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Partial Replacement of Ceramic Powder to the Cement and Check for Sulphate Attack

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Abstract: ***Ceramic waste is one of the most active research areas that surround a number of regulation including civil engineering and construction materials .Modifying huge amount of solid waste into an alternative source will protect the reducing nonrenewable resources of materials. Ceramic waste powder is resolved by sedimentation and discarded away which results in environmental pollution, in addition to forming dust and frightening both public health and agriculture. The use of solid waste material in concrete, which is principal construction material has attracted a lot of studies, mainly those that can replace cement which is a significant contributor of global greenhouse gas emissions. Ceramic tiles industries produce ceramic waste powder during final stage of polishing.***

Ceramic waste powder can cause soil, water and air pollution. Using ceramic waste powder as an alternative material in concrete will have great positive environmental impact. Production of residues from construction sectors an industries has drastically increased in the last few years. Most of the wasteland has been landfilled. The replacement of cement with ceramic waste powder builds a considerable modification in compressive strength and also making them suitable for fabrication of concrete. Ceramic waste powder as the capability to be used as partial replacement of cement in concrete. Studies show that ceramic powder can be used as an alternate material for cement to some level for the preparation of concrete. So hereby be studied as many useful research papers in the field and trying to improve with locally available waste material so it can be proved economic as well. In this paper, an attempt has been made to find out the strength of concrete containing waste ceramic powder as the partial replacement of cement for concrete. A series of tests were conducted to study the effect of 5%, 10%, 15%, 20% replacement of cement with waste ceramic powder.

Keywords: CP (Ceramic powder), PCC

I. INTRODUCTION

Concrete is the most commonly used building material. Concrete is a versatile material that can easily be mixed to meet variety of special needs and formed to virtually any shape. Around 5 billion tonnes of concrete have been used around the word every year. In every construction aspects it require, hence concrete plays a vital role in present scenario of construction industries. On the other hand, to reduce the environmental load there should be an alternative material of fine aggregate in concrete. The research analysed the impact of the use of ceramic powder, procured as residue form of ceramic industry, on the mechanical properties of conventional concrete. Ceramic waste from factories producing construction industry material has been accumulating and frequently illegal rubbish tips, creating increasingly large piles the use of the replacement material offer cost reduction, energy savings, argubaly superior products and fewer hazards in environment the industrial and economic growth witnessed in recent decades has brought with it an increase in the generation of different types of waste. The practice of dumping the inadequate management of waste from the various manufacturing sectors I had notable impact on the receiving environment, leading to water, soil, air, can noise pollution amongst other complications, and adding to the existing environment problems. At the same time, these practices represents an economic cost. However, if waste is managed correctly it can be converted into a resource which contributes to savings in Raw materials, conservation of natural resources and the climate and promote sustainable development. Indian ceramic production is hundred million ton per year. In ceramic industry, about 15% to 30% waste material generated from the total production. 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. A primary goal is to reduce the use of Portland cement, which is easily achieved by partial replacing it with various cementitious materials, preferably those that are bicarbonates of industrial processes. The best know materials as such as ceramic powder.

In addition to helping protect the environment use of such waste offers a series of advantages such as reduction in the use of other raw materials, contributing to an economy of natural resources. Moreover, reuse also offers benefits in terms of energy, primary when the waste is in from kiln industries where are highly endothermic decomposition reactions have already taken place, thus recovering the energy previously incorporated during production. The partial replacement of ceramic powder and cement has gained considerable the importance in the requirements of environmental safety and more durability of construction in the future. Its property is shown in table 1.

Table1. Physical Property of Ceramic powder

S.N.	Specifications	Values
1	Specific gravity g/cc	2.5 to 2.7
2	Chemistry	Felsic
3	Density (lbs/ft^2)	166.5
4	Melting Point (°F)	Approx 2200
5	Solubility In Water	Insoluble
6	Boiling Point (°F)	Approx 3,000
7	Consistency	32.5
8	Particle Shape	Irregular
9	Mohrs Hardness	9
10	Odor and Appearence	Grey and White No odor
11	Vapor Pressure	None
12	Color	Reddish brown , white

II. OBJECTIVES

A. To study the strength of concrete with partial replacement of cement with ceramic powder in various percentage of 0% 10% , 20% , 30% , 40% and so on for sulfate attack by ceramic concrete.
B. To check the durability and Mechanical properties of ceramic waste concrete.
C. To study the workability and other basic properties of basic material in ceramic concrete.

