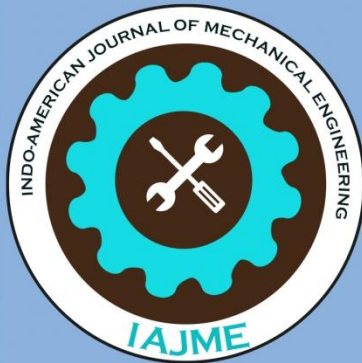




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PARTIAL REPLACEMENT OF AGGREGATE WITH CERAMIC TILE IN CONCRETE

Department of Civil Engineering, Kashi University, Talwandi , Bathinda, Punjab, India

Dr. Varinder (Dean G.G.S.E.T)

Department of Civil Engineering, Faculty of Civil Engineering, Guru Kashi University, Talwandi Sabo, Bathinda, Punjab, India

ABSTRACT

As a result of daily advancements and alterations in the development sector, the consumption of normal totals has expanded considerably, but so has the manufacture of powerful squanders from advancement destructions. In order to lessen strong waste and the scarcity of common totals for concrete manufacture, the reuse of damaged constructional squanders such as clay tile and rock powder was developed. The assembling unit, as well as the destruction of structures, contribute to the waste of artistic tiles. Approximately 20-30% of the material utilised in tile manufacturing companies is lost, according to surveys. To manage the limited resource of natural total and reduce development waste, this waste material must be utilised. Pounded squander earthenware tiles, squashed waste artistic tile powder, and Granite powder are used to replace the coarse and fine totals. Instead of coarse totals, the creative waste pulverised tiles were partly superseded by ten percent, twenty percent, thirty percent, forty percent, and half. By 10%, rock powder and earthenware tile powder were substituted for fine total, together with earthenware coarse tile. The M25 cement review was organised and put to the test. The blend plan for several sorts of blends was constructed by substituting shattered tiles and rock powder at different rates for the coarse and fine totals. After 7, 14, and 28 days of relieving period, tests such as usefulness, compressive quality test, split elasticity test, and flexural quality test were performed on many cement mixes with varying rates of waste crushed, as well as stone powder. The functionality of stone powder and pounded tiles has been seen to grow as the stage of substitution develops. As the overall amount of earthenware coarse tile grows by up to 30%, the cement quality also improves.

Keywords : Ceramic tile aggregate, compressive strength, flexural strength, granite powder, split tensile strength

. INTRODUCTION

Water, aggregate, and cement are the three primary components of concrete. The right

physical qualities for the completed product can be attained by inserting admixtures and extra reinforcements into the concrete mix. By combining these elements in a certain ratio, a solid mass that can be easily moulded into a desired shape is created. More A hard compound material created by cement links the remaining ingredients together over time to form a unique hardcore (stiff) durable material that can be utilised for constructions, road pavements, and other applications. Early on, the ancient Romans accepted the high-tech technology of using concrete, and it became the most extensively used feature of concrete technology throughout the Roman Empire. The pantheon's dome is the world's largest unreinforced concrete structure, while the colosseum in Rome was mostly composed of concrete. As the usage of concrete became less popular after the fall of the Roman Empire in the mid-eighteenth century, technology was upgraded. In terms of tonnage, concrete is the most frequently used man-made substance today. Furthermore, despite the fact that high-strength concrete is a relatively new material, its use has skyrocketed in recent years. In the United States in 1950, concrete with a compressive strength of 34 MPa was referred to as high strength concrete. In the 1960s, concrete with compressive strengths of 41 to 52 MPa was commercially processed. In the last 15 years, concrete with exorbitantly high strength has joined the building line of sky-high skyscrapers and long-span bridges. For usage in pre-stressed concrete members and cast-in-place constructions, IS 456-2000 considers compressive strength more than 110 MPa. Reactive concrete with a compressive strength of roughly 250 MPa is presently the best

option in terms of a solution. To treat it completely, pozzolonic medicines are employed. The first difference between high-strength and nominal-strength concrete is the ultimate resistance covered by the concrete sample's compressive strength for any load application. Despite the lack of a clear differentiation between high- and normal-strength concrete, the Yankee Concrete Institute defines high-strength concrete as having a compressive strength greater than 42 MPa.

MATERIALS USED

Cement

Ordinary portland cement is OPC 43. All cement tests were carried out in compliance with the IS 8112-2013 Indian standard code.

Fine aggregates

The sand utilised in this study had a particle size of less than 2.75mm, as determined by sieve analysis. As well as all other criteria specified in IS:383-1970.

Coarse aggregates

The coarse aggregates used were locally available coarse aggregates with a size of less than 20mm. All specifications are in accordance with IS:383-1970.

Water

For mixing, ordinary drinking water was utilised.

Ceremic Tile Aggregate:

3. 3. Crushed tiles were collected from the solid waste of a ceramic manufacturing plant or from a demolished

structure. Hand-operations and machinery were used to break the discarded tiles into little pieces. The required size of crushed tile aggregate was not dependent on whether or not they could be used as a partial substitute for natural coarse aggregate. The tile waste with a maximum dimension of 4.75 mm was disregarded. The shattered tile aggregate is used after passing through a 16.5mm filter and being retained on a 12mm screen. In conjunction with the coarse aggregate replacement, the aggregate that passes through the 4.75mm filter is used as a 10% partial replacement for fine aggregate.

