IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)
e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 19, Issue 5 Ser. I (Sep. – Oct. 2022), PP 30-32
www.iosrjournals.org

Experimental study on the strength of concrete by partial replacement of ceramic waste and stone powder as fine aggregate

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Abstract
Currently concrete is most demanding material for the construction of various infrastructural activities. Concrete has become a basic need for every structure at the present time. The growingresidents of the world puts a major concern to develop a cost effective as well as an eco-friendly structure according to the need of human beings. To identify the suitability of ceramic waste and stone powder as fine aggregate, cylindricalsamples were casted at different composition of ceramic waste and stone powder.The compressive and split strengthwere tested and compared withreference concrete.Theexperimental resultsshows thatthe strength developed in concrete increased and cost analysis estimated that partial replacement of ceramic waste and stone powder as fine aggregate reduced the cost of concrete.

Keywords: *Ceramic waste, stone powder and cost*

Date of Submission: 07-09-2022 Date of Acceptance: 23-09-2022

I. Introduction

Rapid industrial development causes serious issues in the world such as depletion of natural aggregates and creates enormous amount of waste material from construction and demolition activities. To minimized the use of natural aggregates is to utilize the waste. A hugeamount of wastages produced annually in all countries, in particular construction and demolition waste contribute the highest percentage of wastes worldwide about 75%. Concrete is a heterogeneous mixture of binding material (cement or lime), coarse aggregates, fine aggregates (sand) and water. Fine and coarse aggregates are obtained from quarrying of large rocks which leads to a great destruction to the environment.Many researchers [1-5] conducted research to find out the suitablematerials and strength in concrete. The purpose of this experiment was investigating the suitability of stone powder and ceramic waste as partial replacement of fine aggregate in concrete

II. Experimental Process

Experimental sample were prepared as per specified process [6]. The details are given in table 1

Table 1 Layout of cylindrical experimental sample with replacement of stone powder and ceramic waste

S.No.	Specimen Design	Replacement		Sample Size (Radius×height)	W/C
		C.W.	S.P.		
1	O_{C1}	0%	0%	75×150	0.46
	O_{C2}	0%	0%	75×150	0.46
2	A_{C1}	0%	20%	75×150	0.46
	A_{C2}	0%	20%	75×150	0.46
3	E_{C1}	10%	20%	75×150	0.46
	E_{C2}	10%	20%	75×150	0.46
4	F_{C1}	20%	20%	75×150	0.46
	F_{C2}	20%	20%	75×150	0.46
5	G_{C1}	20%	30%	75×150	0.46

	G_{C2}	20%	30%	75×150	0.46
6	H_{C1}	20%	40%	75×150	0.46
	H_{C2}	20%	40%	75×150	0.46

2.1 Testing of the specimens

Compressive, split tensile and flexure strength of cylinders and beams have been determined as per IS 516-1959 at a loading rate of about 140 kg/cm2/min (about 30 tones per minute) on 2000 tons AIMIL compression testing machine and flexure testing machine.

Figure 1 Compressive Strength Testing Machine

Figure 2 photographic view of cylindrical samples

III. Experimental Outcomes

Compressive and split tensile strength of cylindrical samples was tested by using the Compressive Strength Testing Machine fordifferent composition of ceramic waste and stone powder.

Table 2 Compressive strength of cylindrical samples

S.No.	Specimen Design	Replacement		Compressive Strength
		C.W.	S.P.	In MPa
				28 days
1	O_C	0%	0%	46.5

2	A_C	0%	20%	48.5
3	E_C	10%	20%	48.5
4	F_C	20%	20%	46.5
5	G_C	20%	30%	28.5
6	H_C	20%	40%	21.5

Table 3 Split Tensile Strength of cylindrical samples

S.No.	Specimen Design	Replacement		Split Tensile Strength
		C.W.	S.P.	In MPa
				7 days
1	O_{C1}	0%	0%	2.13
2	A_{C1}	0%	20%	2.09
3	E_{C1}	10%	20%	2.045
4	F_{C1}	20%	20%	2.03
5	G_{C1}	20%	30%	1.95
6	H_{C1}	20%	40%	1.81

COST ANALYSIS

The cost of $1m^3$ concrete with different composition of ceramic waste and stone powder calculated as per standard method and details are given in table

Table 4 Cost for making $1m^3$ concrete

S.No	% Replacement	Total cost for $1m^3$concrete (Rs)	Difference in cost (Rs)	Cost Reduced (%)
1	0%	5124	-	-
2	20% CW	5009	115	2.3
3	20% CW & 10% SP	4920	204	4
4	20% CW & 20% SP	4834	290	6.1
5	20% CW & 30% SP	4748	376	7.4
6	20% CW & 40% SP	4661	463	9.1

IV. Conclusion

Based on experimental results following conclusion drawn

1. The strength developed in concrete with different composition of ceramic waste and stone powder significantly increases
2. Use of ceramic waste and stone powder as fine aggregate reduces the consumption natural aggregates.
3. Cost analysis shows that mixing of ceramic waste and stone powder as fine aggregate reduced the cost of one cubic meterconcrete.

References

[1]. S.C. Bostanci, Use of waste marble dust and recycled glass for sustainableconcrete production, J. Clean. Prod. 251 (2020
[2]. A. Shukla, N. Gupta, A. Gupta, Development of green concrete using wastemarble dust q, Mater. Today Proc. (2020.
[3]. A. Halicka, P. Ogrodnik, B. Zegardlo, Using ceramic sanitary ware waste asconcrete aggregate, Constr. Build. Mater. 48 (2013) 295–305
[4]. J.R. Correia, J. De Brito, A.S. Pereira, Effects on concrete durability of usingrecycled ceramic aggregates, Mater. Struct. Constr. 39 (2006)
[5]. A.M.M. Al Bakri, M.N. Norazian, H. Kamarudin, M.A.A. Mohd Salleh, A. Alida, Strength of concrete based cement using recycle ceramic waste as aggregate, Adv. Mater. Res. 740 (2013) 734–738
[6]. Ashu Singh and Vivek Sachan Experimental investigation on compressive strength by using stone powder and ceramic waste in concrete as partial replacement of fine aggregateIOSR Journal of Mechanical and Civil Engineering19(4) 2022 01-05