International Journal of Innovative Research in Engineering
Volume 4, Issue 2 (March-April 2023), PP: 629-631.
www.theijire.com ***ISSN No: 2582-8746***

Utilization of Ceramic Tiles Wastes as Course Aggregate

Dr.M.Gunasekaran[1], D.Sanjay Kumaran[2], M.Saravanan[3]
[1]*Professor, Dept. of Civil, K.S.R. College of Engineering, Tiruchengode, Tamilnadu, India.*
[2,3] *UG Students, Dept. of Civil, K.S.R. College of Engineering, Tiruchengode, Tamilnadu, India.*

How to cite this paper:
Dr.M.Gunasekaran[1], D.Sanjay Kumaran[2], M.saravanan[3], "Utilization of Ceramic Tiles Wastes as Course Aggregate", IJIRE-V4I02-629-631.

Abstract: *Large tons of broken ceramic tiles change into wastage, these waste materials are not reusable and recyclable due to their physical and chemical structure. Reuse of waste tiles in the construction sector helps to reduce the over quarrying of aggregate and also helps in proper management of waste in urban areas. In this study the physical characteristics of ceramic tile aggregate are measured. They are used inconcrete as the substitute for coarse aggregates with 25%, 50% and 75% substitution. All other materials (cement, sand, coarse aggregate) of the same properties are used for each sample. This experimental study found that the waste ceramic tile aggregate has permissible flakiness index, elongation index, fineness modulus, impact value. Compressive strengths observed are good in most of the composition. This study finds that the use of waste ceramics tile could be the better solution for ceramics waste management. Also for increase in concrete quality 15 to 25 percent addition of ceramic tile aggregate could have been done.*
Key Word: *Aggregate, Ceramic Tile, Concrete, Recycling, Solid Waste.*

I.INTRODUCTION

Concrete is one of the key construction materials worldwide. Large amount of concrete is being used in the construction industry. Use of concrete implies use of cement, fines and coarse aggregate as well. Aggregate is a key ingredient in terms of strength and volume in concrete. Aggregate is a non-renewable natural resource. The resources in our country are being overexploited and the natural stock is decreasing at an alarming rate. Use of waste tile aggregate as replacement for coarse aggregate helps to reduce overexploitation as well as manage the waste. The amount of tile waste on earth is enough for use as an aggregate in concrete. Tile is produced from natural materials sintered at high temperatures. There are no harmful chemicals in the tile. Waste tiles cause only the appearance of pollution. However, some parts of tiles are used in cotto as flooring and also flooring in tennis courts, walkways, cycling paths and gardens as a ground material. Therefore, waste tiles are stored in factory fields because of their economic value. These waste materials can be recycled to save money. Crushed tile aggregate is a material especially proposed for the buildings constructed in hot climates. The unit weight of concrete is decreased with use of the CTA compared to the control concrete [1]. Rapid industrial development causes serious problems all over the world such as depletion of natural aggregates and creates enormous amounts of waste material from construction and demolition activities. One of the ways to reduce this problem is to utilize the waste. A large quantity of wastes produced annually in all countries, in particular construction and demolition waste contribute the highest percentage of wastes worldwide about 75%. Furthermore, ceramic materials contribute the highest percentage of wastes within the construction and demolition wastes about 54% [2]. Ceramic waste can be transformed into useful coarse aggregate. The properties of ceramic waste coarse aggregate are well within the range of the values of concrete making aggregates. The properties of ceramic waste coarse aggregate concrete are not significantly different from those of conventional concrete. The use of ceramic waste coarse aggregate concrete has increased because it has various advantages over other cementation materials [3]. It has been estimated that about 30% of the daily production in the ceramic industry goes to waste. This waste is not recycled in any form at present. However, the ceramic waste is durable, hard and highly resistant to biological, chemical and physical degradation forces. As the ceramic waste is piling up every day, there is pressure on the ceramic industries to find a solution for its disposal. Meanwhile, conventional crushed stone aggregate reserves are depleting fast, particularly in some desert regions of the world. Use of inorganic industrial residual products in making concrete will lead to sustainable concrete design and greener environment (Senthamarai and Manoharan, 2005). Recycling and reusing aggregate from demolished buildings is not a new concept in several countries. Usage of crushing waste aggregate for a number of years. However, the produced aggregate has been mainly limited to such a low level by using it as pipe bedding, site fill, sub base, or as a capping layer [4]. So, recycled waste ceramic tile from buildings also can be used as various forms of aggregate.

II.MATERIALS AND PROPERTIES

2.1. Cement

Cement is a fine powder, which when mixed with water and allowed to set and harden, is capable of uniting fragments or masses of solid matter together to produce a mechanically strong material. The most commonly used cement is Ordinary Portland cement of 53 grade. In our cement sample we found 55 min for initial setting time and 325 min for final setting time. This is between 30 min and 600 minutes.

2.2. Fine Aggregate

Concrete's primary component, aggregate, gives the material volume. Since it is chemically inert, it gives concrete strength and longevity. M-sand that passes through a 4.75mm screen is used as a fine aggregate. The parameters of fine aggregates tested.

