

# Experimental Analysis on Replacement of Aggregate by Broken Ceramic Tiles in Concrete

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## ABSTRACT

### Article Info

May-June-2022

### Publication Issue :

Volume 6, Issue 3

Page Number : 272-278

### Article History

Accepted : 10 June 2022

Published : 20 June 2022

According to the introduction attempts this examination focuses on the waste clay tile total as incomplete coarse totals swap for the solid creation, the neutralizing activity of environmental pollution with considering the segments of sensible and cost-saving advancement adventures, especially material usage. In addition, huge numbers of the development enterprises in India create development squander that contributes to a great extent to strong waste. Use earthenware tile squander, this examination will concentrate on artistic squanders get from the development business in India. By and by a significant part of the fired ventures creation goes to squander, which isn't experiencing the reusing procedure yet. In our work, total 30 cubes and 10 beams were cast with five different proportions. Ceramic waste as partial replacement of coarse aggregates with the percentage of 0%, 10%, 20%, 30% and 40% of ceramic aggregates as partial replacement of coarse aggregates with M-25 grade of concrete. Besides this, all other parameters are constant. The concrete cube and beams were tested as destructive test at last which is compressive test, that to find out compressive strength and flexural strength of specimens of hardened concrete at 7 and 28 days. From the aftereffects of the examination, tests of the solid with 0 to 40% fired coarse total substitution have achieved ideal quality. Discovering Showed that solid tile 0 to 30% demonstrated the higher measure of compressive quality, flexural quality of cement and decrement at 40% contain earthenware tile.

**Keywords :** Ceramic Waste, Concrete, Mix Design, Compressive Strength, Aggregate, Flexural Strength.

## I. INTRODUCTION

Concrete is a most adaptable development material since it is proposed to withstand the unsafe circumstances, with palatable quality and toughness.

Because of overutilization of the solid, material breezes up evidently startled, and besides, the age at greater rate make various risky to the earth. On inverse side, the waste displayed to our condition is an impact to natural cycle, among all mechanical

waste, is the noteworthy wellspring of waste which will impact the earth.

Bond and total, which are the most essential constituents utilized in solid generation, are the fundamental materials required for the development business. This unquestionably affected a steady and broadening energy of regular materials utilized for their generation. Parallel to the need for the usage of the common assets develops a making worry for ensuring the earth and a need to save regular assets, for, for example, total, by utilizing elective materials that are either reused or disposed of as a waste.

Artistic waste is open from immense earthenware mechanical offices, fired thing delivering units and from standard advancement works out. Standard pottery, for instance, squares, housetop and floor tiles, other advancement materials, and particular earthenware production, for instance, porcelain are typically exceptionally heterogeneous in light of the wide compositional extent of the basic mud's used as unrefined materials. Around 300 kg of squanders from an Indian fired association (RAK Ceramics Pvt. Ltd., Chennai) beat broken tiles to make the earthenware total. Thusly, by using this structure to pound clay squanders is possible to obtain coarse totals, fine totals and earthenware powder that ensuing to sieving (IS mm strainer) can be used without additional work and with immaterial cost recommendations.



**Figure 1.** Ceramic Industry Tile Waste

## II. LITERATURE SURVEY

In India the Ceramic Tile Industry estimated worth is Rs.21,000 Crore and was represented, the Indian Ceramic Tiles industry created by around 11% out of 2013-14 and foreseen that would accomplish a size of Rs.301 billion by 2016. As in a present report of Global Ceramic Tiles Market of February 2016, the overall fired tiles market will create at a CAGR (Compound Annual Growth Rate) of 9.59% in the midst of the season of 2016-2020. Extensively India is situated third and spoke to over 6% of total overall age. Without a doubt, even with a colossal advancement in the earthenware creation, there is an inappropriate use. In this manner happening to an immense wastage which is represented to be around 15%-30% yearly, made from the total age.

