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Reusing Granite Dust As Sand Replacement

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***Abstract*—Now-a-days in construction industry we are having a basic need of sand and cement for designing purpose. The basic need out of sand and cement is of sand first as it is used to prepare the mud, while cement is used to mix the sand properly. As we see today the river sand is depleting day by day this is because of river erosions which also affect the environment. Due to erosion of river, there is a lack or shortage of river sand in the industry of construction. Now we have to find the substitute of river sand, so that river erosion is reduced and we can prevent the environment.**

There are so many research going on for finding the substitute of river sand, so we have find one major solution for this problem by replacing sand by graphite dust. If we use the graphite dust in different proportion then it will lead to a good concrete solution mixture. In this research paper we have explained the reusing of a graphite [1] dust as a sand replacement. It will explain the proper mechanism and the strength of the material that we are reusing as a substitute.

Keywords*—Granite-dust, strength and mechanism, sand replacement, eco-friendly, economical use.

I. INTRODUCTION

In today's era, construction of big building requires more sand and concrete. Construction industry is also developing with new technologies but sometimes these new technologies degrade our environment and leads to pollution. As we all now without the use of sand, cement and the aggregate we can't imagine of any construction. The main component of concrete is made of fine aggregate.

To reduce the erosion of rivers some state government has taken up the step to restrict the removal of sand from the rivers which will affect the environment. On other side there are too many wastes coming from industries government open some NGOs to collect those waste like graphite dust and used the waste in construction that is a substitute of river sand. Due to high quantity of waste from the industries will requires the disposal and arrangement at the right time. There is also a shortage of land for dumping the waste into the ground. This will also lead to high number of pollutions that occur through transportation [3] of waste from one place to another.

Now-a-days construction industry is using high quantity of wastes coming from industry like graphite dust which will be the best substitute for the fine aggregate. If we use these waste in our construction of building or roads then the cost of construction is reduced and it will meet our expectations. The price of river sand and natural sand is increasing day-by-day, so it's the responsibility of every citizen and government that we can find the substitute which will easily available and the cost is also very less so that everyone can afford.

In this research paper we have taken the waste quantity of graphite dust that will replace the river sand at an approx. M40 concrete grade.

II. EXPERIMENTAL DETAILS

A. Used Materials In Construction

- *Fine Aggregate*: The fraction aggregate of the granite is 6-8, 8-11, 11-16mm and we have taken sand according to PN-EN 12620:2004[3].
- *Cement:* Cement is taken into figure on the basic of CEM I 32,5 R & CEM I 42,5 R. For defining the properties of the used cement, we have taken the help from PN-EN 197-1 2012[2].
- *Granite Dust:* We have collected granite deust form the industry and its properties are well defined below:

	Specification	Value
1	Specific surface, m^2/kg	220 … 250
2	Bulk density, kg/m^3	920 … 970
3	Clay content, %	0,2 … 0.5
4	Humidity, %	0,3 … 0,5
5	Water soluble contaminants, %	none

Table 1. Properties of Granite Dust (physical & mechnaical)

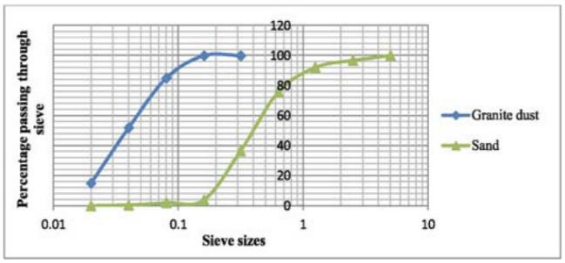

Fig 1. The distribution of the particle size of Granite dust.