2.3. Coarse Aggregate

As coarse aggregate, natural crushed stone with a 20mm minimum particle size was employed. The testresults for the coarse aggregates' characteristics are displayed.

2.4. Water

Generally speaking, water fit for drinking can be used to mix concrete. Water impurities may influence the concrete's strength, shrinkage, and setting time as well as encourage reinforcement corrosion. Hence, the task was done with drinking water that was locally accessible and filtered.

III.DESIGN MIX METHODOLOGY

3.1. Mix Design

The test samples were created with a mixed M20 grade that adhered to IS 10262:2009. In this experimental study, weight batching and mechanical mixing are used. Table 6 displays the weight of their materials as well as the percentage of FA and PVA fiber added in place of standard cement.

3.2. Compressive strength test

The most frequent test on concrete is the compressive strength test because it is a measure of the desirable characteristics of concrete that are quantitatively connected to its compressive strength. Compressive Testing Machine (CTM) with a 2000 kN capacity was used to measure compressive strength. Concrete's compressive strength was evaluated using cube specimens of 150 mm by 150 mm by 150 mm. The test was conducted by sandwiching a specimen between a CTM's loading surfaces, then applying load until the specimen broke. For each proportion, three test specimens were cast, and the compressive strength was measured under each set of test conditions. The average value was taken into account. Below are three specimens' average compressive strengths at ages 7, 14, and 28 days for each category.

3.2.1. Results and Discussions

Replacement of Coarse Aggregate as Tile Wastes In Kg

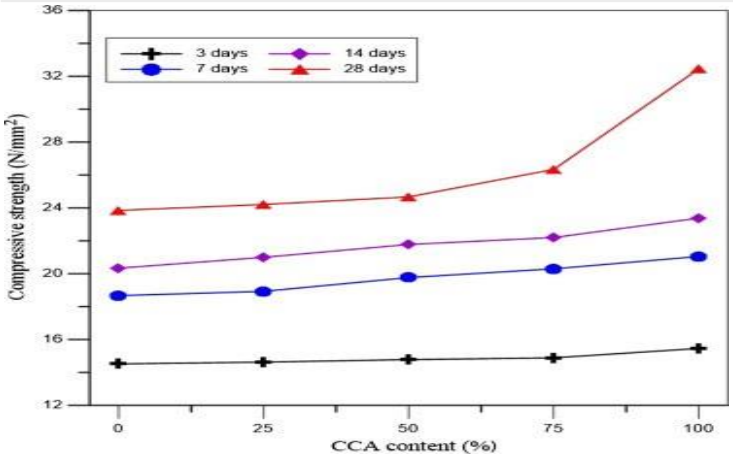
% OF CUBE	COURSE AGGREGATE IN KG	CERAMIC WASTE TILES INKG	TOTAL MIX
25 %	10.25	3.5	13.75
50 %	6.875	6.875	13.75
75 %	3.5	10.25	13.75

Seven Days Density and Compressive Strength Of Cube

Mix	Density (gm/cc)	Strength (Mpa)
25 % CTA	2.55	24.22
50 % CTA	2.49	23.26
75 % CTA	2.40	20.04

Twenty-Eight Days Density and Compressive Strength of Cube

Mix	Density (gm/cc)	Strength (Mpa)
25 % CTA	2.72	32.00
50 % CTA	2.65	31.78
75 % CTA	2.60	30.11



IV.SUMMARY AND CONCLUSION

1. Gradation (sieve analysis) of 20 mm down waste ceramic tile aggregate can be obtained within a permissible value as per IS 383, when tiles are crushed with manual hammering method.
2. 20 mm down tile crushed aggregate has better flakiness and elongation index than natural crushed aggregate.
3. Ceramic tile aggregate has lower specific gravity, higher water absorption ratio than that of natural aggregate.
4. There is no significant difference obtained on impact value of tile and natural aggregate.
5. Up to 30% replacement of natural aggregate by tile aggregate shows better 7 and 28 days compressive strength than that of 0% tile aggregate.
6. With addition of tile aggregate, split tensile strength was increased.

Reference

1. *Rawaid Khan, Abdul Jabbara, Irshad Ahmada,Wajid Khana, Akhtar Naeem Hana, Jahangir Mirza Reduction in environmental problems using rice-husk ash in concrete,Construction and Building Materials, Vol.30, pg 360365, 2012.*
2. *C.B. Echeta,E.E. Ikponmwosa and A.O. Fadipe Effect of partial replacement of granite with washed gravel on the characteristic strength and workability of concrete. ARPN Journal of Engineering and Applied Sciences*
3. *K. A. Mujh Edu, I. O. Lamidi and D. O. Ayelabola, An Investigation on the Suitability of the Broken Tiles as Coarse Aggregates in Concrete Production. The International Journal Of Engineering and Science(IJES), Vol. 3*
4. *Hemanth Kumar Ch1, Ananda Ramakrishna K, Sateesh Babu K, Guravaiah T, Naveen N and Jani Sk (2015)*
5. *International Advanced Research Journal of Science, Engineering and Technology, Vol. 2,Issue 6, pp.13-16, June 2015.*