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Study on Replacement Level of Concrete Waste as Fine Aggregate in Concrete

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Abstract: ***Fine aggregate (river sand) is the most important ingredients for making concrete but scarcity for river sand due to continuous exploitation and high transportation cost has become major problem in the field of construction. The main focus of this study is to give an alternate source for fine aggregates and also in order to prevent the over exploitation of river sand. In this study we are going to replace the fine aggregates by a crushed concrete which is obtained from demolished building. Concrete from the demolished building is crushed properly and used in concrete as fine aggregates. By this method we can able to reduce the waste as land filling material through the process of recycling. It acts as a ecofriendly material and also we can able to prevent the natural resources. There is no specification or any guideline when using recycled concrete aggregate in the constructions. In this experimental study to replace the fine aggregate by recycled aggregate in different ratio such as 0%, 10%, 20%, 30%, 40% and 50%. Recycled aggregate concrete is found to be 42% greater water absorption than that of natural aggregate. Beyond 30% replacement levels of concrete containing recycled fine aggregate shows 20-40% lower compressive strength is developed at the ages of 7, 28 and 56 days. Both tensile splitting and flexural strength are slightly decreased with the increase of the replacement ratio. The reduction in strength is 15% and 20% when compared to the reference concrete.***
Key words: ***Recycled aggregates, Mechanical properties, M_{30} Grade, Crushed concrete, Fine aggregates***

I. INTRODUCTION

Concrete has the distinction of being the largest man made material in the. In the last two decades, a variety of recycling methods for recycled concrete aggregate have been explored and well developed. Such recycling operations have the added benefit of reducing landfill disposal, while conserving primary resources and reducing transport costs. The construction of new buildings, as well as the maintenance and demolition of existing ones, is responsible for the production of large amount of waste, commonly referred to as Construction and Demolition C&D Waste. Out of the total construction demolition waste, 40% is of concrete, 30% ceramics, 5% plastics, 10% wood, 5%metal, & 10% other mixtures. As reported by global insight, growth in global construction sector predicts an increase in construction spending of 4800 billion US dollars in 2013. The recycled concrete aggregates are the main components of old concrete and Recycling of aggregates from demolition waste may bridge this gap between supply and demand. Creation of building wastes which result from natural destructive phenomena (earthquakes, storms, etc). The main reason that choosing the building as the source for recycled aggregate is that there is a huge amount of crushed demolition cement concrete that can be recycled. **Khoshkenari et al** inferred that the test results showed that both coarse and fine RCAs are about 20% lighter than normal aggregates. The lower density of RCAs was due to the old mortar being attached to the normal aggregates **Yang et al** The initial slump of recycled aggregate concrete was slightly affected by the relative water absorption of aggregates, whereas the rate of slump loss increased with the increase of the relative water absorption of aggregates **Poon et al.** The initial slump of fresh concrete slightly decreased with the increase of the replacement level of recycled aggregates. He showed that the initial slump of recycled aggregate concrete was significantly affected by the moisture condition of aggregates. **Yang et al** Compressive strength of concrete using recycled fine aggregate with higher absorption was lower than that of the control specimen by 20 to 40%; equally much lower relative compressive strength is developed at ages of 1 and 3 days. **Sérifou et al** The compressive strengths for all mixes of 1, 14, and 28 days of curing shows that the higher the replacement by recycled aggregates, the lower the compressive strength for all the curing durations. Both coarse and fine recycled aggregates decrease the compressive strength. **Katz** observed for the recycled OPC concrete, the effect of the crushing age was much smaller; the differences between the lower and the higher strengths were7% and 13% at testing ages of 7 days and 90 days ,respectively. **Khoshkenari** found that the reduction in the splitting tensile strength of concrete due to the use of RCAs instead of normal aggregates in a normal-strength-normal-aggregate concrete is more pronounced than the reduction in compressive strength.

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II. MATERIAL PROPERTIES AND MIX PROPORTIONING

A. Cement

Ordinary Portland cement - 43 grade chettinadu cement is used for the present study. The physical properties of the cement such as tested in accordance with IS: 4031-1988. The results of these tests are reported in Table 1.

