

Fly Ash Concrete with Waste Tiles Sand

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ABSTRACT: Due to continuously increase in development in construction field, the use of natural material is high and at same time production of waste tile from construction sites and shops is also very high. Because of these reasons the reuse of waste tiles came into picture to reduce solid waste and to reduce the load from natural materials. Crushed waste tiles sand were replacing in place of natural sand by 20%, 40%, 60%, 80% and 100% for M30 grade of concrete and also replacing cementitious material by 20% using fly ash in concrete. Experimental study like Workability Test, Characteristic Strength of Concrete and Durability Test for different concrete mix after 28 days curing period. It is observed that, replacement of waste tile sand to natural sand gives good result for concrete.

KEYWORDS: Waste tiles sand, Natural Sand, Fly ash, Workability Test, Characteristic strength, Durability Test.

I. INTRODUCTION

This present environment is very much dependent on concrete for building various infrastructural activities. Concrete is an integral part of all civil engineering work. The most significant constituents used in construction are the cement sand and aggregate. This leads to an ever-increasing demand for natural materials used for their processing. This rise in demand puts tremendous pressure on civil engineers to build both cost-effective and environmentally sustainable structures.

Sustainable infrastructural growth now requires the alternative content, which must satisfy the technical requirements of fine aggregates, and which should be widely available. Crushed tile sand provides a viable alternative on this basis. Crushed tile sand must meet technical specifications such as workability and concrete strength. Since there is insufficient data on this dimension of concrete with crushed tile sand, the concrete made with crushed tile sand has to be investigated.

The tiles are robust, strong and highly resistant to weather, chemistry, physical and biology. This tile product is perfect for concrete and suitable. This project aims, therefore, to research the use of waste tiles as a replacement for fine concrete aggregates. This will help to improve concrete efficiency, make it cost-effective and solve the waste problem.

II. RELATED WORK

Sunilaa [1] was working on replacing river sand with sand and quarry dust created in cement concrete. Ordinary Portland cement (OPC-43 grade), sandy river, quarry dust, quarry stone were materials used for preparation of concrete. The concrete design was built at the water cement ratio of 0.43 for a ratio of 1:1.23:2.58. River sand has been replaced by 100 and 50% by quarry sand, and compression, tensile and flexural tests have been performed. The findings suggested the substitution by quarry dust and sand of 50% of river sand to obtain concrete strength, which increases the concrete's consistency as well.

Daniyal [2] focused on the use of concrete aggregates of ceramic tile waste. Waste ceramic tiles, grading of the concrete was carried out using natural aggregates, with ceramic tile aggregates compact according to I. Pages 383-1970. Afterwards, the experiment took place with ceramic aggregates according to I. S. 2386 (Second Part) 1960. The aggregate of the ceramic tile is replaced by 0%, 10%, 20%, 40%, and 50% with 0,4, 0,5 and 0,6 sample natural course, and the optimal percentages of the aggregate of the Ceramic tile, as well as the water cement. The results of the test show that concrete with ceramic tile assemblies are workable, solid, compressive and flexural strength satisfactorily achieved.

Usha [3] performed an experimental study on sand replacement in concrete with broken bricks. The stone sand of quarry was used for river sand as an alternative. The use of artificial sand in concrete instead of fluvial sand saves 40% of the cost. The purpose of the experiment was to test the properties of concrete made from crushed stem and to study different important characteristics such as compression strength, tensile strength and bolted concrete strength. The sand with partial replacement of natural sand was used for crushed rocks. Grade M 25 was used to cast cubes, beams and

cylinders of seven, 28 and 56-day curing. The proportion of crushed brick was 15 percent, 20 and 25 percent in concrete.

Manasseh [4] focused on substituting fine granite for river sand. Casting blocks of M35 grade concrete were used and cured for 7 days, 14 days, and 28 days. The tests for compressors and traction show that the concrete made from a crushed granite has a lower physical and mechanical strength and is better than traditional concrete.

Nagraj[6] using concrete mixtures with rock dust as a fine aggregate "investigated which of the aspects of concrete mix proportioning would be affected by the partial and full use of rock dust to replace sand. He found that the rock dust greatly decreases the working power of the concrete but does not impair the compressive strength. He concluded that rock dust with the appropriate use of super plasticizers can be used as a fine aggregate.

