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Behavior of Concrete Blended With Granite Powder and Steel Fibers

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Summary: *Now a day the quality of natural sand is degrading and digging at higher depth in water ways leads to land sliding. To find a new building material in construction field which fulfill the construction requirements such as strength, characteristics, availability and cost. Indian construction industry is the second largest employer of the country after agriculture. It makes a significant contribution to the national economy. In construction sector concrete is used in tremendous quantity and it requires large quantity of natural river sand as fine aggregate. On other side Granite industry has grown significantly in the last decades. Accordingly, the amount of mining and processing waste has increased. In order to utilize stone waste effectively and also find alternative for natural aggregate used in concrete is our aim to cured out the harmful effect of stone waste and it's disposal. Alternative materials to prepare concrete. Therefore this paper presents the review of some research papers which uses locally available granite powder replacing fine aggregate. Research in this field and positive results of their research work are important to study further in the sustainable construction activities by using granite powder and steel fibers.*

Key Words: Concrete, Steel Fibers, Granite Powder, Compressive Strength, Flexural Strength, Split Tensile Strength, optimal entitlement

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I. Foreword

Concrete is one of the major construction materials utilized worldwide. Concrete is made usually from a properly proportioned mixture of cement, water, fine and coarse aggregates and often, chemical and mineral admixtures. Cement is the important binding material in concrete. Fine aggregate is an essential component of concrete. The global consumption of natural sand is very high due to the extensive use of concrete. In particular, the demand for natural sand is quite very high in developed countries owing to infrastructural growth. In this situation some developing countries are facing a shortage in the supply of natural sand. The non-availability of sufficient quantity of ordinary river sand for making cement concrete is affecting growth of the construction industry in many parts of the country. Therefore, the construction industries in developing countries are under stress to identify alternative materials to reduce the demand on river sand

II. Materials

2.1 Binding Material:

The binding material used in this study majorly consists of OPC 53 Grade at suitable proportions.

2.2 Granite Powder:

Granite is a common type of felsic intrusive igneous rock that is granular and phaneritic in texture. Granite can be predominantly white, pink and grey in color depending on their mineralogy. The average density of granite is between 2.65 to 2.75 g/cm^3. Granite powder, a waste material from the granite polishing industry, is a promising material for use in concrete similar to those of puzzolonic materials such as silica fume, fly ash, slag and others. These products can be used as a filter material to reduce the void content in concrete. Granite Powder gives good strength when it is used in concrete. 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. Granite powder preserves the natural resources of sand and also keeps these powder particles from being airborne into atmosphere causing health hazards to humans. Granite powder is available with free or less cost, since it is a waste material.

2.4 Coarse aggregate:

Material which is held on 4.75 mm or more strainer is known as a coarse total. It decreases the expense of cement, since it involves significant volume. The sythesis, shape and size of the total all have critical effect on the crisp, mechanical properties just as weight and shrinkage of the solid. The most extreme size of coarse total utilized in this undertaking is 20 mm and the spans of coarse total utilized are 10mm, 12.5mm and 20 mm individually.

S.No	Tests	Materials			
		Cement	F.A	Granite Powder	C.A
2.	Cement setting Time (Initial)	34 min.			
3.	Cement setting Time (Final)	525 Min.			
4.	Sp.Gravity	3.14	2.74	2.67	2.74
6.	Water Absorption				1%
7.	Bulking of sand		6%	6%	

Table No. 2.2

The above table speaks to the essential properties of the Course total and Fine total and is discovered that water retention, Sp.Gravity vales are inside the point of confinement when looked at standard qualities

III. Experimental Methods:

3.1 Mix Design

Receive Configuration blend for Evaluation of Cement M20 configuration by utilizing IS10262:2009 and IS 456:2000 code arrangements the following are the details.

