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An Experimental Research on Partial Replacement of Fine Aggregate with Granite Powder

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Abstract: ***The most commonly used fine aggregate across world is river sand. River sand is expensive due to excessive cost of transportation from natural sources. The use of sand in construction activities results in the excessive mining. Due to excessive mining natural resources are getting exhausted results in increase in scour depth and sometimes flood possibility. Thus becoming inevitable to use alternative material in concrete. Also large scale depletion of the source creates environmental problems as environmental transportation and other constraints make the availability and use of river sand less attractive. A substitute or replacement product for concrete industry needs to be found. Granite is an igneous rock which is widely used as construction material in different forms. Granite industries produce lot of dust and waste materials. The wastes from the granite polishing units are being disposed to environment which causes health hazards. Granite fines are used as a filler material in the concrete, replacing the fine aggregate which will help in filling up the pores in the concrete. Filling up of the pores by granite fines to increase the strength of the concrete and also a material which is abundantly to investigate the strength behaviour of concrete with use of granite fines as an additive .In this project an attempt is made experimentally to investigate the Strength and durability behaviour of ordinary and high strength concrete with the use of granite fines as an additive. Concrete is prepared with granite fines as a replacement of fine aggregate in 6 different proportions namely 0%,10%,20%,30%,40%and 50%.To improve the workability of concrete 1% superplasticizer added to ordinary strength concrete. The test results indicate that granite as replacement for fine aggregate with has beneficial effect on the mechanical durability properties such as compressive strength, split tensile strength.***

Keywords: Granite powder, compressive strength, split tensile strength, admixtures

I. INTRODUCTION

Fine aggregate is an essential component of concrete. The most commonly used fine aggregate is natural river sand. The global consumption ofnatural river sand is very high due to the extensiveuse of concrete. In particular, the demand of natural river sand is quite high in developed countries owing to infrastructural growth. 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 its undesirable impact on the environment. On the other hand, the granite waste generated by the industry has accumulated over years. Only insignificant quantity has been utilized and the rest has been dumped unscrupulously resulting in pollution problems. With the enormous increase in the quantity of waste needing disposal, acute shortage of dumping sites, sharp increase in the transportation and dumping costs necessitate the need for effective utilization of this waste.

The fine aggregate in concrete production is very high, and several developing countries have encountered some strain in the supply of natural sand in order to meet the increasing needs of infrastructural development in recent years. A situation that is responsible for increase in the price of sand, and the cost of concrete. Expensive and scarcity of river sand which is one of the constituent material used in the production of conventional concrete was reported in India The present work is aimed at developing a concrete using the granite scrap, an industrial waste as a replacement material for the fine aggregate. By doing so, the objective of reduction of cost of construction can be met and it will also help to overcome the problem associated with its disposal including the environmental problems of the region. Accordingly this project work will examine the ordinary and high strength concrete were cast by varying the percentage replacement of sand with granite fines.

The partial replacement of fine aggregate with granite powder can result in changes in the performance characteristics that may be acceptable for high strength concrete. Use of chemical admixtures usually superplasticizer reduces the water content, thereby reducing the porosity within the hydrated cement paste.

Use of these materials individually or in combination with cement and proper dosage of super plasticizer improves the strength and durability of the concrete.

II. OBJECTIVE OF THE STUDY

1) In this project the main objective is to study the influence of partial replacement of fine aggregate with granite powder, and to compare it with strength and durability properties of the concrete.
2) To find the optimum percentage of granite fines replaced with fine aggregate in concrete that makes the strength of concrete is maximum.
3) Nowadays granite powder has become pollutant. So by partially replacing sand with granite fines are proposing a method that can be of great use in reducing pollutant to great extant.

III. GRANITE POWDER

The granite sludge was obtained in wet form as an industrial byproduct directly from the deposits of granite factories, which forms during the sawing, shaping and polishing processes of granite. The wet granite sludge was dried up prior to the preparation of the samples. The dried material was sieved and finally the granite powder was obtained to be used in the experiments as fine sand aggregate.

Granite stone industry generates both solid waste and stone slurry. Whereas solid waste results from the rejects at the mine sites or at the processing units, stone slurry is a semi liquid substance consisting of particles originating from the sawing and the polishing processes and water used to cool and lubricate the sawing and polishing machines. Stone slurry generated during processing corresponds to around 20% of the final product from stone industry. Therefore the scientific and industrial community must commit towards more sustainable practices. There are several reuse and recycling solutions for this industrial by-product.