**Shaik Akhil Mastan. et. al. (2017)** has examined out that experimental investigation on partial replacement of cement with fly ash and fine aggregate with foundry sand. The principle point of this exploration is to ponder the use of waste ceramic tiles as a fractional replacement of coarse aggregate (20mm) and 10% fly fiery remains as a supplanted of cement in concrete. For every one of the materials physical properties might be done and mechanical properties, for example, compressive strength and split elasticity of concrete were inspected and contrasted and typical concrete. M30 review of concrete was intended to set up the customary blend. The 3D shapes and chambers are resolved at 7 years old and 28 days. Solid shapes for compressive strength as size 15X15X15 cm and chamber for split rigidity as size 15X30 cm were thrown by receiving weight bunching and hand blending. The blend was assigned with different level of waste ceramic tiles, for example, 0%,10%,20%,30%,40% and half to assess different properties. The outcome which

turns out from the examination work demonstrates that the strength created in concrete is expanded, it can be likened to higher strength concrete and it can be effortlessly utilized as development material in development work.

**M. Sekar (2017)** has analyzed that fractional substitution of coarse total by waste fired tile in cement. In this examination, an undertaking has been made to find the fittingness of fired coarse total as a possible substitute for standard total in cement. The solid models were tossed with mix 1:1.65:2.82 and 1:1.56:2.82. Ceramic waste total 15%, 30%, 45% fragmented substitution, the quality of cement. The tests were finished after 7 days and 28 days of the tossing solid model. The artistic business is known to make a great deal of calcined-earth squanders each year. So far a monster part is used as a piece of landfills. Reusing these misfortunes in cement could be an inside situation. So we lean toward earthenware waste to grow the quality and soundness of cement

**Ofonime A. Harry and Ifiok E. Ekop (2016)** has taken a gander at that the compressive quality characteristics of tile squander concrete. This paper shows the delayed consequences of an examination concerning the compressive quality properties of cement made with clay tile squander as coarse totals. The dimension of tile squander vacillates in endeavors of 25% from 0 to 100%. For each thought to be dimension of tile squanders, three (3) set of solid squares were tossed each for 7, 14 and 28 days relieving age which realized a total of 45 3D squares. The test result showed that the compressive quality declines as the dimension of tile squanders increases. The 28th-day compressive quality for 25% and 100% substitution were 23.93N/mm<sup>2</sup> and 21.43N/mm<sup>2</sup> independently which is attractive for fundamental lightweight cement. The specific gravity of tile squander was

seen to be 2.27 which is commensurate to the specific gravity of standard total. Droop test moreover shown that usefulness of solid decreases with growing tile squander content.

**Abdullah Anwar, et. al. (2015)** has explored that re-procedure of ceramic waste for the intensification of eco-productive concrete. In the ceramic industry, almost 15%- 30% creation goes as waste. The replacement of cement with Ceramic Waste Powder (CWP) produces a significant alteration in compressive strength, making them reasonable for the creation of eco-proficient concrete. In this examination think about the (OPC) cement has been supplanted by CWP as needs be in the compass of 0%, 15%, 20%, 25%, 30% and 35% by weight of M-20 review concrete. Concrete blends were tried at 03 days, 07 days and 28 days and thought about as far as compressive strength of the ordinary concrete at 28 days. The point of this exploration is to think about the conduct of concrete sturdiness in correlation by halfway replacement of cement with Ceramic Waste Powder, coming about to coefficient concrete

**Suresh. S and Monika. N. R (2016)** has played out that mechanical properties of concrete with the partial replacement of fine aggregate as foundry sand and coarse aggregate as ceramic tiles. To fulfill the exploration an exploratory program was led in which ten concrete blends were thrown, by keeping every single other parameter for concrete proportioning as steady and just change made were in the measure of fine aggregates and coarse aggregates. Ten, Twenty and 30% replacement level of waterway sand by utilized foundry sands and coarse aggregate by ceramic tiles were kept up with M25 review in this investigation. All aggregates were chosen subsequent to accomplish wanted physical and synthetic tests. Workability,

compressive strength and modulus of flexibility were measured and contrasted and the regular concrete named as control blend. It was watched that workability expanded with replacement levels. Concrete was delivered, tried and contrasted and ordinary concrete in a plastic state and additionally in solidify state for workability, compressive strength and split elasticity. These tests were completed on the standard 3D square, a chamber for 7, 14 and 28 days to decide the properties of concrete.