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Mix	Component consumption, kg/m^3								
	CEM I 42,5 R	CEM I 32,5 R	Granite dust	Sand	Coarse aggregate (granite, fraction)			SP	Water
					6–8 mm	8–11 mm	11–16 mm		
42,5-G0	350	–	0	730	400	400	400	3,5	180
32,5-G0	–	350	0	730	400	400	400	3,5	180
42,5-G200	350	–	200	530	400	400	400	3,5	180
32,5-G200	–	350	200	530	400	400	400	3,5	180
42,5-G300	350	–	300	430	400	400	400	3,5	180
32,5-G300	–	350	300	430	400	400	400	3,5	180

Table 2. Mix proportion of Concrete

- *Superplasticizer*: Here we have used the MasterGlenium 115 that is completely depends on the ethers of polycarboxylic and having high performance.

B. *Experimental Methods*

We have designed that we have used in our project to demonstrate. We have studied the method that is used in current standards that is construction of the basic design and the difficult properties of technical ground to examine the use of mixture of concrete taking granite dust as a sample.

- *Compressive Strength*: We have define the compressive strength of the granite dust on the basic of specimens [4] defined in cubic. The formation of concrete took places by layer to layer While placing on a table known as vibrating table. We have to put this specimen as a steady for 1 complete day then pick it up and placed that into a box that is holding the humidity of approx. (96%) for testing. The obtained specimen's sample is tested and observed.

- *Absorption of Water*: For water absorption we have to take a specimen into (11 x 11 x 11 cm), it will keep steady for approx. 26 days having same humidity of 96% and then we took it out from the box and kept the specimen into the container that is known as bath container and filled it with water to some height.
  We have to wait for 1 complete day water is higher to 11mm. For testing we have to check on an average interval of 1 day take it out and weight the sample. After complete testing and observation when we see that the weight of specimen [13] is constant then we will dry the sample at 107^0 C.

- *Penetration of Water*: For penetration of water, we have to take a specimen of (16 x 16 x 16 cm). When the removing of moulds take place then the water surface to which pressure is given is cleaned with the brush. Kept it for 26-27 days and then put it in device to check the penetration of water apply the pressure at 520kPa for 70hrs. At a particular time, specimen break down and we have the testing result of penetration of water.

- *Consistency*: We have examined the consistency of the granite dust by using slump test. We have to design a shape of a cone in which the mixture of concrete is flow of the mould. So that we can check out the consistency of the granite dust when the mould is removed from the cone.

C. *Proportion Mixture of Concrete*

As we have already discussed in construction material that we have used two varieties of cements. Both the varieties of cement will be mixed in equal proportion. So, to examine the result of granite dust we have replace the river sand with granite dust in a quantity of 200kg/m^3 and 300kg/m^3. The mixture is concrete proportion is shown in Table 2.

III. Results And Discussion

A. *Compressive Strength*

For measuring the compressive strength of granite dust, we have designed our specimen into (16 x 16x 16 cm) with mixture of concrete.[5] We have given the specimen the normal humidity of 96% approx. and a temperature of about 22^0 C. We have determined the compressive strength upto 11 specimen samples at different time interval.

The test of compressive strength is observed by an instrument known as FormTest PRUFSYSTEME. All the observed result of the specimen sample is defined in Table 3. We have observed that granite dust will be having more strength than the river sand.

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Experimental results of the studied compositions of concrete mixtures.

Mix number	Slump cone, cm	Average density, kg/m^3	Compressive strength, MPa					Water penetration, mm	Water absorption, %
			3 days	7 days	28 days	90 days	180 days		
42,5-G0	12	2344	28,8	37,4	44,8	53,5	61,2	67	4,92
32,5-G0	11	2325	21,0	28,1	35,4	42,2	50,1	81	4,86
42,5-G200	16	2376	34,2	43,7	52,2	59,1	65,1	27	3,45
32,5-G200	15	2362	26,3	35,0	43,0	51,2	57,8	41	3,90
42,5-G300	15	2408	37,2	46,3	54,2	60,4	66,2	18	3,02
32,5-G300	14,5	2385	27,8	39,8	47,1	52,2	58,4	31	3,30

Table 3.