Table 1 Physical properties OPC 43 grade cement

Sl.no	Test properties	Results
1	Specific gravity	3.05
2	Initial setting time (min)	100
3	Final setting time (min)	265
4	Consistency (%)	29

B. Fine Aggregate

As per IS: 2386-1963 and IS: 383-1970 recommendations the following properties of river sand as well as recycled fine aggregate were determined and presented in Table 2 The particle size distribution curves are as shown in Fig1 for river sand and recycled fine aggregate.

Table 2 Test result for natural fine aggregate and Recycled fine aggregate

Sl.no	Test properties	Results		Relevant Indian standards
		Sand	Recycled fine aggregate	
1	Specific gravity	2.6	2.64	IS 2386(part III) 1963
2	Fineness modulus	3.16	3.82	IS 2386(part I) 1963
3	Bulk density (kg/m^3)	1750	1540	IS 383-1970
4	Water absorption (%)	1.07	6.49	IS 2386(part III) 1963
5	Zone	II	II	IS 383- 1970

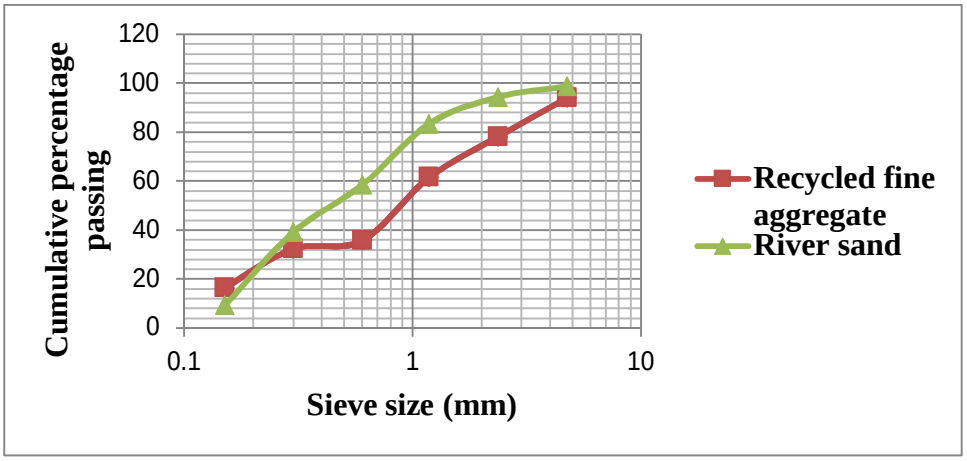

Fig 1 Particle size distribution curve for Sand and Recycled Aggregate

C. Coarse Aggregate

The crushed granite stone is used as natural coarse aggregate. As per IS: 2386-1963, IS: 9376-1979 and IS: 9377-1979 recommendations the following physical and mechanical properties were determined and presented in Table 3. Fig 2 shows the particle size distribution curve for natural coarse aggregates.

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Table 3Properties of natural coarse aggregate

Sl.no	Test properties	Results	Relevant Indian standards
		Natural Coarse Aggregate	
1	Specific gravity	2.77	IS 2386 (part III) 1963
2	Fineness modulus	9.13	IS 2386 (part I) 1963
3	Water absorption (%)	0.6	IS 2386 (part III) 1963
4	Bulk density(kg/ $m^{3)}$	1510	IS 2386 (part III) 1963

