www.ijecs.in
International Journal Of Engineering And Computer Science ISSN:2319-7242
Volume 3 Issue 12 December 2014, Page No. 9602-9605

Utilization of Recycled Demolition Concrete

R. Praba Rajathi, J. Jai kanth

[1] Assistant Professor, Department of Civil Engineering,
A.S.L. Pauls college of Engineering & Technology, Coimbatore – 642 109, Tamilnadu, India
v.prabarajathi@gmail.com

[2] Site Engineer,
Sai Hi-tech. builders, Coimbatore, Tamilnadu, India
Jaikanth46@gmail.com

Abstract: India is presently generating construction and demolition (C & D) waste to the tune of 23.75million tones annually and these figures are likely to double fold in the next 7 years. C & D waste and specifically concrete has been seen as a resource in developed countries. Works on recycling have emphasized that if old concrete has to be used in second generation concrete, the product should adhere to the required compressive strength. This paper deals with the review of the existing literature work for the use of recycled concrete as aggregates in concrete in respect of mainly the compressive strength and proposes and approach for use of recycled concrete aggregate without compromising the strength. The need for demolition, repairs and renewal of concrete and masonry structures is rising all over the world, more so in the developing countries. It is highly desirable that the waste materials of concrete and bricks of further reutilized after the demolition of old structures in an effective manner especially realizing that it will help in reducing the environmental damages caused by excessive reckless quarrying for earth materials and stones. Secondly, this will reduce pressure on finding new dumping ground for these wastes, thus further saving the natural environment and ecosystem. This paper critically examines such properties in reused concrete and brick masonry waste materials and suggests suitable recommendations for further enhancing life of such structures thereby resulting in sufficient economy to the cost of buildings.

Keywords: Demolition waste aggregate, cement, aggregates, sand**.**

1. Introduction

Concrete has been around for many centuries, the first known use of a material resembling concrete was found by the Minoan civilization around 2000BC. During the earlier stages of the Roman Empire around 300 BC, the Romans discovered that mixing a sandy volcanic ash with lime mortar created a hard water resistance substance which we know as concrete. A huge amount of solid waste is generated annually from construction and demolition activities. This has lead to the promotion of waste recycling as a major measure to reduce waste and to mitigate the harmful effects of construction activities on the environment. Among these waste, concrete apportions more than half of the total [6]. The construction industry conspicuous consumer of raw material of many types and thus large material inventories are required to sustain the growth. Among the various raw materials used in construction, aggregates are important components for all the construction activities and the demand in 2007 has seen increase by 5%, to over 21 billion tones the largest being in developing countries like china, India etc. [7]. The use of swine manure, animal fat, silica fume, empty palm fruit bunch, citrus peels, fly ash, foundry sand, glass, plastic, carpet, and concrete aggregate in construction is becoming increasingly popular due to the shortage and increasing cost of raw materials. This study present an initial understanding of the current strengths and weaknesses of the practices intended to support construction industry in developing effect policies regarding uses of waste and recycled materials as construction materials [2]. Regardless of the replacement ratio, recycled aggregate concrete (RAC) had a satisfactory performance, which did not differ significantly from the performance of control concrete in this experimental research. However, for this to be fulfilled, it is necessary to use quality recycled concrete coarse aggregate and to follow the specific rules for design and production of this new concrete type [4]. Durability, reliability and adequate in service performance of these reused waste materials over the stipulated design life of designed structures are of paramount importance to structural designers [3]. The production technics of recycled aggregate, the mixture proportion, the physical property, the durability, the basic mechanical behavior and the structural performance of recycled aggregate concrete are mainly investigated. The results indicate that it is feasible to reuse waste concrete and the recycled aggregate concrete which can be adopted in both self-bearing members and load-bearing members in civil engineering [5]. Concrete is the main material used in construction in the Gulf Cooperation Council (GCC). Therefore, it makes economic and environmental sense to use recycled materials in the making of new concrete for different applications [1]. The scope of the study is a comparative analysis of the experimental results of the properties of fresh & hardened concrete with different replacement ratios of natural with recycled coarse aggregate. Recycled aggregate was made by crushing the waste concrete of laboratory test cubes & precast concrete columns.

2. Materials

2.1. Cement

Ordinary Portland cement of 53 grade from the local market was used and tested for physical and chemical properties as per IS: 4031 – 1988 and found to be confirming to various specifications as per IS:12269 – 1987. Table 1 shows the properties of cement.