Grade of Concrete : M_{30}
Mix Ratio : 1:1.50:2.4
Water-Cement Ratio : 0.465

IV. Results

To inspect the properties of New concrete and solidified Cement done different trials in the lab, such as Slump Cone test and compaction factor test to examine workability of Fresh concrete as well as Compressive strength, Split & Flexural strength tests to study about hardened concrete properties. The following are the details.

4.1 Compressive Strength:

Granite Powder (%)	Compressive Strength of Concrete (N/mm$^{2)}$		
	7 days	14 days	28 days
0%	26.67	33.34	34.23
5%	28.45	34.89	35.82
10%	29.34	35.30	37.34
15%	29.80	35.36	38.45
20%	32.71	38.71	41.60
25%	34.04	39.56	43.15
30%	32.89	38.89	41.80

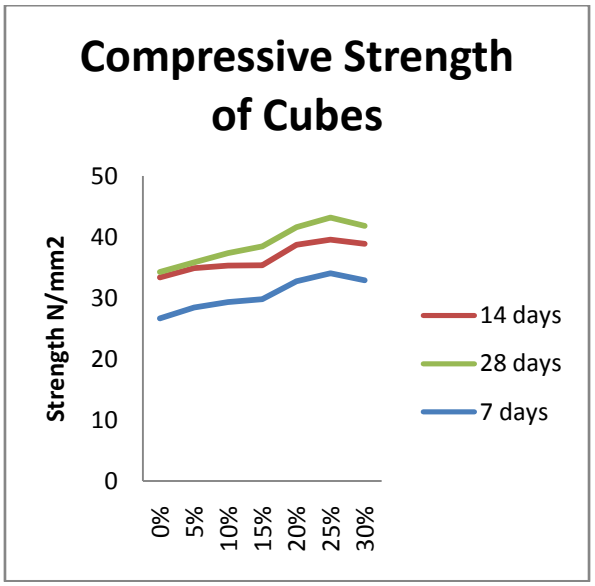

Fig No.4.1 Impact of Granite Powder on Compressive Strength of Matrix

The above diagram shows compressive strength outcomes for Traditional fine aggregate subbed with Granite Powder and discovered that compressive strength of Ordinary Matrix increment with 25% of Granite Powder.

Steel Fibers (%)	**Compressive Strength of Concrete (N/mm$^{2)}$**		
	7 days	**14 days**	**28 days**
0%	34.04	39.15	43.15
0.5%	34.89	40.46	44.68
1%	36.25	42.25	45.5
1.5%	38	43.12	48.25
2%	40	45.8	51.1
2.5%	37.5	42	48.68

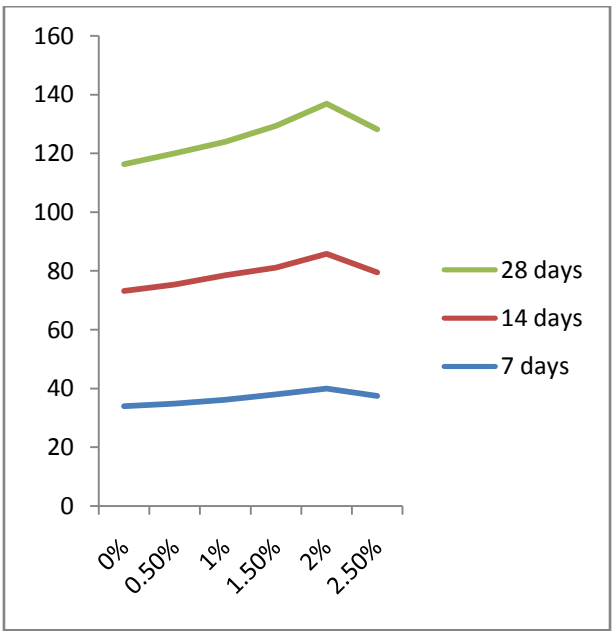

Fig No.4.2 Impact of Steel Fibers on Compressive Strength of Matrix

The above diagram shows Compressive strength results for Ordinary Concrete substituted with 25% of Granite powder**,** Steel Fibers. It is discovered that Compressive strength of Concrete rises up to 51.1 N/mm^2 with adding of 2% Steel Fibers further decrease if increases Steel Fibers value

