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Compressive Strength of Concrete by Partial Replacement of Cement with Dolomite Powder

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Abstract: ***Concrete is used as a construction material because of its good compressive strength. Nowadays, the cost of construction materials are increased which need to look at a way to reduce the cost of cement. One of the recent, study says that the replacement of the materials of concrete with some other similar materials. The construction industry is looking for supplementary cementitious material with a aim to protect environment from carbon-dioxide emission and cheap availability. Dolomite is acts as a good material obtain from dolostone mineral.***
This paper deals with the effective use of dolomite powder in cement. It is focused on M20 grades of concrete by nominal design. The percentage of Dolomite powder which replaces cement are 5%,10%, 15% and 20% by the weight of cement to form concrete. The compressive strength of concrete with dolomite powder is compared with those of the standard specimens.
The results indicate that replacement of cement with dolomite powder increases the compressive strength of concrete in optimum mix. The reduction in the consumption of cement will affect the cost of concrete, the emission of CO2 in environment. Dolomite powder has some characteristics of cement.
This study aims to create a concrete with low cost and is focused on the compressive strength of the concrete by partially replacing cement with dolomite powder and obtained results are examined to get optimum mix with maximum strength is determined.
Keywords: Compressive strength, Dolomite powder, Cement, Replacement, Optimum mix

I. INTRODUCTION

Concrete is a important constituent of civil engineering which is used in construction work. Cement, fine and coarse aggregates, admixtures and water are the basic requirement to make concrete. Cement manufacture supplements greenhouse gases, directly through its production of carbon-dioxide when calcium carbonate is thermally decomposed, producing lime and carbon-dioxide, and also through the use of energy from the combustion of fossil fuels. Portland cement (PC) is considered to be the best building material due to its high mechanical strength.

However, ordinary PC has insufficient durability and low resistance towards chemical attacks. Cement industry which consume most of the energy and emits greenhouse gases, leads to be responsible for 7% of the global carbon dioxide emissions. The need of low cost materials and sustainable alternatives or blended cements with lower embodied energy to be rapidly growing demand of cement. Blended cements means which replaces the cement with either slag and other mineral additives such as limestone and silica fume, which reduce the production of PC and enhance its performance.

Dolomite (CaCO3.MgCO3) theoretically encloses CaCO3 54.35% and MgCO3 45.65% or CaO 30.4%, MgO 21.9% and CO2 47.7% in composition. However, in natural state dolomite is not accessible in this exact proportion. Therefore, the rock containing 40-45% MgCO3 is usually called dolomite.

Dolomite rock which comprises in addition to dolomite either Calcite or a mixture of Calcite & Magnesite in a definite proportion are called "Dolomitic Limestone". It acts as a flux & construction minerals. Dolomite is easily available in almost all parts of the country. Dolomite is a preferred because of its higher surface hardness, density and similar properties as to the cement.

II. PROBLEM IDENTIFICETION

Nowadays, there is the huge demand of concrete in this modernisation world. So in the field of civil engineering the main aim of any construction is to get high strength and durability with effective cost. And also, it's our duty to save the environment from harmful gases. The main purpose of doing partial replacement of cement with dolomite is to solve these problems.

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III. METHODOLOGY

A. *Material Used*

1) *Cement:* OPC-43 cement is used with reference to IS 8112-1989. The cement used is dry and lumps free, and properties of cement tested were as follow:

Properties	RESULT
Fineness modulus	2%
Specific gravity	3.35
Consistency	28%
Initial setting time	32min
Final setting time	600min

2) *Fine Aggregate:* The sand used for this project has the maximum size of 4.75mm. According to sieve analysis test, the sand is of zone II(IS383-1970). Test of fine aggregate are as follows:

PROPERTIES	RESULT
Zone	Zone-II
Water absorption	1.1%
Fineness modulus	2.86
Specific gravity	2.66

3) *Coarse Aggregate:* Machine crushed aggregate of 20mm size is used. And it is separated by sieving size passing from 40mm and retain on 20mm. The test results are as follow:

PROPERTIES	RESULT
Size of C.A	20mm
Water absorption	0.8%
Fineness modulus	7.2
Specific gravity	2.79

4) *Dolomite Powder:* Dolomite is a CaMg(CO3)2. Dolomite is a rock forming mineral which is well-known for its remarkable wettablity and dispersibility. It is also good in moderate oil and plasticizers absorption and weathering resistance.

Properties	RESULT
Colour	White
Specific gravity	2.75
Consistency	28%
Initial setting time	8 minutes
Crystal system	Trignal

5) *Water:* Water is an important ingredient of concrete, as it participates in chemical reaction to form a paste of concrete. Water which is used for mixing concrete should be free from harmful impurities. The water which is used to make concrete should have pH 6-8. The water used in this work is locally available.

IV. DETAILS OF CONCRETE MIX

In this project the dolomite is used as partial replacement of cement with 5%,10%,15% and 20% by the weight of cement. The quanties of cement, sand, and coarse aggregate required for 1m.cu of concrete are 403.2kg, 604.8kg, 1209.6kg. M20 grade of nominal mix design is used. The analysis of compressive strength is done to determine the optimum percentage of dolomite added to give the maximum compressive strength. The cube of 150mmx150mmx150mm size of mould is used to make a cube of different percentage for dolomite in mix. The compression test is done after 28days, and till that period the cubes are completely submerged in water. All the procedure which is used to test the cubes is according to IS code.