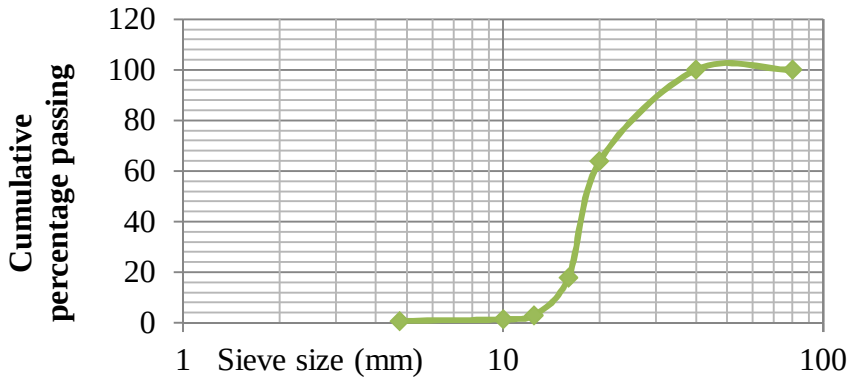

Fig 2Particle size distribution curve for natural coarse aggregate

D. Water

Ordinary portable water available in Pondicherry engineering college campus is used for the entire experimental investigation including curing of specimens.

E. Mix Proportioning

The various ingredients of all the concrete mixes per m^3 of concrete is given in Table 3.5.

Table 4 Ingredients required for per $m^3$of concrete

Sl.no	Materials	Quantity
1	Cement	350 kg/m^3
2	Water	157.6 kg/m^3
3	Fine aggregate	758.16 kg/m^3
4	Coarse aggregate	1181 kg/m^3
5	Water/ Cement ratio	0.45
6	Super plasticizer	2.45lit/m^3

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III. EXPERIMENTAL INVESTIGATIONS

A. Compressive Strength Results

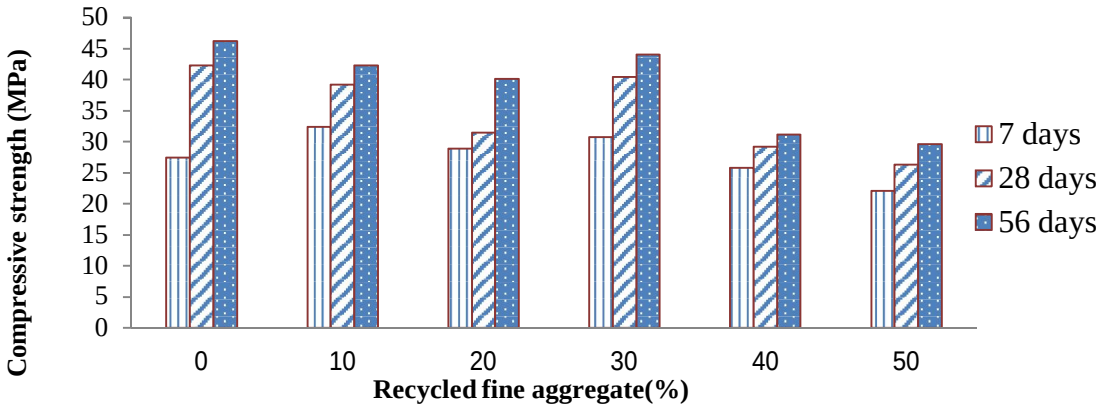


Fig 3 Compressive strength of natural and recycled aggregate concrete

The compressive strength of various concrete mixtures was schematically represented in Fig 3 From the observed results it is found that the compressive strength up to 30% of fine aggregate replaced by recycled aggregate give strength closer to the strength of reference concrete and strength reduction of 35.9% for recycled concrete mix .This reduction is due to insufficient hydration and a weak interface-zone formed between different components of the concrete matrix owing to a large amount of old cement paste on the surface of recycled aggregates, which can be the cause of a poor development of the compressive strength of concrete. In addition, an inconsistent surface of recycled fine aggregate would produce numerous microcracks between aggregates and cement paste, which would reduce concrete compressive strength.