4.2 Split Tensile Strength:

Granite Powder (%)	Split Tensile Strength of Concrete (N/mm$^{2)}$		
	7 days	14 days	28 days
0%	2.83	3.28	3.74
5%	2.90	3.39	3.89
10%	2.970	3.48	4.1
15%	3.04	3.88	4.31
20%	3.53	4.03	4.45
25%	3.96	4.17	4.95
30%	3.67	3.96	4.52

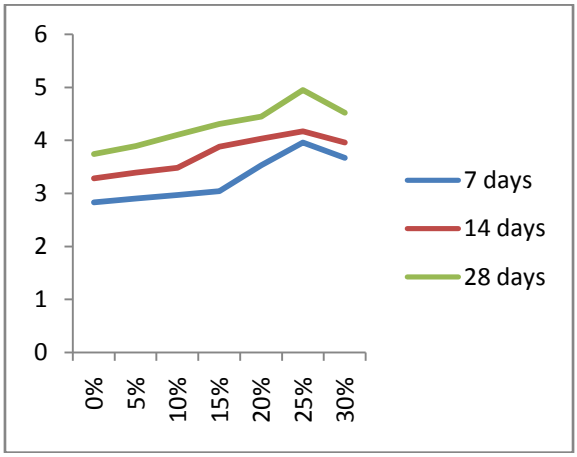

Fig No.4.3 Impact of Granite Powder on Split Tensile Strength of Matrix

The above diagram shows Split Tensile Strength outcomes for Traditional fine aggregate subbed with Granite Powder and discovered that Split Tensile strength of Ordinary Matrix increment with 25% of Granite Powder.

Steel Fibers (%)	Split Tensile Strength of Concrete (N/mm$^{2)}$		
	7 days	14 days	28 days
0%	3.46	3.89	4.24
0.5%	4.03	4.59	4.88
1%	4.59	4.81	5.24
1.5%	4.89	5.38	5.81
2%	5.66	5.95	6.45
2.5%	3.65	5.8	6.02

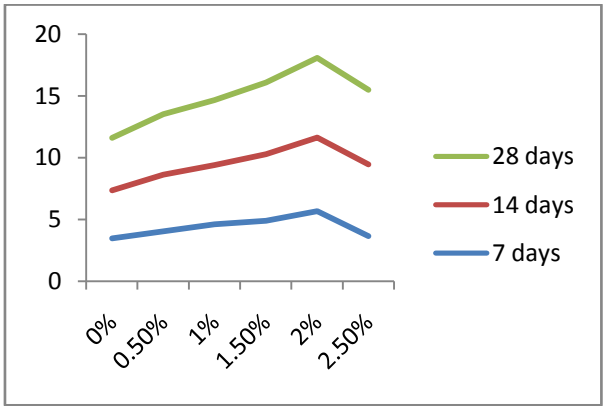

Fig No.4.4 Impact of Steel Fibers on Split Tensile Strength of Matrix

The above diagram shows Split Tensile strength results for Ordinary Concrete substituted with 25% of Granite powder**,** Steel Fibers. It is discovered that Split Tensile strength of Concrete rises up to 6.45 N/mm^2 with adding of 2% Steel Fibers further decrease if increases Steel Fibers value

4.3 Flexural Strength:

Granite Powder (%)	Flexural Strength of Concrete (N/mm$^{2)}$		
	7 days	14 days	28 days
0%	3.60	4.0	4.30
5%	3.70	4.2	4.70
10%	4.0	4.3	4.80
15%	4.2	4.5	5.0
20%	4.4	4.8	5.10
25%	4.7	5.0	5.30
30%	4.5	4.66	5.20