IV. MIX PROPORTIONS

a) cement	=	359	Kg/m3
b) replacement of cement	=	0	Kg/m3
c) water	=	197	Kg/m3
d) admixture	=	0.0036	m3
e) fine aggregate	=	506	Kg/m3
f) coarse agggregate	=	1145	Kg/m3
g) replacement of F.A	=	0.555962	Kg/m3
h) replcement of C.A	=	0	Kg/m3
i) water cement ratio	=	0.499	

V. RESULTS

A. *Compressive Strength Of Concrete*

TABLE : 1

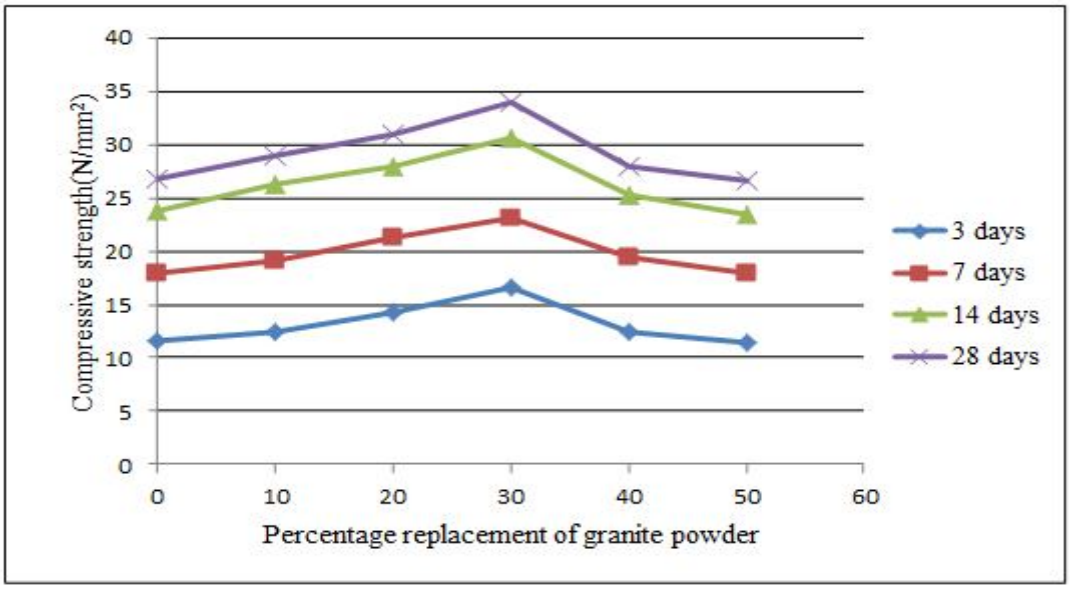
SI. No	% replacement of granite fines	Compressive strength (N/mm^2)			
		3 days	7 days	14 days	28 days
1	0	11.50	17.90	23.75	26.73
2	10	12.34	19.01	26.20	28.90
3	20	14.23	21.30	27.90	30.91
4	30	16.56	23.02	30.62	34.01
5	40	12.35	19.35	25.20	28.01
6	50	11.40	17.85	23.40	26.62

B. Tensile strength of Concrete

TABLE : 2

SI. No	% replacement of granite fines	Split tensile strength (N/mm^2)			
		3 days	7 days	14 days	28 days
1	0	1.12	1.90	2.52	2.80
2	10	1.24	2.01	2.79	3.10
3	20	1.33	2.16	2.99	3.33
4	30	1.44	2.34	3.24	3.66
5	40	1.38	2.24	3.10	3.45
6	50	1.11	1.88	2.41	2.70

Graph shows the strength variation of M20 grade of concrete



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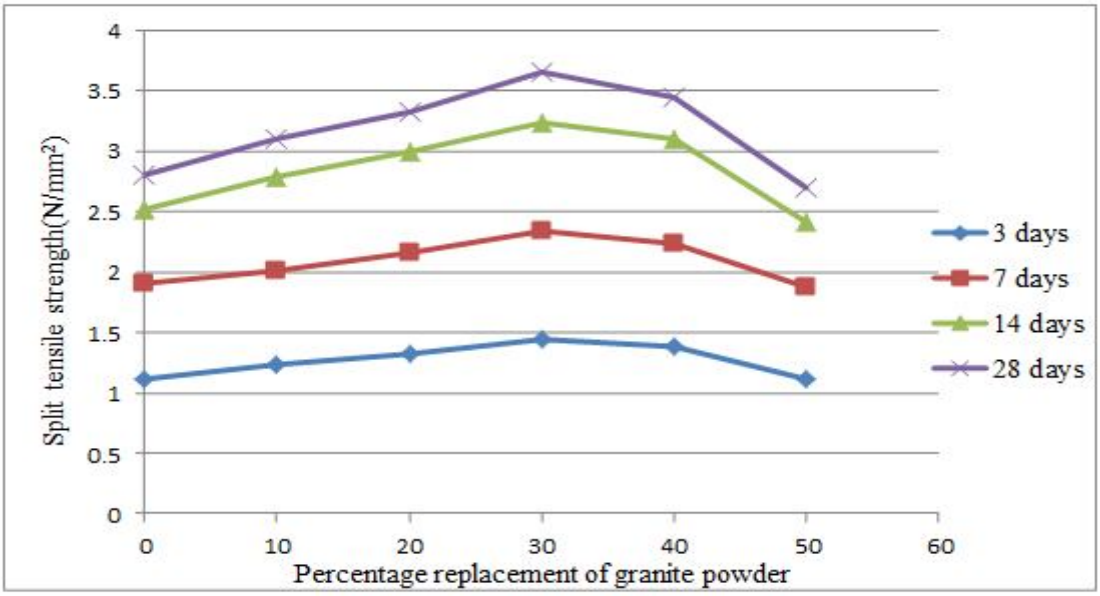

VI. CONCLUSIONS

A. *Summary*

The main aim of the present investigation was to study the strength and durability properties of ordinary and high strength concrete with the partial replacement of fine aggregate with granite powder with different percentages such as 0%,10%,20%,30%,40%and 50%.