4. TEST PERFORMED

Slump Test

Every sample was subjected to a slump test to ensure that the concrete was workable. In India, the slump value was determined using the techniques outlined in IS: 1199 – 1959.

Compaction Factor Test

The compaction factor test resulted in a comparable mix that was drop cone tested for utility.

Compressive Strength

After 7 days, 14 days, and 28 days, concrete cubes of size 150x150mm were tested for compressive strength. IS:516-1959 specifies the requirements.

3.4 Split tensile strength

According to IS:5816-1999, split tensile strength tests were done on a concrete cylinder with a diameter of 150mm and a length of 300mm. After 7 days, 14 days, and 28 days, the procedure was repeated.

3.5.Flexural Strength Test

Make the concrete in the required ratio and prepare the sample by placing it in the proper mould shape of 10x10x50cm prism with full compaction, then placing it in water for 24 hours to cure.

LITERATURE REVIEW

Because concrete is one of the most important structural components, several studies have been conducted to change its properties using every known technique in order to develop a long-lasting concrete mass. The only way to strengthen concrete is to replace its components with superior technology. Not only does rehabilitation by any particular material benefit the environment, but it also makes waste material more acceptable for construction. Many discoveries have been made in this stream on the use of tile aggregate in concrete, which is a waste material originating either directly from industry or indirectly from the destruction of a structure. These days, research is mostly focused on knowledge related to the usage of tile aggregate in concrete as a coarse aggregate replacement. For tile waste-based concrete, coarse aggregates were reduced by 20mm, tile wastes by 0%, 5%, 10%, 15%, 20%, and 25%, and cement was partially substituted by fly-ash. At a replacement rate of 25%, the average maximum compressive strength of roof tile aggregate concrete is formed. When 25% of the roof tile aggregate is replaced, a 10-15% drop in strength is observed when compared to conventional concrete. Roof tile waste concrete has a medium workability. To summarise, replacing tiles with concrete is ideal for small buildings. Shattered tiles were used as the ceramic waste. 0 percent, 15 percent, 20 percent,

25 percent, and 30 percent ceramic waste concrete built with these tiles. The concrete used is of the M20 grade; For all concrete mixes, a consistent water cement ratio of 0.48 is maintained. At 3, 7, and 28 days, the characteristics of concrete such as workability for fresh concrete, as well as Compressive Strength and Split Tensile Strength, are measured. According to the study, waste tile aggregate should be replaced at a rate of 5-30%, and it is also preferable to standard combinations such as M15 and M20. The amount of tile debris produced is sufficient to use in concrete as a coarse aggregate replacement. The use of ceramic tile waste has a positive impact on the environment as well as cost. The self weight of concrete is reduced by around 4% when tile aggregate is used, making the building

more cost effective. When it comes to concrete

strength, tile aggregate replacement has a negative impact on the compressive and split tensile strengths. However, this study uncovered the most important tile waste alternatives, which may be broken down into small percentages and employed in concrete to produce desirable results.

RESULTS

Compressive strength:

After completing the workability tests, a total of 42 cubes measuring 150 x 150 x 150mm were filled and tested for 7 days and 28 days. The following are the outcomes:

Compressive strength results of M25 grade of concrete for 7, 14 and 28 days

Serial num	Mix Designation	Aggregate Replacements %	Compressive strength of M25 grade in N/mm ²		
		(CCA+CFA+GP)	7 days	14 days	28 days
1	M0	0+0+0	20.57	28.54	33.18
2	M1	10+0+0	24.09	31.39	36.5
3	M1	20+0+0	26.27	32.8	39.5
4	M2	30+0+0	28.05	37.53	43.14

Split Tensile strength:

The split tensile strength achieved by testing the cylindrical sample for M25 grade of concrete to all the mixtures

specified for various replacements are shown below

Split tensile strength results for M25 grade of concrete

Serial num	Mix Designation	Aggregate Replacements %	Split Tensile Strength of M25 grade in N/mm ²
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		(CCA+CFA+GP)	7 days	14 days	28 days
1	M0	0+0+0	1.67	2.18	2.56
2	M1	10+0+0	1.67	2.19	2.61
3	M2	20+0+0	1.69	2.24	2.615
4	M3	30+0+0	1.71	2.26	2.65

5.3 Flexural Strength:

The flexural test was performed for M3 mixture only since it has the highest

compressive strength and split tensile strength to compare it with conventional i.e., M0. A Total of six beams were filled and tested as indicated below:

Serial num	Grade	Mix Code	Flexural Strength in N/mm ²		
			7 days	14 days	28 days
1	M25	M0	7.92	8.98	9.95
2	M25	M3	8.88	9.15	10.28

6.0 CONCLUSION:

The compressive and tensile strength of concrete increased with the replacement of tile aggregate, as evidenced by the aforementioned data. Increases in granite powder, which acts as an admixture because to its chemical makeup, improve workability even further. The quality of concrete improved statically with the addition of ceramic aggregate, reaching a peak of 30% replacement after which it began to deteriorate statically.

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