B. Split Tensile Strength

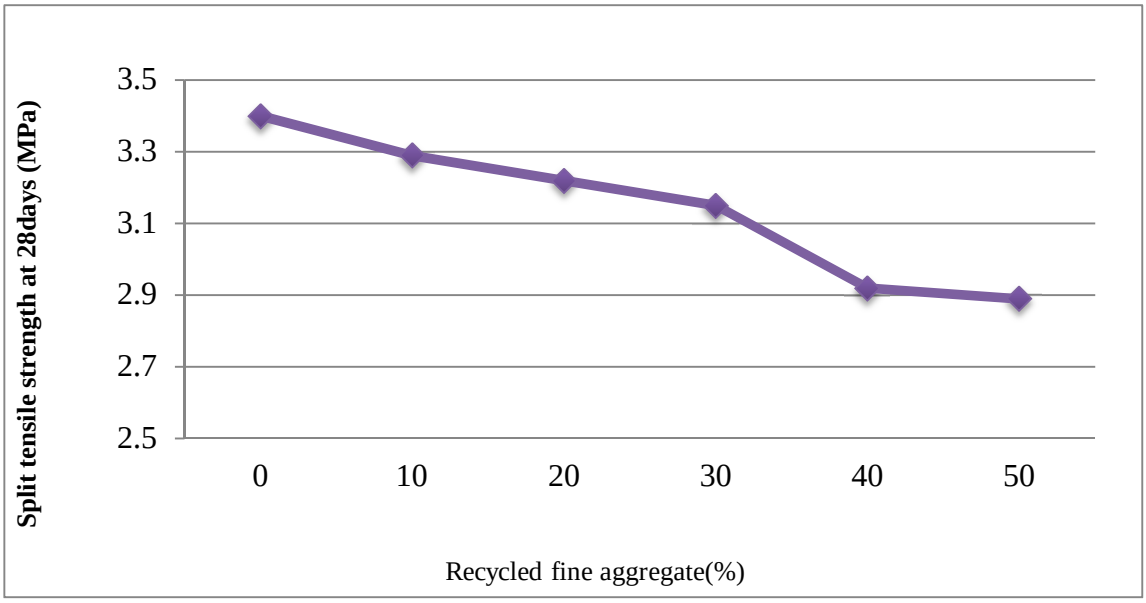


Fig. 4 Split tensile strength of concrete

The concrete's split tensile strength is presented in Table 4, which shows a clear decrease of this property with the increase of FNA replacement with FRA. Therefore, it is perfectly natural that a decrease occurs as the replacement ratio rises, due to the more porous structure of the recycled aggregates. When compared to the reference concrete, the recycled concrete mix gives 15% less strength

C. Flexural Strength

From the observed results it is found that the flexural strength up to 20% of fine aggregate replaced by recycled aggregate give strength closer to the strength of reference concrete and strength reduction of 20.7% for recycled concrete mix containing 50% replacement. The reduction in flexural strength would be attributed to the weaker bond among different components of the concrete matrix owing to the cement paste on the surface of recycled aggregates.