Table 1: Tests on cement

Sl.No.	*Properties*	*Value*
1	Normal consistency	30%
2	Initial setting time	35 min
3	Compressive strength(7 days)	37 N/mm2
4	Compressive strength(14 days)	47 N/mm2
5	Compressive strength(28 days)	53 N/mm2
6	Specific gravity	3.01

2.2. Fine aggregate

In the present investigation, fine aggregate is natural sand from local market is used. The properties of fine aggregate are tested and shown in table 2.

Table 2: Tests on Fine aggregate

Sl.No.	*Properties*	*Value*
1	Specific gravity	2.60
2	Fineness modulus	4.35
3	Water absorption	6.4%
4	Surface texture	Smooth

2.3. Coarse aggregate

The crushed coarse aggregate of 12.5mm size rounded obtained from local crushing plant, Robo silicon Tamil nadu is used in the presenct study. The properties of coarse aggregate are tested and shown in table 3.

Table 3: Tests on Coarse aggregate

Sl.No.	*Properties*	*Value*
1	Specific gravity	2.75
2	Fineness modulus	7.05
3	Water absorption	8.2%
4	Particle shape	angular
5	Impact value	8.3%
6	Crushing value	19.5

2.4. Demolition waste aggregate

The crushed demolition waste coarse aggregate of 14.5mm size rounded obtained from local area nearby construction site in Coimbatore, Tamil nadu is used in the presenct study as a replacement material for aggregate(30% & 70%). The properties of demolition waste coarse aggregate are tested and shown in table 4.

Table 4: Tests on demolished waste coarse aggregate

Sl.No.	*Properties*	*Value*
1	Specific gravity	2.95
2	Fineness modulus	7.25
3	Water absorption	8.5%
4	Particle shape	angular
5	Impact value	8.7%
6	Crushing value	20.5

3.Methodology

Concrete grade = M_{20}
Design – IS 10262 :1980
Moulding of specimen:
Cube – 10Nos (150x150x150mm)
Cylinder- 10Nos (150mm dia 200mm length)
Prism – 2Nos (100x100x500mm)

Three types of concrete mixtures were tested: concrete made entirely with natural aggregate as a control concrete and two types of concrete made with natural fine and recycled coarse aggregate (30% and 70% replacement of coarse recycled aggregate or demolished waste coarse aggregate). Ninety nine specimens were made for the testing of the basic properties of hardened concrete.

4. Mix Design

The process of selecting suitable ingredients of concrete and determining with their relative amount with the objective of producing a concrete of the required strength, durability and workability as economically as possible is termed concrete mix design. Table 5 shows the mix proportion of concrete

Table 5: Mix proportion

Mould	*Volume (m3)*	*Cement* (kg)	*FA* (kg)	*CA* (kg)	*Demolition concrete*	
					30%	*70%*
Cube	0.00338	1.5	3	6	1.8	4.2

Cylinder	0.00157	0.75	1.5	3	0.9	2.1
Prism	0.5	2.25	4.5	9	2.7	6.3

FA – fine aggregate; CA- coarse aggregate

5. Results & Discussion

5.1. Test on concrete cubes:

Figure 1(a): Compression test on concrete cubes

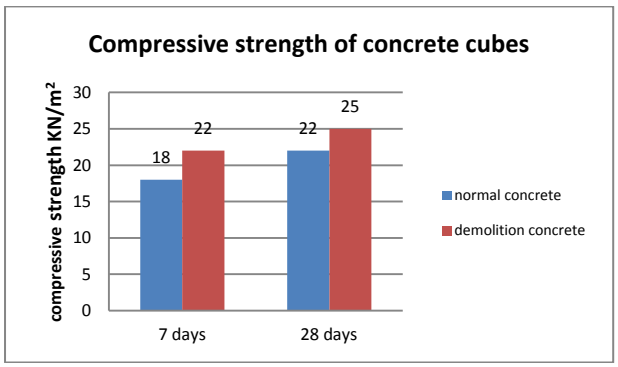

Figure 1(b): Compressive strength of concrete cubes

Hence the above results are discussed by the compressive strength of the cubes under the 7, 28 days curing. From the above graph (Fig.1.), the normal concrete attains the strength in general and the replaced material attains more strength than normal concrete. It shows that the recycled demolished concrete increased the strength than the normal concrete.