III. MATERIALS USED

1) *Cement* –OPC 43 grade, ULTRATECH brand cement was used.
2) *Coarse Aggregate* – Size of 20 mm t0 12.5 mm was used.
3) *Fine Aggregate* – M sand was used.
4) *Water* – Tap water having the PH value satisfying the I.S. Code was used.
5) *Ceramic Powder* – Sieved on 90 micron was used.

IV. MIX DESIGN

Grade designation - M30
Type of cement - OPC 43 grade conforming to IS 8112
Maximum nominal size of aggregate - 20mm
Minimum cement content - 320 Kg/m^3
Maximum water-cement ratio - 0.5
Workability - 50 mm (slump)
Exposure condition - Severe (for reinforced concrete)
Degree of supervision - Good
Type of aggregate - Crushed angular aggregate
Maximum cement (opc) content - 450 kg/m^3

A. Test Data for Materials

1) Cement used - OPC 43 grade confirming to IS 8112

Specific gravity of

a) Cement - 3.145
b) Fine Aggregate - 2.605
c) Coarse aggregate - 2.63

2) Water absorption

a) Coarse aggregate - 0.5%
b) Fine aggregate - 1.0%

3) Sieve analysis

a) Coarse Aggregate - Conforming to table 2 of IS – 383
b) Fine Aggregate - Conforming to zone 1 of IS- 383

B. Mix Proportion

Mass of cement = 413.33 kg/m^3

Mass of water = 186 liters

Mass of fine aggregate = 769.95 kg/m^3

Mass of coarse aggregate = 1017.9 kg/m^3

Water cement ratio = 0.45

PROPORTION= 1 : 1.863 : 2.463

Table 2.Details of Mix Proportioning

Mix	Mix Details
R	1 : 1.863 : 2.463
GD1	R – 5% Cement + 5% Granite Powder
GD2	R – 10% Cement + 10% Granite Powder
GD3	R – 15% Cement + 15% Granite Powder
GD4	R – 20% Cement + 20% Granite Powder

V. TESTS CONDUCTED

Compressive Strength and Split Tensile Strength test was conducted for 7 days and 28 days curing.

Casting of Specimens:

1) Cube = 15
2) Cylinder = 15

VI. TESTS RESULTS AND DISCUSSION

A. Compressive Strength

Compression testing is a very common testing method that is used to establish the compressive force or crush resistance of a material and the ability of the material to recover after a specified compressive force is applied and even held over a defined period of time. Compression tests are used to determine the material behaviour under a load. Compressive strength of each concrete cube casted for 7 days and 28 days curing are given in the table 3.

Table 3. Compressive Strength For Different Trails Mixes

% Replacement of GP	Load(KN)	Average Load(KN)	Compressive strength(N/mm2)	
	7 days	7 days	7 days	28 days
0%	500.28	504.68	22.43	29.84
	509.08			
5%	624.40	631.58	28.07	36.06
	638.76			
10%	660.42	664.88	29.55	40.81
	669.34			
15%	712.42	704.93	31.33	42.14
	697.44			
20%	494.64	501.53	22.29	31.77
	508.42			

Fig 1. Chart for compressive Strength for Different % of CP.

