of Waste Concrete for Aggregate of Concrete*", Seminar on Energy and Resource

Conservation in Concrete Technology , Japan-US co-operative science programme , San Franciso.

6) W. Zhao, R.B. Leeftink , V.S. Rotter, Evaluation Of Economic Feasibility For Recycling Of Construction And Demolition Waste In China – The Case Of Chongqing , *Resources Conservation And Recycling*, 54(2010) 377-389,15 January 2009
7) Erik K. Lauritzen, "Recycling Of Concrete – *An Overview Of Development And Challenges" Demex Consulting Engineers A/S , Denmark ,*(January-2006)
8) Wilson , D. G. Foley, P. , Wiesman, R., Erondistou-Yannas S., *" Demolition Debries: Quantities , Composition And Possibilities For Recycling* ", Proceedings, 5th Mineral Waste Utilization Symposium, Chicago , April 1976
9) C.S.Poon., "On site sorting of construction and demolition," in Hong Kong, polytechnic university, Hong Kong, 157-172, 19 January 2001.
10) Prof. Chetna M.Vyas and Prof. Jayeshkumar Pitroda, "Fly Ash and Recycled Coarse Aggregate in Concrete: New Era for Construction Industries," *IJETT – Volume 4 Issue 5- May 2013*
11) Dr. M.N.Bajad,Nandan Mutha, Hatim Husain, Nikhil Kshirsagar, "Effect of Recycled Aggregate and Fly Ash in Concrete," *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 12, Issue 2 Ver. III (Mar - Apr. 2015)*
12) Yasir Karim, Zubair Khan, Mohammad S. Alsoufi, Mohammed Yunus, "A Review on Recycled Aggregates for the Construction Industry," *American Journal of Civil Engineering and Architecture, 2016, Vol. 4.*