**Batriti Monhun R. Marwein, et. al. (2016)** has performed about an audit paper on the use of ceramic waste in concrete. This investigation points in accomplishing a worthy normal strength concrete with ceramic waste as a substitute of traditional coarse aggregates. The ceramic waste to be embraced is broken tiles from nearby shops. Ceramic waste concrete (CWC) will be made with these tiles at 0%, 15%, 20%, 25% and 30%. M 20 review concrete will be received; a consistent water cement proportion of 0.48 will be kept up for all the concrete blends. The attributes properties of concrete, for example, workability for crisp concrete, likewise Compressive Strength, Split Tensile Strength and Modulus of Elasticity for solidified concrete will be discovered in this examination at 3, 7 and 28 days for every level of replacement. 3 quantities of examples for every rate replacement will be thrown and tried with the relating tests lastly contrasted and consistent M20 review concrete. The ideal level of ceramic waste replacement ought to be between 5 to 30% with a specific end goal to acquire most extreme strength of the concrete. An ideal ceramic waste must be discovered which will be reasonable to be utilized as a substitute for traditional coarse aggregate. Research ought to be made with normal concrete like M15 and M20 as this sort of concrete

just is usually embraced, after which research can be conveyed with high strength concrete.

### Scope of Study

The industrial waste contains many inorganic and toxic substances beyond the acceptable limit cause impact to living life. To overcome these issues these industrial waste can be recycled and reused for any useful purpose with acceptance levels.

Clay industry squander is the main modern waste gotten in different structures like artistic powder, broken tiles, slurry squander and so forth., which is arranged to landfill make contamination at bigger rate. In this undertaking work, clay squander tiles are gathered and broken into 10mm tiles for fractional supplanting with coarse total. These replacements will reduce the cost of the project at greater percentage because aggregates are more costly than cement for concrete production.

### Aim of Study

This study was conducted to achieve the following objectives:

- To consider the quality improvements solidified cement with waste earthenware coarse total.
- To supplant the coarse totals with different rate 0%, 10%, 20% , 30% and 40% of fired waste in M25 concrete.
- To decide the impact of different level of clay squander as fractional coarse totals substitution towards compressive, split ductile, flexural quality of cement.
- To decide the water ingestion of fired total cement containing different substance of fired tile as halfway coarse totals substitution material.

- To ponder the impact of compressive, split malleable, flexural quality trademark properties of clay squander in cement.
- To establish a comparative study between aggregate 10 mm and ceramic tiles replacing aggregate 10 mm.

### III. METHODS AND MATERIAL

1. To prepare of M25 concrete grade and obtain its fresh and hardened properties.
2. To prepare ceramic tile aggregate of M25 grade study their fresh and hardened properties.
3. To analyze the different type of load behavior of M-25 concrete.



Figure 2 : Preparation of Samples

### IV. ANALYSIS RESULTS

#### Compressive strength of Cube

Table 1: Compressive Strength of Concrete Cubes

Days/% of replacement	0 %	1 %	2 %	3 %	4 %	Remark
7 day	25.9 12	25.8 25	25.0 38	23.9 4	22.5 57	Average
28 days	32.8	32.7		31.5	30.9	.