The experiments carried out on stone crushing dust were finely agglomerated. Prakash [7] concluded that the concrete cubes with crusher dust had a compression resistance of about 17 percent higher, tensile strength was 7 percent higher, and the bend force was 20 percent higher than those of concrete with riparian powder. According to them, the higher strength can be attributed to the sharp edges of the stone dust providing a stronger bond with cement compared to the rounded shape of the river sand. The reinforced concrete beams with crusher dust held up about 6% more load and produced smaller deflections and strains than the beam with river sand.

III. MATERIAL & MIX DESIGN

The cement is used in Ordinary portland supporting IS: 8112-1989 with a specific gravity of 53 grades 3.15. The fine, natural rough aggregate available locally is used. The Waste Tiles Sand is used in the experimental material produced by crushing tiles collected from the locally nearby buildings and tile shops as shown in Figure 1. Sand was screened and used to measure less than 4.75 mm.

Table 1: Physical Properties of fine Aggregate

<i>Test</i>	Specific Gravity	Water Absorption	Sieve Analysis	Silt Content
<i>Natural Sand</i>	2.54	1.20%	Zone II	1.96%
<i>Waste Tile Sand</i>	2.49	1.62%	Zone II	0.56%



Figure 1: The waste tiles

Mix design carried out for M30 grade concrete by using IS 10262:2009 for following properties of ingredients.

Super Plasticizer	:	15
Cement	:	245 kg
Fly Ash	:	105 kg
Mix Proportion	:	1.0: 2.42: 3.44: 0.45
Slump	:	80 mm
Compressive Strength	:	33.00 MPa

Following table shows the various abrasions used for different mix design of concrete. This norm is as follow:

Table 2: Mix Proportion

<i>Norm</i>	<i>Description of Mix Design</i>
DF1	0% Waste Tile Sand and 100% Natural Sand
DF2	20% Waste Tile Sand and 80% Natural Sand
DF3	40% Waste Tile Sand and 60% Natural Sand
DF4	60% Waste Tile Sand and 40% Natural Sand
DF5	80% Waste Tile Sand and 20% Natural Sand
DF6	100% Waste Tile Sand and 0% Natural Sand

IV. EXPERIMENTAL RESULTS

For Mix DF3 replacement of natural sand to waste tile sand increases the Compressive Strength up to 7.36%, after that it decreases, Tensile Strength up to 26.07%, after that it decreases and Flexural Strength up to 35.89% after that it decreases.

For DF3 (40% replacement of natural sand to waste tile sand) increases the Shear Strength up to 22.89% after that it decreases. For Mix DF3 increases the Impact Strength up to 232.71% after that it decreases. Up to 40% replacement of natural sand to waste tile sand increases the Durability of concrete up to after that it decreases.

Table 3: Fundamental Strength of Concrete Mix

<i>Mix No.</i>	<i>Compressive Strength (MPa)</i>	<i>Tensile Strength (MPa)</i>	<i>Flexural Strength (MPa)</i>
DF1	33.03	2.80	12.26
DF2	34.96	3.07	13.6
DF3	35.55	3.53	16.66
DF4	33.03	3.29	15.14
DF5	31.40	3.02	12.64
DF6	29.77	2.87	10.91

Table 5: Shear Strength, Impact and Durability of Concrete Mix

<i>Mix No.</i>	<i>Shear Strength (MPa)</i>	<i>Impact energy in N-m for</i>		<i>RCPT (mA)</i>
		<i>First Crack</i>	<i>Final Crack</i>	
DF1	11.75	3257.72	3637.4	3838.01
DF2	12.68	5060.01	5505.56	3541.57
DF3	14.44	10838.77	11368.7	3669.42
DF4	14.07	8565.83	8964.42	4623.44
DF5	12.77	7011.03	7425.52	4633.37
DF6	12.03	4521.37	4837.27	4583.6