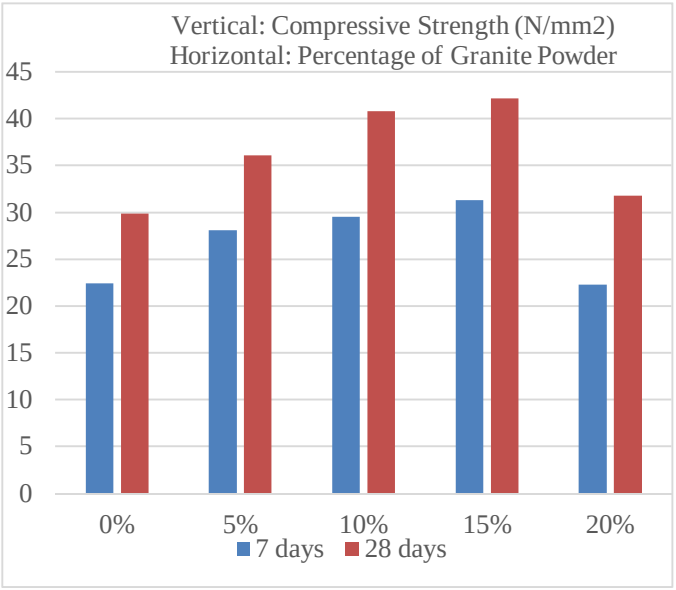

Table 4. Percentage Increase and Decrease of Compressive Strength.

% Replacement of GP	Compressive Strength of Concrete(N/mm2)		% increase or decrease of Compressive Strength	
	7 days	28 days	7 days	28 days
0%	22.43	29.84	-	-
5%	28.07	36.06	20.09	17.25
10%	29.55	40.81	24.09	26.88
15%	31.33	42.14	28.41	29.19
20%	22.29	31.77	-0.63	6.07

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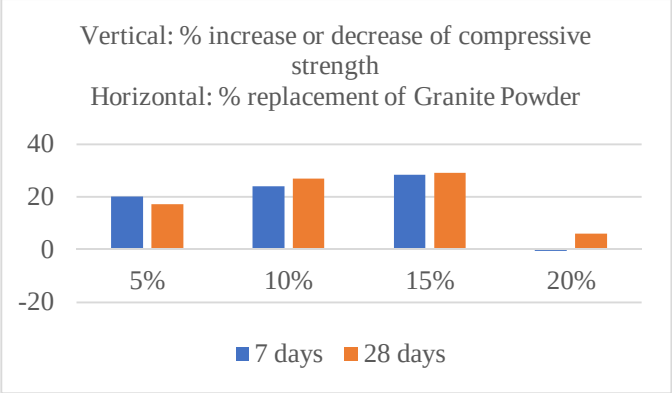
Fig 2. Chart for % increase or decrease of Compressive Strength



B. Split Tensile Strength

The concrete is very weak in tension due to its brittle nature and is not expected to resist the direct tension. The concrete develops cracks when subjected to tensile forces. Thus, it is necessary to determine the tensile strength of concrete to determine the load at which the concrete members may crack.

Table 5. Split Tensile Strength for Different Trail Mixes

% Replacement of GP	Load(KN)	Average Load(KN)	Split Tensile Strength (N/mm2)	
	7 days	7 days	7 days	28 days
0%	218.62	221.95	3.14	3.85
	225.28			
5%	240.20	236.09	3.34	4.12
	231.98			
10%	252.12	257.30	3.64	4.33
	262.48			
15%	324.30	327.28	4.63	5.48
	330.26			
20%	278.67	291.93	4.13	4.95
	305.19			

