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To Study the Effect of Granite Powder on Concrete

Prof. S.S. Shinde¹, Ashwini D Chavan², Amruta P. Bhosale³, Dhanshree C. Gajankush⁴, Vaishnavi D. Dhage⁵, Akshay A. Desai⁶.

¹Asst.Prof, Department of Civil Engineering, Sanjay Ghodawat Institutes, Atigre 416118

^{2, 3, 4, 5, 6} Department of Civil Engineering, Sanjay Ghodawat Institutes, Atigre 416118

Abstract: Granite is an igneous rock which is widely used as a construction material in different forms. Granite industries produce lot of dust and waste material. The wastes from the granite polishing units are being disposed to environment which cause health hazard. This granite powder waste can be utilized for the preparation of concrete as partial replacement of sand. In order to explore the possibility of utilizing the granite powder as a partial replacement to sand, an experimental investigation has been carried out. The % of granite powder added by wt. to replace sand by wt. were 0, 10, 20, 30, 40, 50 & 100. This attempt has been done due to the exorbitant hike in price of fine aggregate and its limited availability.

Keywords: Granite powder, Compressive strength, Split tensile strength, optimal replacement percentage

I. INTRODUCTION

Concrete has been a leading construction material for over a century. Its annual global production is about 3.8 billion m³ - roughly 1.5 tonnes per capita according to data obtained from Portland Cement Association. Granite waste is an industrial waste which is obtained from the granite polishing industry in a powder form.

Fine aggregate is an essential component of concrete. 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.

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 utilisation of this waste.

A. What is granite

Granite is among the most plentiful rocks on earth. This intrusive igneous composite, formed by volcanic magma, makes up most of the continental crust. Anywhere you stand on dry land, granite is somewhere beneath your feet. It's also all around us in daily life. Granite has many uses in commercial construction and manufacturing, and has a long tradition in statues, headstones and carvings. The fabrication of granite produces large amounts of granite tailings, slurry and dust. These remainders are processed into powdered granite for several purposes.

II. AIM

A. To study the effect of granite powder on concrete.

III. OBJECTIVE

A. To study the effect of granite powder waste on the concrete mix.

B. To study the optimal percentage of granite powder to replace the river sand in the concrete mix by checking mechanical properties like compressive strength and split tensile strength of concrete.

C. To study the economy and social benefits of using the granite powder on the concrete mix.

IV. METHODOLOGY

A. Quantity Calculation

- 1) Cement = 370Kg/m³
- 2) Fine Aggregate = 841Kg/m³
- 3) Course Aggregate = 982Kg/m³
- 4) Water = 179Kg/m³

B. Procurement Of Material

- 1) Cement
- 2) Fine Aggregate
- 3) Course Aggregate
- 4) Granite Powder
- 5) Water

C. Casting of Specimens

- 1) Cube = 21
- 2) Cylinder = 21

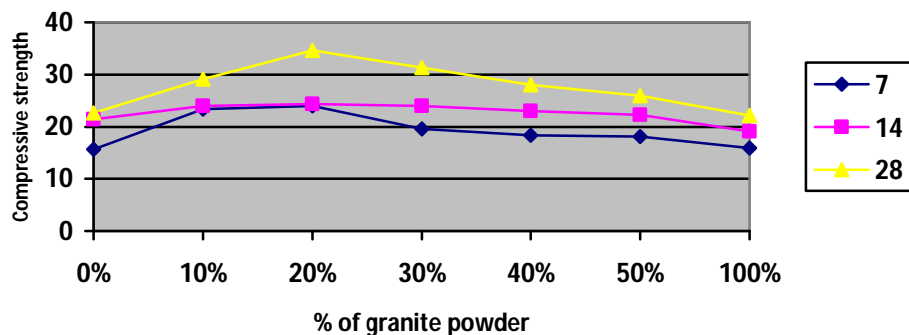
D. Testing

- 1) *Compressive Test:* Compression testing is a very common testing method that is used to establish the compressive force or crush resistance of a material and the ability of the material to recover after a specified compressive force is applied and even held over a defined period of time. Compression tests are used to determine the material behaviour under a load.

Compressive strength= load/cross sectional area

% Of Granite Powder	Compressive Strength MPa			Average Strength MPa
	7	14	28	
0%	15.68	21.38	22.61	19.89
10%	23.38	23.96	29.11	25.65
20%	23.92	24.36	34.66	27.64
30%	19.57	23.92	31.29	24.92
40%	18.34	22.95	28.02	23.10
50%	18.15	22.31	25.88	22.11
100%	15.92	19.04	22.15	19.03

Chart No. 1

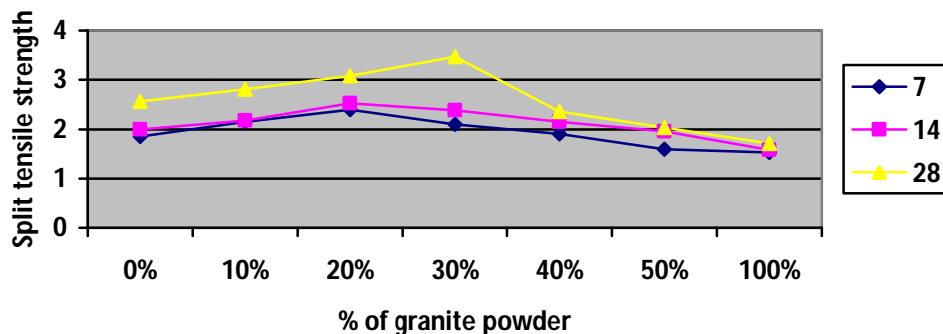


- 2) *Split Tensile Test*: The concrete is very weak in tension due to its brittle nature and is not expected to resist the direct tension. The concrete develops cracks when subjected to tensile forces. Thus, it is necessary to determine the tensile strength of concrete to determine the load at which the concrete members may crack.

Split tensile strength = load/cross sectional area

% Of Granite Powder	Split Tensile Strength MPa			Average Strength MPa
	7	14	28	
0%	1.85	2.00	2.56	2.13
10%	2.15	2.17	2.81	2.37
20%	2.39	2.53	3.08	2.67
30%	2.10	2.38	2.47	2.31
40%	1.90	2.15	2.36	2.13
50%	1.59	1.95	2.03	1.83
100%	1.53	1.58	1.71	1.60

Chart No.2



V. CONCLUSION

In this work ,natural sand is replaced by various % of granite powder (0% ,10% ,20%), to study effect of compressive strength ,split tensile strength. The following conclusions were observed from the above information. Granite powder on various properties of concrete. The following conclusions were observed from the above information.

- It is clearly seen that replacement of 10% granite powder with the river sand increases the compressive strength and split tensile strength of concrete.
- 20% replacement of granite powder does not produce increase in any strength but it helps to achieve the same strength as of plain concrete i.e. without adding granite powder.
- Further in increase in % of granite powder i.e. 30% decreases the strength but it reduces the actual strength of concrete which is not beneficial for any structure.

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