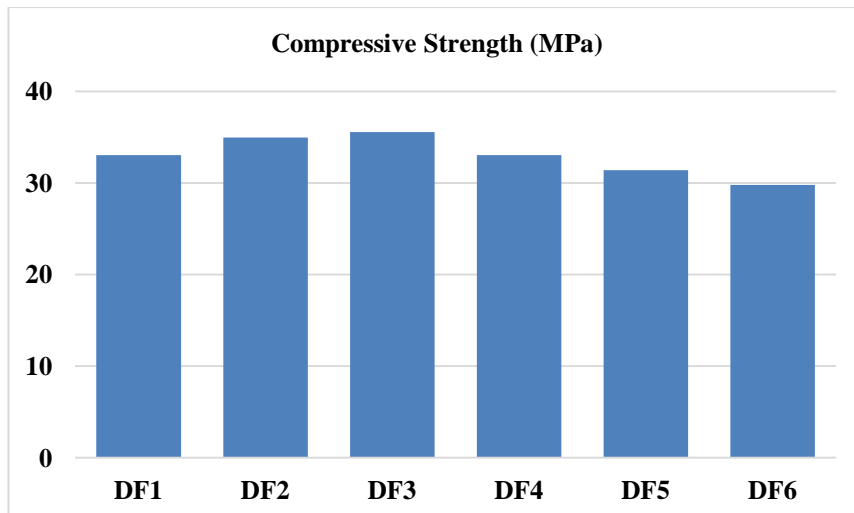


Figure 2: Average 28 Days Compressive Strength

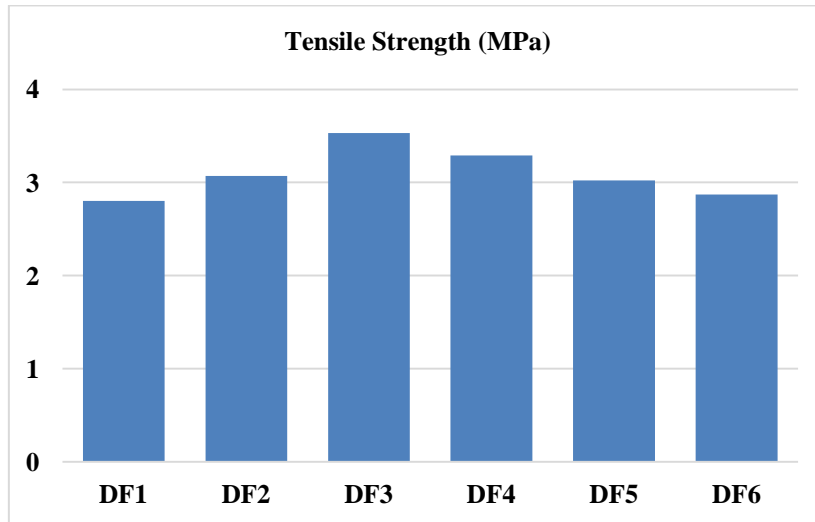


Figure 3: Average 28 Days Tensile Strength

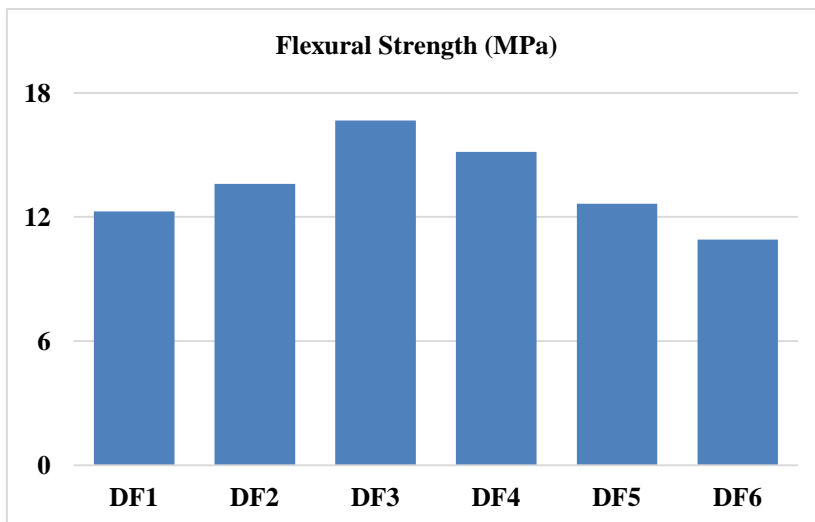


Figure 4: Average 28 Days Flexural Strength

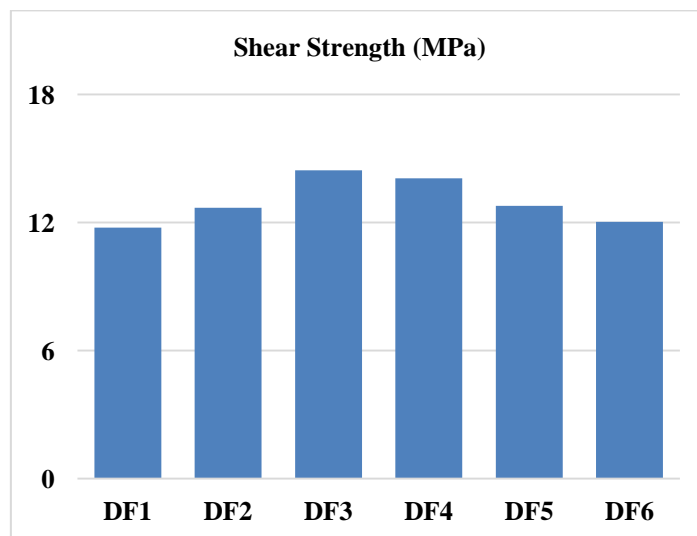


Figure 5: Average 28 Days Shear Strength

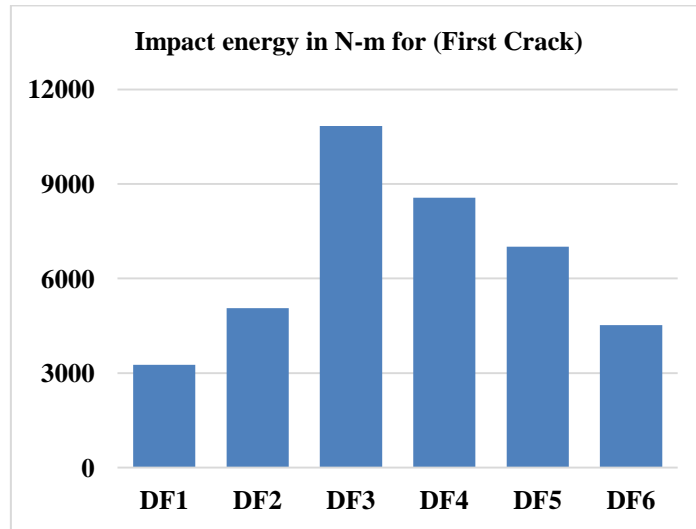


Figure 6: Impact Energy at First Crack