B. *Ordinary concrete*

1) The maximum slump value is obtained at 30% replacement granite fines with replacement of fine aggregate. Further increases in percentage granite fines there is decrease in slump value.

2) The compressive strength is increased by 27.19% for 28 days curing with the use of 30 % replacement of fine aggregate with granite fines. Further increases in percentage there is decreases in strength but that value is greater than conventional concrete up to 40%replacement by using water cement ratio 0.50.

3) The split tensile strength is increased by 28.57% for 28 days curing with the use of 30 % replacement of granite fines in comparison to the strength of nominal concrete mix of without granite fines. Further increases in percentage there is decreases in strength but that value is greater than conventional concrete up to 40% replacement.

4) Based on the results the replacement of fine aggregate with granite fines up to 40%.But maximum strength is obtained at 30% replacement of granite fines.

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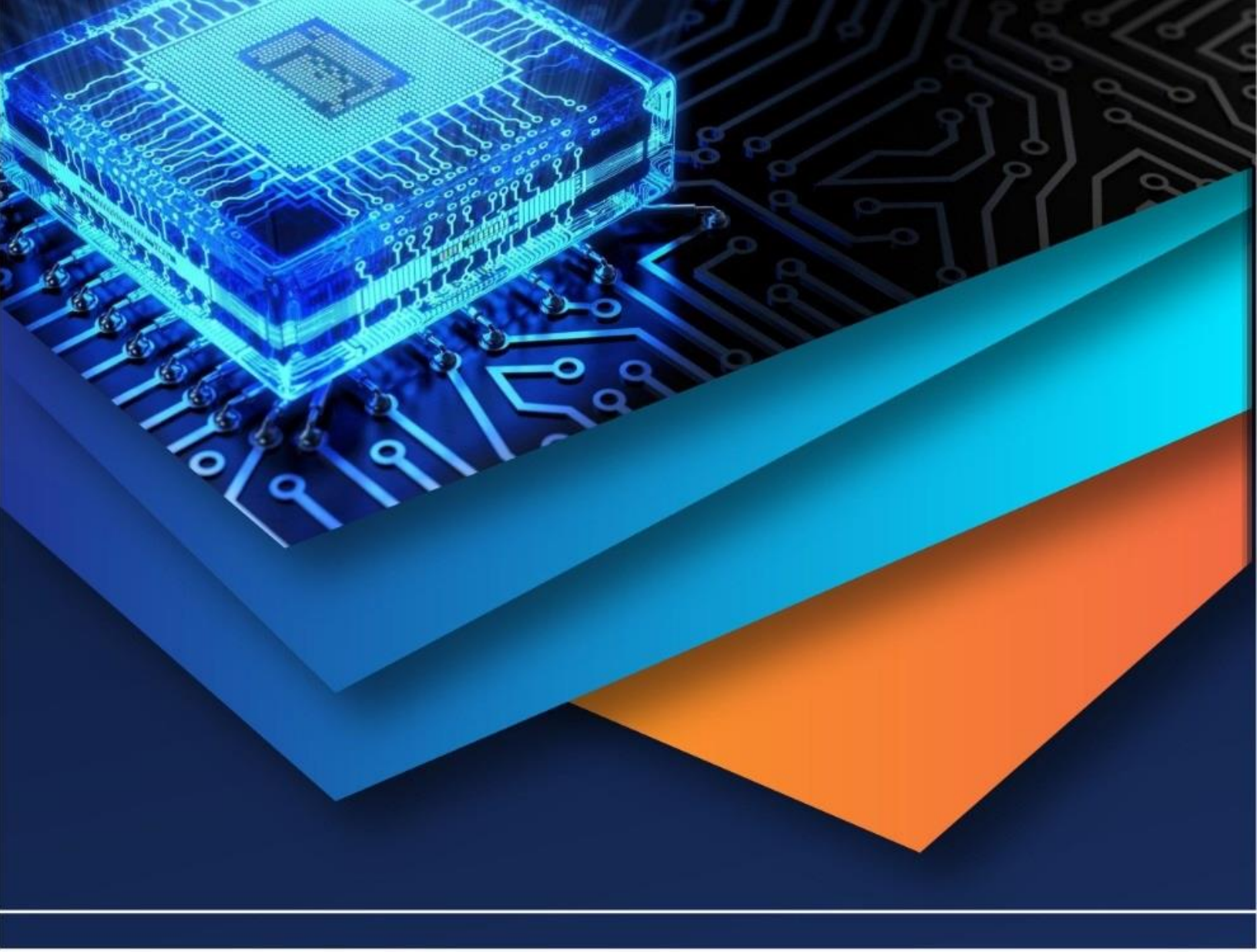

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