Fig 3. Chart for Split Tensile Strength for different % of CP

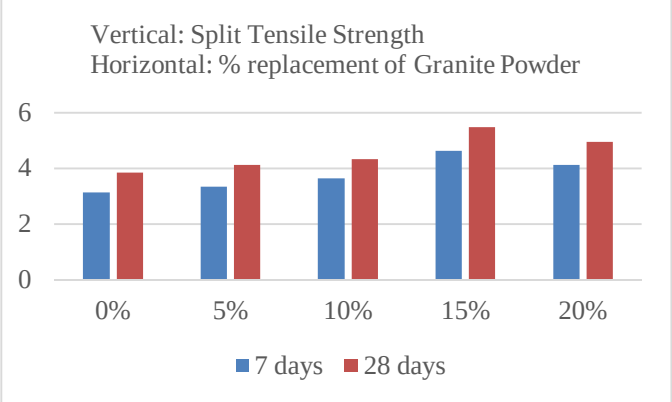
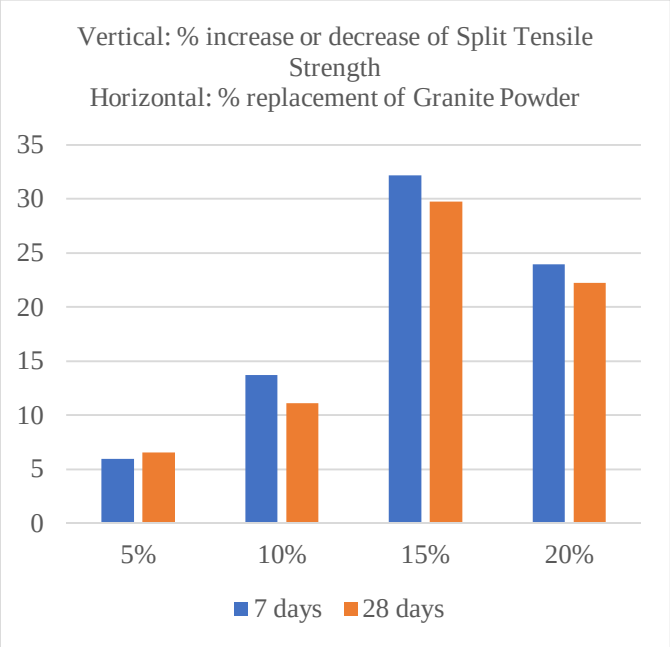


Table 6. Percentage of Increase and Decrease of Split Tensile Strength

% Replacement of GP	Split Tensile Strength of concrete(N/mm2)		% Increase or decrease of Split Tensile Strength	
	7 days	28 days	7 days	28 days
0%	3.14	3.85	-	-
5%	3.34	4.12	5.99	6.55
10%	3.64	4.33	13.74	11.09
15%	4.63	5.48	32.18	29.74
20%	4.13	4.95	23.97	22.22

Fig 4. Chart for % Increase or Decrease of Split Tensile Strength



VII. CONCLUSION

A. As compared to conventional concrete, on addition of ceramic waste powder its characteristic strength is decreased. So the ceramic waste powder as been replaced by up to 15% by weight of cement without affecting the characteristic strength of m30 grade concrete on the further replacement of cement with ceramic waste powder decreases the compressive strength.

B. It is the possible alternative solution for safe disposal of ceramic waste powder does stepping into realm of solving the environmental pollution by cement production ; being one of the primary objectives of civil Engineers.

C. Utilisation of artistic waste and its application are utilised for the improvement of the construction.

D. The compressive strength of the concrete increases up to 15% replacement of ceramic powder and then gradually decreases with increase in ceramic powder content

E. Along with compressive strength, the flexural strength of the concrete increases up to 15% replacement and then decreases with increase partial replacement of ceramic powder

F. Workability of concrete increases with the use of ceramic powder.

G. Split Tensile Strength of concrete goes on increasing upto the 15% addition of ceramic powder is 32.18% for 7 days and 29.74% for 28 days.

H. The waste ceramic powder used for this purpose also reduces the environmental pollution is economical.

REFERENCES

[1] Adullah Anwar, Sabih Ahmad, Syed Mohd. Ashraf Husain and Syed Aqeel Ahmad "Replacement of cement by ceramic waste in concrete for sustainable development" International journal of innovative science, Engineering & Technology , Vol. 2 Issue 6 , June 2015.

