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Partial replacement of fine aggregate by granite powder in concrete

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Abstract— Experimental Investigation on locally available granite powder as a partial replacement of sand with admixtures in the production of concrete is presented in the paper. The concrete was made by using ordinary Portland cement. Granite is an igneous rock which is widely used as construction material in different forms. Nowadays many researches are going in to replacement of sand using many waste material like silica fume, fly ash, slag etc. Like this we are using granite powder is also used as a binder with partial replacement of sand. Now days the construction industry is in need of finding effective material for increasing the strength in concrete. The test results show clearly that granite powder of marginal quantity, as partial sand replacement has beneficial effect on the above properties. Concrete with replacement of fine aggregate by waste glass powder such as 15%, 20%, 25% and 30% were produced. Cube, cylinder, prism specimens of each one 9 numbers were cast, cured and tested for 7, 14, 28 days for strength.

Key words- Granite powder, compressive strength, curing, replacement of fine aggregate.

I. INTRODUCTION

The most commonly used fine aggregate is natural river sand. The global consumption of natural river sand is very high due to the extensive use of concrete. The non-availability of sufficient quantity of ordinary river sand for making cement concrete is affecting the growth of construction industry in many parts of the country. Recently, Tamil Nadu government (India) has imposed restrictions on sand removal from the river beds due to unsafe impacts threatening many parts of the state. The utilization of granite powder in high performance concrete could turn this waste material into a valuable resource with the added benefit of preserving environment. On the other hand, the granite waste generated by the industry has accumulated over years. The present work is aimed at

developing a concrete using the granite scrap, an industrial waste as a replacement material for the fine aggregate. Accordingly, this paper will examine the properties of concrete by varying the granite powder as a replacement of sand in the concrete that have originated from granite crushed unites.

II. OBJECTIVES

The Granite stone industry generates different types of waste. Granite powder obtained from the polishing units and the properties were found. The main objective of this study is to investigate experimentally the suitability of granite powder waste as a substitute material for fine/natural aggregate in concrete production. Utility of granite powder as a partial replacement of fine aggregate in concrete the performance conventional concrete and granite powder in concrete the effectiveness of the granite powder concrete in strength enhancement.

Experiments are conducted on concrete prepared by partial replacement of fine aggregate by waste granite powder of particle size 90 micron.

1. Partial replacement for fine aggregate
2. Investigate the potential use of granite powder in concrete as replacement for natural sand.
3. The percentage of granite powder which gives maximum strength when compare to concrete.

III. EXPERIMENTAL PROCEDURE

A. Material used

Ordinary port land cement	- 60grade
Fine aggregate (m-sand) size	- 4.75 mm
Coarse aggregate	- 20 mm
Granite powder	- 90 micron

IV. MATERIAL PROPERTIES

Specific gravity of cement	= 3.15
Specific gravity of fine aggregate	= 2.74
Specific gravity of coarse aggregate	= 2.80
Specific gravity of granite powder	= 2.58
Fineness of coarse aggregate	= 7.86
Fineness of fine aggregate	= 3.86

V. EXPERIMENTAL PLAN

In this work 15%, 20%, 25% and 30% of fine aggregate is replaced by granite powder for M60 Grade concrete. Were casted for different proportion with granite powder and compared with the properties of concrete prepared without granite powder. Compressive Test was performed on the concrete after 7, 14 and 28 days.

VI. MIX DESIGN

The mix design for M60 grade concrete was made using IS456 :2000, IS 1026 : 2007 and IS 516 : 1959

VII. MIX PROPORTIONS

The mix proportion was obtained for various percentages of granite powder such as 15%, 20%, 25%,and 30% replaced for fine aggregate in this the water content was maintained constant.

TABLE I

DETAIL OF MIX PROPORTION FOR CUBE

% OF REPLACEMENT	CEMENT (KG)	FINE AGGREGATE (KG)	COARSE AGGREGATE (KG)	GRANITE POWDER (KG)	WATER CEMENT RATIO
0	1.701	2.305	3.739	0	0.45
15	1.701	1.960	3.739	0.345	0.45
20	1.701	1.530	3.739	0.460	0.45
25	1.701	0.955	3.739	0.575	0.45
30	1.701	0.265	3.739	0.690	0.45

TABLE II

DETAIL OF MIX PROPORTION FOR CYLINDER

% OF REPLACEMENT	CEMENT (KG)	FINE AGGREGATE (KG)	COARSE AGGREGATE (KG)	GRANITE POWDER (KG)	WATER CEMENT RATIO
0	1.701	3.621	3.739	0	0.45
15	1.701	3.078	3.739	0.543	0.45
20	1.701	2.354	3.739	0.724	0.45
25	1.701	1.449	3.739	0.905	0.45
30	1.701	3.630	3.739	0.108	0.45

TABLE III

DETAIL OF MIX PROPORTION FOR PRISM

% OF REPLACEMENT	CEMENT (KG)	FINE AGGREGATE (KG)	COARSE AGGREGATE (KG)	GRANITE POWDER (KG)	WATER CEMENT RATIO
0	1.701	0.854	3.739	0	0.45
15	1.701	0.726	3.739	0.128	0.45
20	1.701	0.684	3.739	0.420	0.45
25	1.701	0.641	3.739	0.443	0.45
30	1.701	0.600	3.739	0.540	0.45

VIII. TEST OF SPECIMEN

All the casted specimen were demoulded after 24 hours and were placed in curing tank for a period of 7, 14 and 28 days the specimen were tested in the compression test machine of 2000 KN capacity.

Three numbers of specimen in each Cube, cylinder and prism were tested and average value was calculated.



FIGURE 1 COMPRESSION TEST

IX. COMPRESSION STRENGTH

The overall Result of compressive strength for cube, cylinder and prism is respectively.

TABLE IV
COMPRESSIVE TEST RESULT FOR CUBE

S.NO	% OF REPLACEMENT	CUBE 7 DAYS (N/MM ²)	CUBE 14DAYS (N/MM ²)	CUBE 28DAYS (N/MM ²)
1	0	35.01	40.23	44.98
2	15	36.26	41.25	47.43
3	20	37.58	43.68	49.26
4	25	38.96	46.26	51.72
5	30	36.70	44.92	47.62