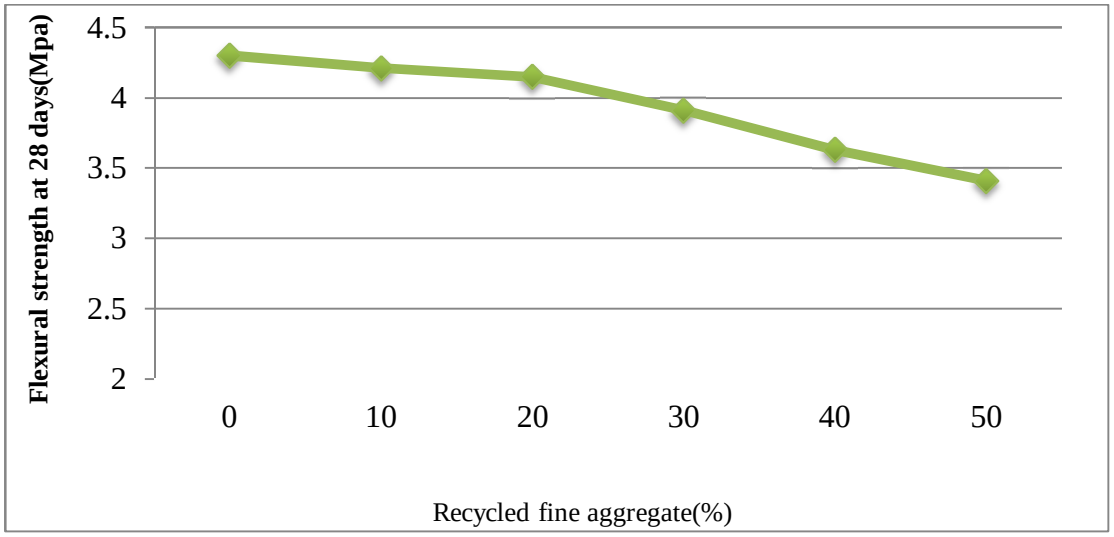


Fig. 5 Flexural strength of concrete

IV. CONCLUSIONS

Recycled aggregate concrete is found to be 42% greater water absorption than that of natural aggregate.

The initial slump of recycled aggregate concrete was marginally affected by the higher water absorption of recycled fine aggregate.

Beyond 30% replacement levels of concrete containing recycled fine aggregate shows 20-40% lower compressive strength is developed at the ages of 7, 28 and56 days.

Both tensile splitting and flexural strength are slightly decreased with the increase of the replacement ratio. The reduction in strength is 15% and 20% when compared to the reference concrete.

V. SCOPE FOR FURTHER STUDY

Studies on improving the performance on the effect of RFA may be carried out.

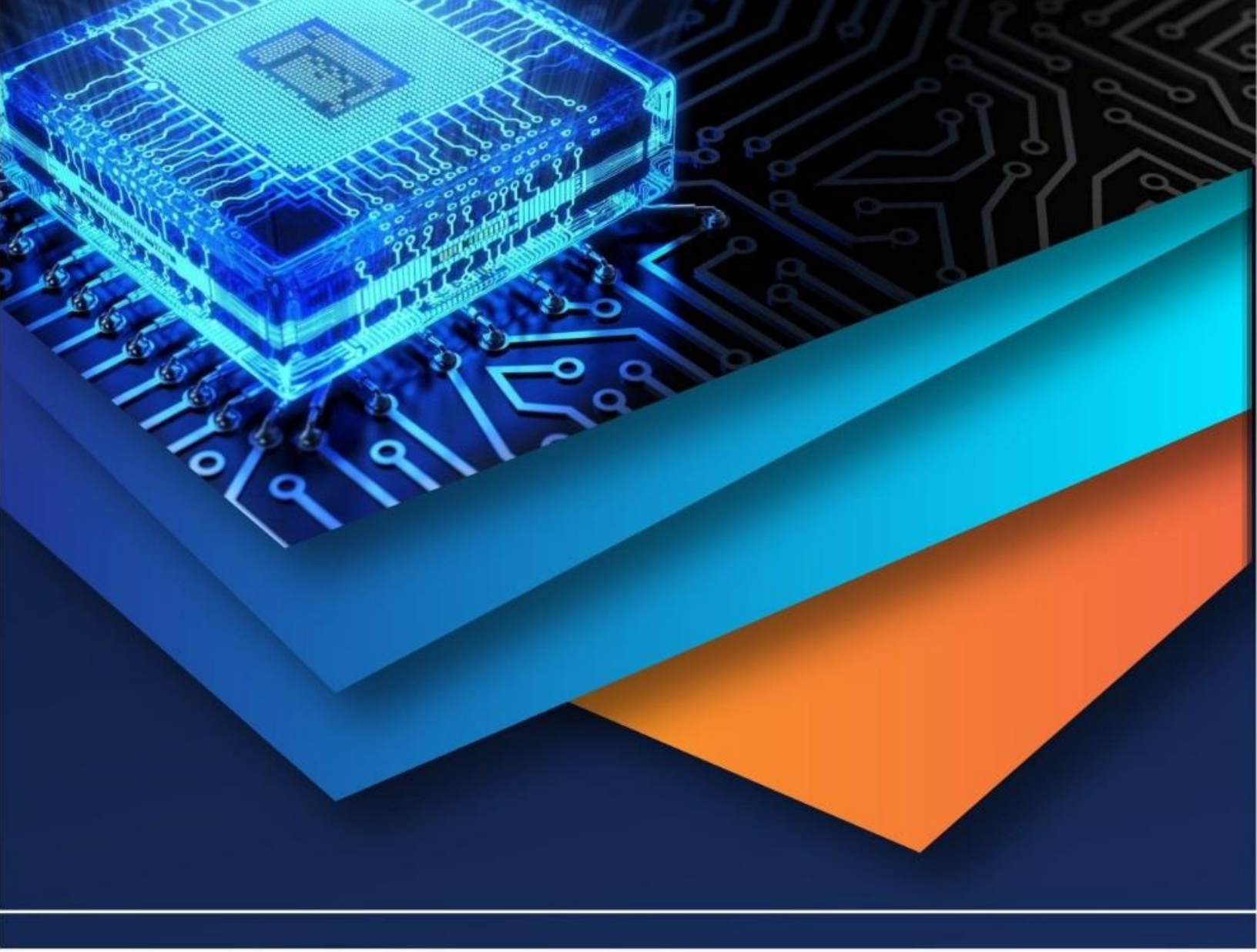
Use of RFA in making high performance concrete may be carried out.

