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Effect of Aggregate Combination on Optimization of Concrete Strength

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Abstract: ***Much research in recent years has been devoted to establishing the fundamental and engineering properties of high-strength concrete, as well as the engineering characteristic of structural member made with material it is well known that the inhomogeneous structure of concrete can be described as three-phase system consisting of hardened. In this research work the locally available constituents of concrete were selected for the purpose of investigating the effect of size of aggregate on the compressive strength of concrete, Various combinations are studied from this it is found that From the comparison between O.P.C gives cement saving from 10.47 % to 32.46 % than P.P.C. and Depending upon combination of aggregate the percentage cement saved must be replaced by substantial ideal material ranging from 2.86 % - 43.31 % except concrete of 10mm aggregate because it requires excess of cement.***

Keywords: OPC, PPC, aggregate, combination

I. INTRODUCTION

Cement is one of the most expensive components of concrete. Although cement paste is required to fill aggregate voids, bind them together and provide mobility to fresh concrete, it is also responsible for drying shrinkage, heat generation and porosity. Consequently, minimizing the amount of cement paste would be one of the goals of concrete optimization. Optimization is the set of procedures used to make a system as effective as possible. The objective of this research is to find combined aggregate gradations, using available aggregate sources, which will significantly reduce the amount of cement required by 10% to 15% without compromising concrete fresh properties including slump, static and dynamic yield stress and plastic viscosity, and hardened properties including strength, drying shrinkage and permeability (resistivity). To achieve this objective, several types of combination of different size of aggregates are used for optimization techniques, which will be applied to the pavement design for 20 MPa strengths.

II. AIM

The aim of the present work is to make a comparative study of properties of these two types of cements mixed in different proportions

III. OBJECTIVE

The objectives of present work are as follows :-

A. To find the optimized mix of aggregate.
B. To compare the various replacement effects of aggregate on strength of concrete.
C. To study the effect of partial replacement of sand by dust and stone crusher cheep.

IV. METHODOLOGY

The methodology for present work is as mentioned below :-

A. PHASE-I
1) Finalizing , Aim, Objectives and need of this work.
2) Review of Various Literatures Base on Topics.
3) Deciding Work Flow Steps for easy going of work

B. PHASE-II
1) Detail Study Regarding Topic.
2) Study of Codes and other technical Sources.
3) Fixing Specimen Combination.

C. PHASE-III

1) Casting and testing Various Types of Cubes

2) Comparative Result Discussion and Conclusions.

V. CASE CONSIDERATIONS

A. Cube Combinations

The tests were conducted in two cases.

1) In first case cubes were cast using PPC with different coarse aggregate combination.

2) In second case cubes were cast with different fine Aggregate combination.

3) 48 numbers of standard cubes (150x150x150 mm) were cast to measure the compressive strength after 7 days and 28 days.

4) Special mixes were prepared to study their characteristics.

The grade of concrete used for the cube preparation is M20 (1:1.5:3). The designation given to the cubes as:

a) Coarse Aggregate Combinations

Table 1 Detail Structural Parameters

Mix Designation	Aggregate Combination
M1	40mm
M2	40mm + 20mm
M3	20mm
M4	20mm + 10mm
M5	10mm

Similarly, the mix proportion for making the special mixes by 50% replacement of sand with 5mm crushed aggregate and aggregate dust as given below:

Prepared concrete mix by 40+ 20 combination coarse aggregate and OPC cement.

b) Special Mix Combination

Table 2 material properties

S1	5mm crushed stone + sand
S2	5 mm crushed stone + dust
S3	Pure dust

-

VI. RESULTS FOR ALL MODELS

A. Test Reports For Cubes Of P.P.C Cement

Table 03 test report for cubes of P.P.C cement

Sr. No	MIX	DAY	WGT. (KG)	MEAN WGT. (KG)	COMP. STRENGTH (N/MM^2)	MEAN STRENGTH (N/MM^2)
1	M1	7	8.95		19.85	
		7	8.95	8.93	19.85	19.75
		7	8.90		19.55	
		28	8.90		34.86	
		28	8.90	8.90	34.56	34.96
		28	8.90		35.46	
2	M2	7	8.80		20.36	
		7	8.80	8.77	20.56	20.46
		7	8.70		20.46	

		28	8.95		34.95	
		28	8.90	8.92	34.16	34.19
		28	8.90		33.45	
3	M3	7	8.70		13.95	
		7	8.70	8.75	13.50	13.47
		7	8.70		12.95	
		28	8.75		23.92	
		28	8.75	8.75	22.01	22.63
		28	8.75		21.95	
4	M4	7	8.45		12.98	
		7	8.40	8.45	12.50	12.58
		7	8.50		12.25	
		28	8.65		20.78	
		28	8.60	8.63	21.25	20.63
		28	8.65		19.85	
5	M5	7	8.10		10.05	
		7	8.15	8.10	10.10	10.10
		7	8.05		10.15	
		28	8.35		14.46	
		28	8.25	8.25	14.53	14.41
		28	8.15		14.23	

B. Test Reports For Cubes Of Special Mixes

Table.04 test report for cubes of Special mixes.