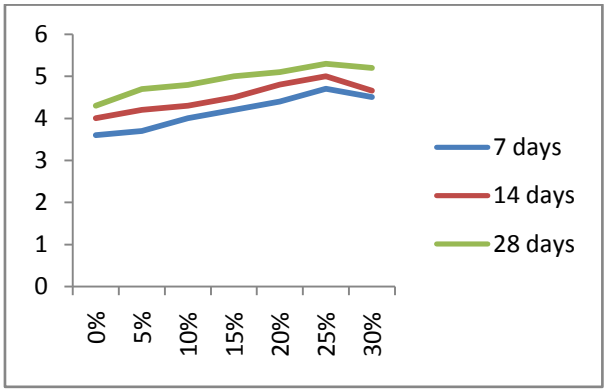

Fig No.4.5 Impact of Granite Powder on Flexural strength of Matrix

The above diagram shows Flexural Strength outcomes for Traditional fine aggregate subbed with Granite Powder and discovered that Flexural strength of Ordinary Matrix increment with 25% of Granite Powder.

Steel Fibers (%)	Flexural Strength of Concrete (N/mm$^{2)}$		
	7 days	14 days	28 days
0%	4.7	5.0	5.3
0.5%	5.1	5.8	6.2
1%	5.6	6.0	6.6
1.5%	6.2	6.4	7.0
2%	6.8	7.2	7.8
2.5%	6.4	7.0	7.2

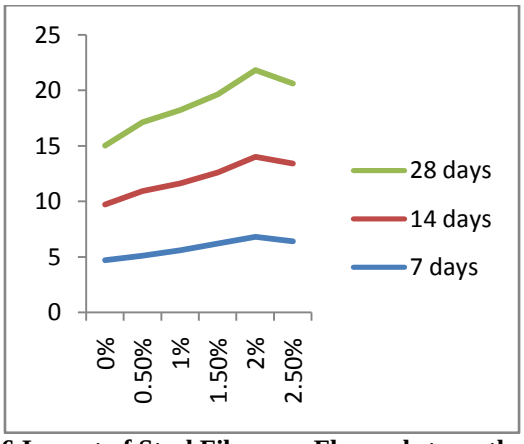

Fig No.4.6 Impact of Steel Fibers on Flexural strength of Matrix

The above diagram shows Flexural strength results for Ordinary Concrete substituted with 25% of Granite powder**,** Steel Fibers. It is discovered that Flexural strength of Concrete rises up to 7.80N/mm^2 with adding of 2% Steel Fibers further decrease if increases Steel Fibers value

V. Conclusions

The following conclusions are drawn from this investigation:

It is observed that the compressive strength and flexure strength of concrete can be improved by partial replacement of Granite Powder for fine aggregate.

From the above experimental results it is proved that, Granite Powder can be used as partial replacement for the natural sand, and the compressive and flexure strengths are increased as the percentage of Granite Powder is increased up to optimum level. The optimum percentage of replacement of natural sand by Granite Powder is 25%

Due to scarcity of natural sand and its high cost could encourage the adoption of Granite Powder by 25% replacement of natural sand.

The optimum percentage of Steel Fibers is 2% for getting maximum compressive strength and the maximum Compressive Strength obtained is 51.10N/mm^2.

The Split Tensile Strength increases with the increase in percentage of Steel Fibers as well as with 25% percentage of Granite Powder and the maximum Tensile Strength obtained is 6.45 N/mm^2.

The Flexural Strength also increases with the increase in percentage of Steel Fibers as well as with 25% percentage of Granite Powder and the maximum Flexural Strength obtained is 7.80 N/mm^2.

The maximum increase in Compressive Strength, Split Tensile Strength, and Flexural Strength is higher than compared to that of the conventional mix at the age of 28 days.

The percentage of increase in the compressive strength is **26.05%** and the flexure strength is **10.48%** at the age of 28 days by replacing 25% of natural sand with Granite Powder.

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