The strength and performance studies on RFA with high volume replacement may be carried out.

REFERENCES

[1] Yang, K.H., H.S.Chung, and Ashraf F.Ashour(2008) Influence of type and
[2] replacement level of recycled aggregate on concrete properties. ACI Materials Journal, 105(3), May-June, 289-296L. Evangelista a, J. de Brito. Mechanical behaviour of concrete made with fine recycled concrete aggregates. Cement & Concrete Composites 29 (2007) 397–401
[3] S. T. Lee, H. Y. Moon, R. N. Swamy, S. S. Kim, and J. P. Kim. Sulfate Attack of Mortars Containing Recycled Fine Aggregates. ACI Materials Journal, V. 102, No. 4, July-August 200
[4] Valeria Corinaldesi *, Giacomo Moriconi. Influence of mineral additions on the performance of 100% recycled aggregate concrete. Construction and Building Materials 23 (2009) 2869–2876
[5] Mohd Monish1, Vikas Srivastava1, V. C. Agarwal1 and Rakesh Kumar2.Utilization of demolished waste as fine aggregate in Concrete. Journal of Academic and Industrial Research. Vol. 1(7) December 2012
[6] Khatib JM. Properties of concrete incorporating fine recycled aggregate. Cement & Concrete Composites Research 2005;35(4):763–9.
[7] Katz A. Properties of concrete made with recycled aggregate from partially hydrated old concrete. Cement & Concrete Composites Research 2003;33:703–11
[8] de Brito J, Pereira AS, Correia JR. Mechanical behaviour of nonstructural concrete made with recycled ceramic aggregates. Cement & Concrete Composites 2005;27:429–33
[9] Diogo Silva1; Filipe Gameiro2; and Jorge de Brito3. Mechanical Properties of Structural Concrete Containing Fine Aggregates from Waste Generated by the Marble Quarrying Industry. American Society of Civil Engineers 2014

[10] Nobuaki Otsuki, M.ASCE1; Shin-ichi Miyazato2; and Wanchai Yodsudjai3 .Influence of Recycled Aggregate on Interfacial Transition Zone, Strength, Chloride Penetration and Carbonation of Concrete. 10.1061/~ American Society of Civil Engineers!0899-1561~2003!15:5~443!
[11] J. Silva1; J. de Brito2; and R. Veiga3. Recycled Red-Clay Ceramic Construction and Demolition Waste for Mortars Production. 10.1061/ American Society of Civil Engineers 0899-1561201022:3236
[12] Adel Gorjinia Khoshkenari a, Payam Shafigh b,Mahmoud Moghimi c, Hilmi Bin Mahmudb.The role of 0–2 mm fine recycled concrete aggregate on the compressive and splitting tensile strengths of recycled concrete aggregate concrete. Materials and Design 64 (2014) 345–354
[13] S. Manzi , C. Mazzotti, M.C. Bignozzi .Short and long-term behavior of structural concrete with recycled concrete aggregate. Cement & Concrete Composites 37 (2013) 312–318



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