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V. RESULT OF COMPRESSION TEST

The compressive strength of cubes are determined using compression testing machine (CTM) of capacity 2000KN. Compression test for 150mmX150mmX150mm cubes is done in 28days. The test result of different percentage of dolomite replacement is as follows:

% of dolomite powder added to the cement	Result Load in KN	Average compressive strength result N/mm.sq
0%	622	
	620	619
	614	

% of dolomite powder added to the cement	Result Load in KN	Average compressive strength result N/mm.sq
5%	663	
	660	662.3
	664	

% of dolomite powder added to the cement	Result Load in KN	Average compressive strength result N/mm.sq
10%	680	
	696	697
	715	

% of dolomite powder added to the cement	Result Load in KN	Average compressive strength result N/mm.sq
15%	571	
	554	564
	567	

% of dolomite powder added to the cement	Result Load in KN	Average compressive strength result N/mm.sq
20%	505	
	507	507.3
	510	

VI. CONCLUSIONS

From the experimental analysis of the mix proportion and discussing the result, the following conclusions have been drawn which are given in below:

A. At low percentage from 5% to 15%, dolomite powder shows an active role in compression strength which means that its behave like a cement. Further increase in dolomite will acts like a dilution in cement.

B. The compressive strength is maximum at 10% dolomite present in mix by the partial replacement of cement. Below 10%, the strength gradually increases but further increasing the dolomite percentage there is a decrease in compressive strength.

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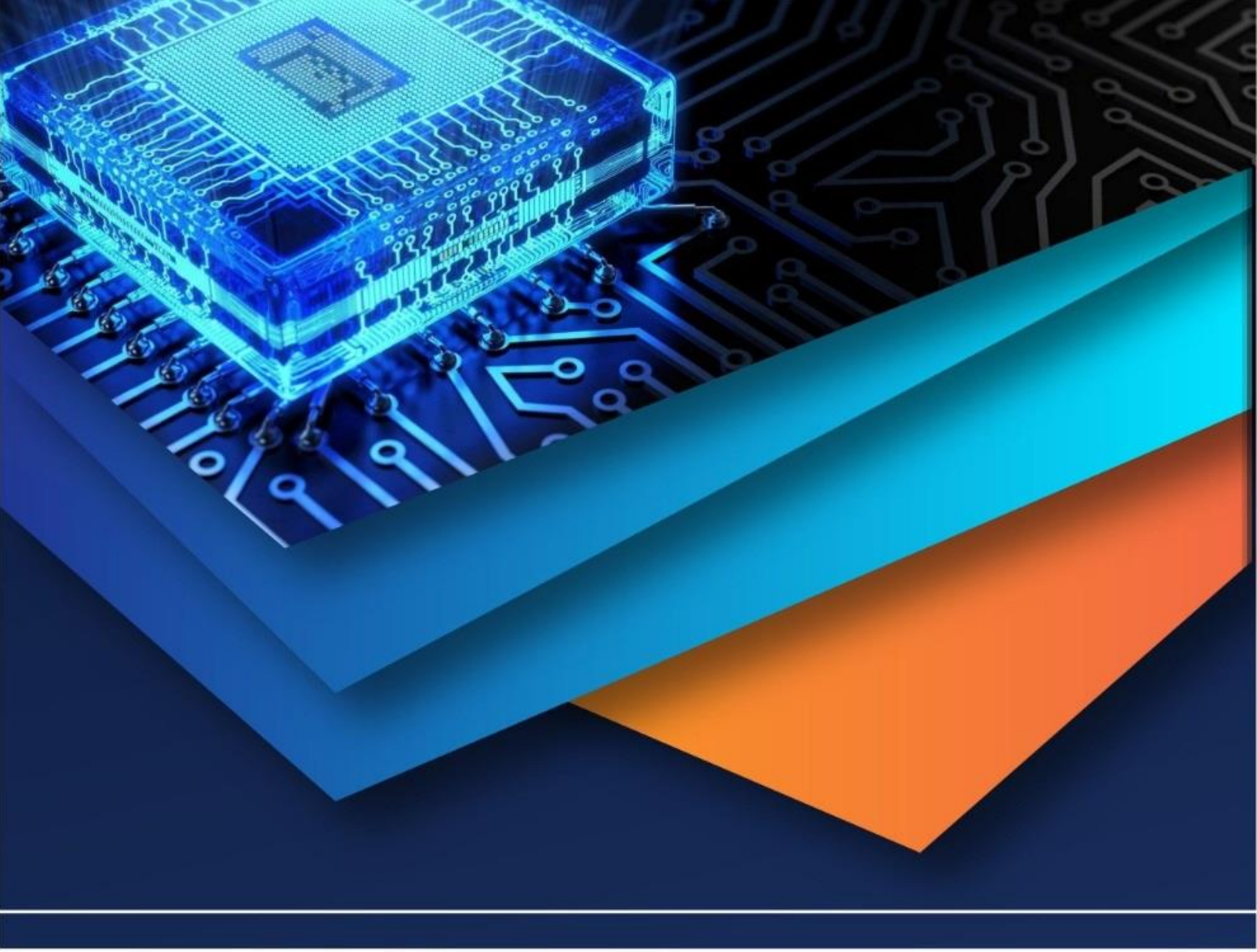

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