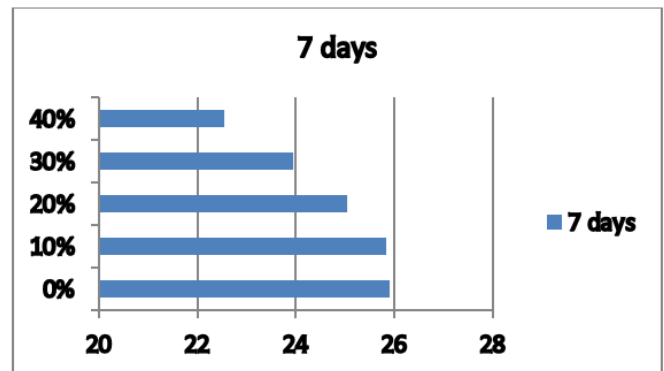


Figure 3. Flow Chart Compressive strength 7 days

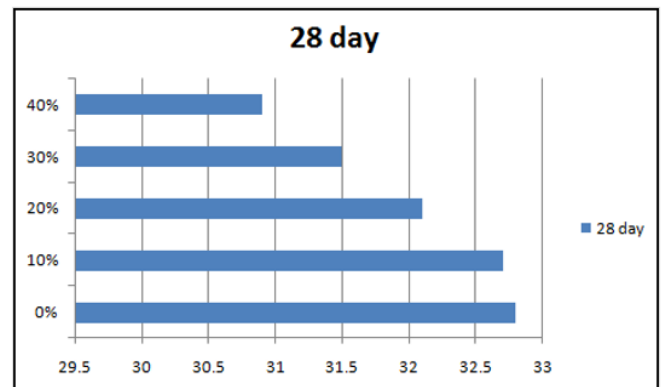


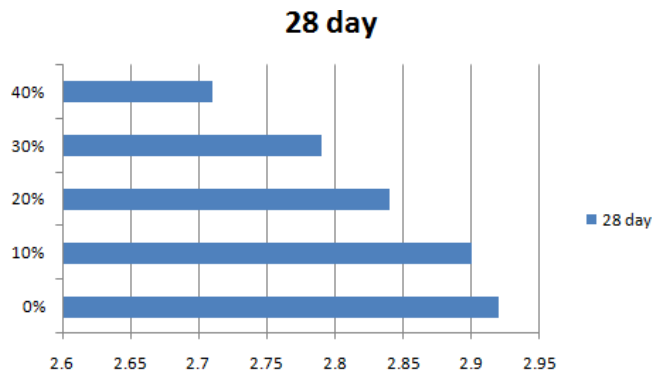
Figure 4. Flow Chart Compressive strength 28 days

#### Flexural strength of beam concrete

The results are determined from the universal testing machine. Concrete contains ceramic waste crushed tile aggregate with the replacement of coarse aggregate.

**Table 2** Flexural strength of Beam

Flexure Strength in Div. contain ceramic waste crushed tile aggregate					
Day's	0	10	20	30	40
28	2.92	2.90	2.84	2.79	2.71



**Figure 5.** Flow Chart Flexural Strength of M25

From the above table is seen that the flexural strength in the M25 grade of concrete at 28 days flexural strength is incremented when the 0%,10%, 20%, 30% and decrement 40% of the level of the ceramic waste crushed tile aggregate with the replacement of fine aggregate increments with the age of 28days.

### VI. CONCLUSION

Following are the following conclusions of the study:-

- In this exploratory examination, we have used ceramic tile aggregate as incomplete substitution of 10 mm aggregate as an option material of concrete for M25 review of concrete and from different tests on concrete cubes and beam. we have closed after outcomes.
- Droop shows that the usefulness decrements with the augmentation in the rates of containing aesthetic waste broken tile total

with the level of 10% to 40%.All examined containing let go squander pummeled tile total blends had stature droop respects and exemplary functionality at M25 review of cement.

- The result of CTM of M25 grade of a concrete cube having ceramic waste crushed tile aggregate s partial replacement of fine aggregate with the percentage of 0%,10%, 20%, 30% and 40% with the age of 7, and 28 days for concrete cubes and 28 days for beam.
- We can see that the flexure quality in M25 review of cement at 28 days, flexural quality are higher than when dimension of utilization of 10%, 20%, 30% and bring down dimension at 40% of the ended waste pulverized tile total with the replacing of fine total increments with the age of 28 days.
- We observed that gradient of 10 mm aggregate sample with ceramic tile sample shows that our experimental results are in its specific limits as per I.S. code.

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**Cite this article as :**

Abhishek Kumar Vishwakarma, Afzal Khan, "Experimental Analysis on Replacement of Aggregate by Broken Ceramic Tiles in Concrete A REVIEW", International Journal of Scientific Research in Civil Engineering (IJSRCE), ISSN : 2456-6667, Volume 6 Issue 3, pp. 272-278, May-June 2022.  
URL : <https://ijsrce.com/IJSRCE226326>