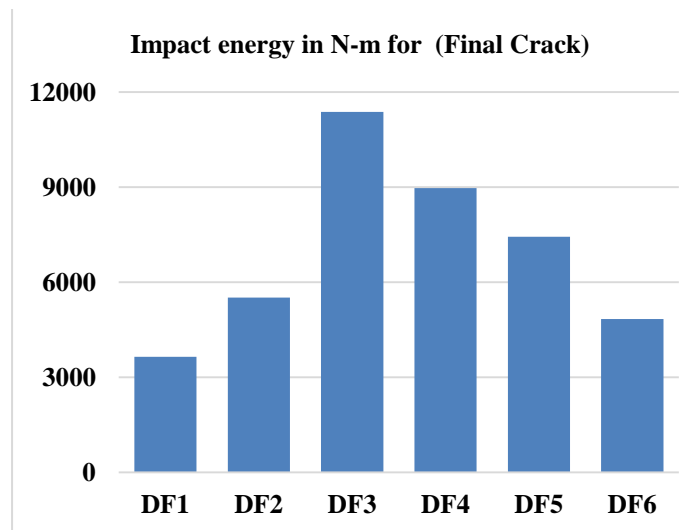


Figure 7: Impact Energy at Final Crack

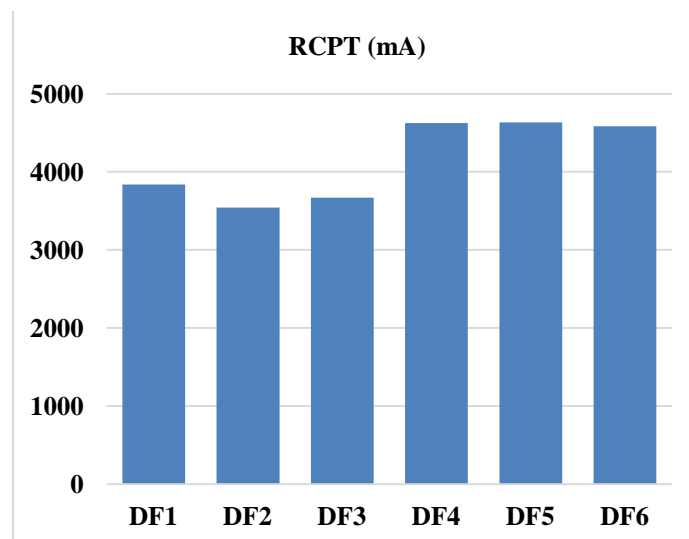


Figure 8: Rapid Chloride Penetration Test



V. CONCLUSION

At 40% natural sand substitution to sand tiles, optimum strength for fly ash concrete is obtained. Waste tile sand has greater longevity as far as natural sand is concerned. This is best to use 100% waste tiles for concrete.

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