5.2. Test on concrete Cylinders:

Figure 2(a): Split tensile test on concrete Cylinders

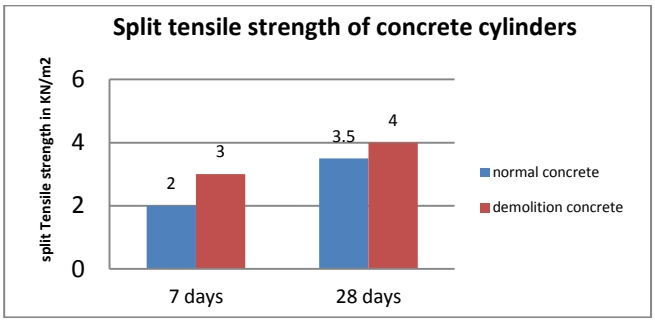

Figure 2(b): Split tensile strength of concrete Cylinders

Hence the above results are discussed by the split tensile strength of the cylinders under the 7,28 days curing. From the above graph (Fig.2.), the normal concrete attains the strength in general and the replaced material attains more strength than normal concrete. It shows that the recycled demolished concrete increased the strength more than normal concrete.

5.3. Test on concrete Prisms:

Figure 3(a): Flexure test of concrete prisms

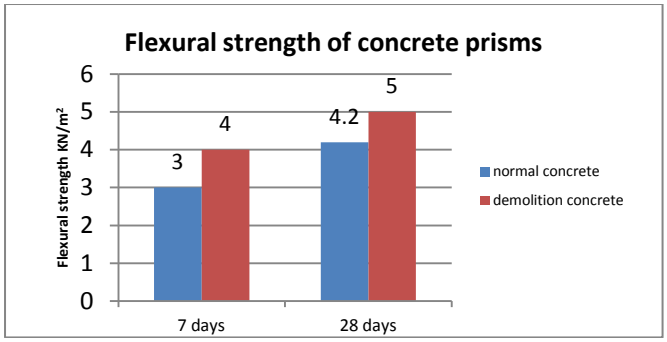

Figure 3: Flexure strength of concrete prisms

Hence the above results are discussed by the split tensile strength of the cylinders under the 7, 28 days curing. From the above graph (Fig.3.), the normal concrete attains the strength in general and the replaced material attains more strength than normal concrete. It shows that the recycled demolished concrete increased the strength more than normal concrete.

6. Conclusion

From the present study the following conclusions were drawn:

- The idea of reusing the waste material is very exciting and encouraging specially when it will be helpful in minimizing destruction to earth's crust and green forest cover by virtue of reduced mining.
- Protection of environment from the demolition concrete waste.
- Compressive strength of the demolished concrete is getting greater than normal concrete.
- The tensile and flexural strength is also high
- This method in the construction filed is very effective.

References

[1] Akmal S. Abdelfatah and Sami W. Tabsh, "Review of Research on and Implementation of Recycled concrete Aggregate in the GCC", Advances in Civil Engineering, Article ID 567924, 6 pages Hindawi Publishing Corporation, 2011.

[2] Johnny Bolden, Taher Abu-Lebdeh and Ellie Fini, "Utilization of recycled and waste materials in various construction applications", American Journal of Environmental Science, 9 (1), pp. 14-24, 2013.

[3] Lalit Gamashta and Swarna Gumashta, "Reuse of concrete and masonry waste materials in construction to minimize environmental damages due to quarrying", Journal of Environmental Research and Development, 1 (1), pp. 65-67, July-September 2006.

[4] Mirjana Malešev , Vlastimir Radonjanin and Snežana Marinković , "Recycled Concrete as Aggregate for Structural Concrete Production", Sustainability(Open Access), (2), pp. 1204-1225, 2010.

[5] Nixon, P.J., "Recycled Concrete an Aggregate for Concrete–a Review," Rilem TC-37, DRC, Materials Structures, Vol. 19, No. 111, 1986

[6] V. W. Y. Tam PhD, K. Wang BEng and C. M. Tam PhD, FCIOB, MHKIE, FHKICM, "Ways t o facilitate the use of recycled aggregate concrete," Waste & resource management,WR3, (60), pp. 125-129, August 2007.

[7] S.R. Yadav, S.R. Pathak, "Use of Recycled Concrete aggregate in making Concrete- an overview" In Proceedings of the 34th Conference on Our World in Concrete & Structures, pp. 16 – 18, August 2009.

Author Profile

R. Praba Rajathi received the B.E. degree in Civil Engineering from Thiagarajar College of Engineering, Madurai, Tamilnadu, India in 2003 and M.E. degree in Environmental Engineering from Government College of Technology, Coimbatore, Tamilnadu, India in 2009. Now she is working as an assistant professor in Department of Civil Engineering, A.S.L.Pauls College of Engineering & Technology, Coimbatore. She has published several journals in different publications regarding concrete and recycle of waste materials.

J. Jai kanth received the B.E. degree in Civil Engineering from A.S.L.Pauls College of Engineering & Technology, Coimbatore Tamilnadu, India in 2014. Now he is working as a site Engineer, Sai Hi-tech. builders, Coimbatore.