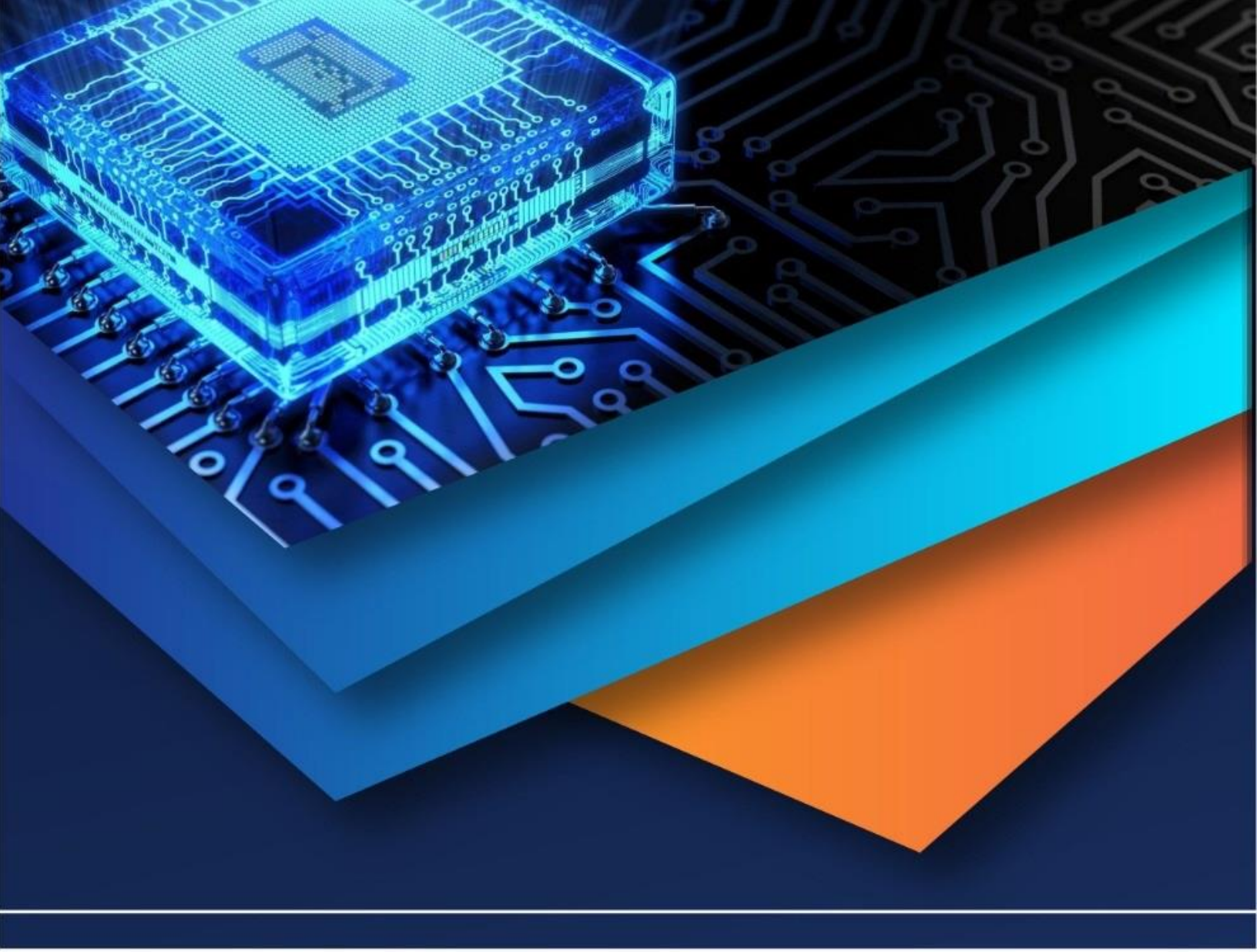
[2] Ch.Devi, D Venkateswarul "A study on various Properties of concrete by using Ceramic Dust Powder as a partial replacement of cement." International Journal of Engineering and Technical Research (IJETR) Volume-3,Issue-12,December 2015.

[3] V Praveen Kumar, Dr.K Chandrashekar reddy "Durability Aspects of concrete by partial replacement of cement by ceramic waste" International journal of civil Engineering and technology ,volume 8, Issue-4, April 2017.

[4] NiveditaNayak, V.BalaRaju" Understanding The Strength Of Concrete By Replacing ceramic Powder Against Sulphate Attack"International Journal of Advances Research in science and Engineering, Volume-06, Issue No- 07, July-2017.

[5] Abhishek Verma, Jeevan Meena, Krishna Murari, Ravindra Goliya " A study on use of Ceramic Aggregate in Concrete with HCL" International Research Journal of Engineering and Technology (ISSN) Volume -05, JULY 2017.

[6] Deepak katoch , Shivani Bharadwaj "Partial replacement of fine aggregates with Ceramic Powder." International research journal of Engineering and technology" (IRJET) ,Volume-05, May 2019.



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