Sr. No	MIX	DAY	WGT.	MEAN WGT.	STRENGTH (N/MM^2)	MAEN STRENGTH (N/MM^2)
1	S1	7	8.45		16.55	
		7	7.95	8.18	15.95	16.25
		7	8.15		16.25	
		28	8.65		30.55	
		28	8.95	8.42	29.35	30.38
		28	7.65		31.25	
2	S2	7	8.45		19.75	
		7	7.95	8.55	21.35	19.95
		7	7.45		18.75	
		28	8.15		28.45	
		28	8.25	7.98	26.55	26.92
		28	7.55		25.75	
3	S3	7	8.00		9.65	
		7	8.15	8.12	8.73	9.71
		7	8.20		10.75	
		28	7.95		16.75	
		28	8.10	8.07	17.25	16.65
		28	8.15		15.95	

VII. CONCLUISONS

A. By considering special mix replacing Fine aggregate by dust results in decrease in strength. So it is risky to replace sand by dust.

B. Depending upon combination of aggregate the percentage cement saved must be replaced by substantial ideal material ranging from 2.86 % - 43.31 % except concrete of 10mm aggregate because it requires excess of cement.

C. The stone crusher dust can not be used instead of sand because it yield less strength of concrete than which is achieved by using sand in concrete.

D. If stone crusher dust is used in concrete it requires more water for its mixing.

VIII. ACKNOWLEDGEMENT

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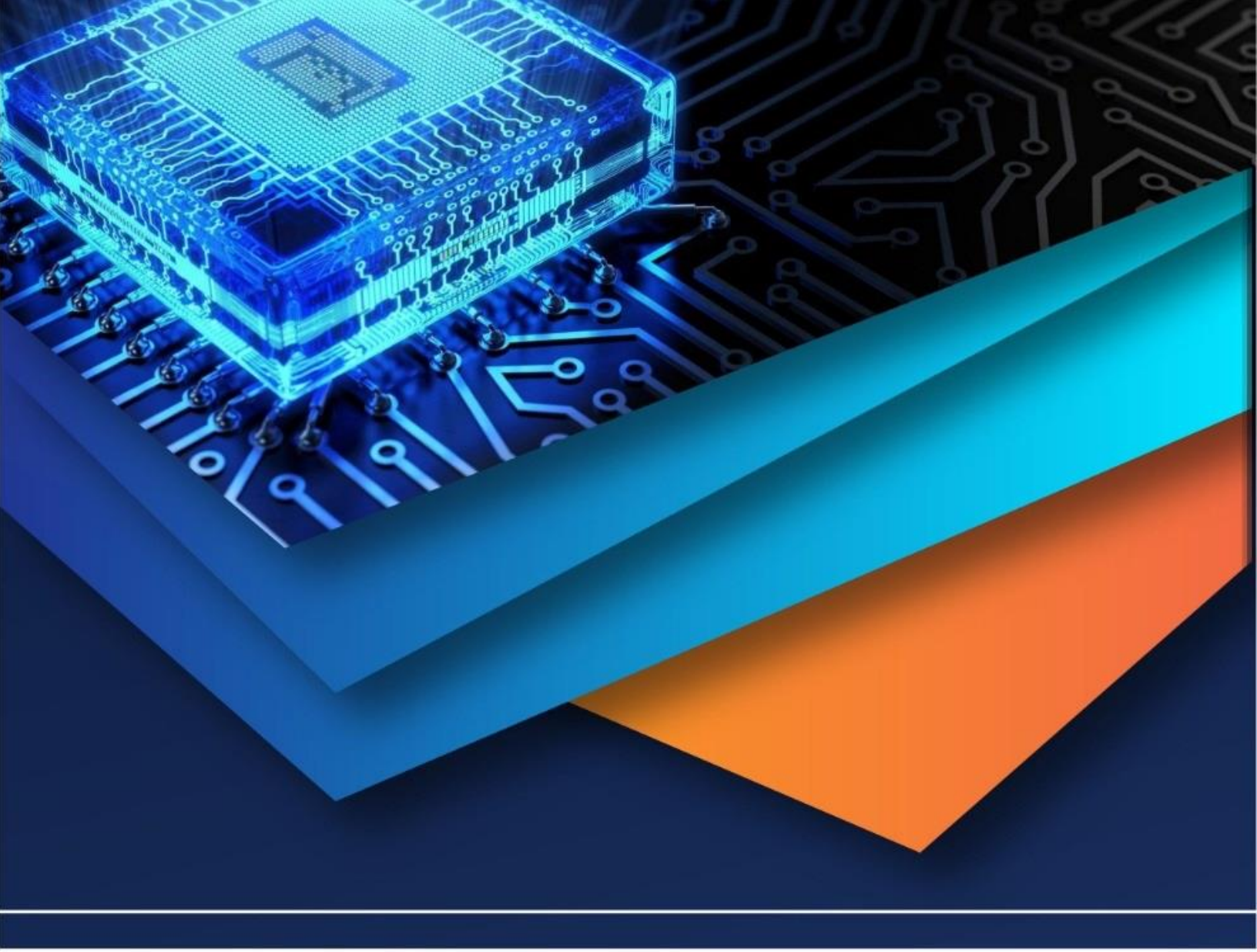

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