The size of the granite dust is much smaller than that of the river sand. Dur to which connection is established between the concrete and the granite dust and they make strong force, that's why compressive strength [12] of granite dust is stronger.

B. Consistency

We have tested the consistency of granite dust with the help of cone shape slump technique. The observed consistency is shown in diagram 2.

There will be a difference in the consistency of fresh and any other ordinary granite dust. This will be observed with the help of mixture concrete. There will be noise and the force that will be external in nature and it make the mixture as self-compacting.

As soon as we have added more 200kg/m^3 into the mixture of concrete of granite dust then the initial consistency slump will increase upto 16-17cm. On the other hands when we again add 200+100kg/m^3 then slump started reducing. The all examine data is shown in Table 3. This observation of consistency will result in the concrete density will tends to increase if we are adding more granite [6] dust into the mixture.

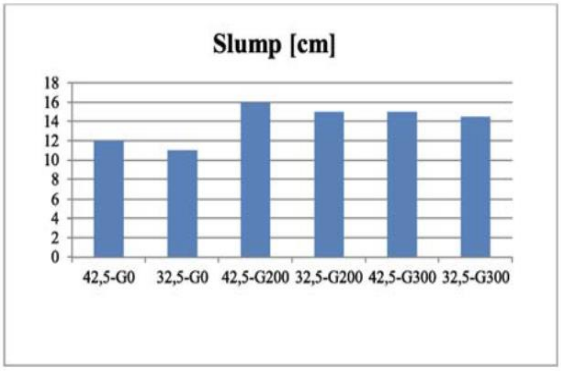

Fig 2. Concrete mixtures slump

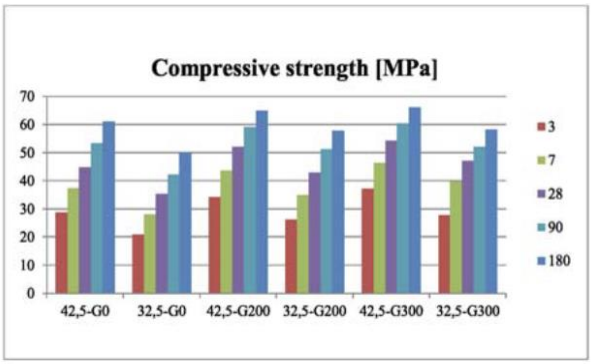

Fig 3. Compressive strength examined

C. Microstructure

We have observed the microstructure at the age of 28days. We have taken two samples to examine this 42,5-G0 & 42,5-G200 this will examine the microstructure [7] of granite dust with concrete. We have used a microscope know as JSM -5500 LV for scanning of granite dust at particular intervals.

We have seen with our naked eyes that a small particle of crystals and leads to a crystal with having belite and alite in it composition.

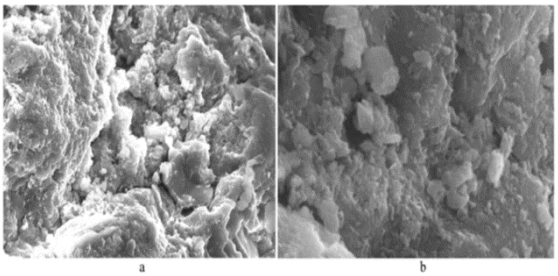

Fig 4. (a) Microstructure of concrete with granite dust.
(b) At age of 28 days

D. Absorption of Water

We have observed the specimens with (11 x 11 x 11 cm) this is done with approx. 4-5 cubes of specimens. We have placed for 1 month, then will examine the absorption

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of water by checking the weight before and after the specimen is completely drying.

While adding the dust of granite in the mixture of sand has a great water absorption concrete. We can reduce the absorption by adding sand into granite dust. By adding the dust of granite with 200kg/m^3 will reduce the absorption [8] property and also leads to reduce if we add more 300kg/m^3 granite dust to the mixture concrete.

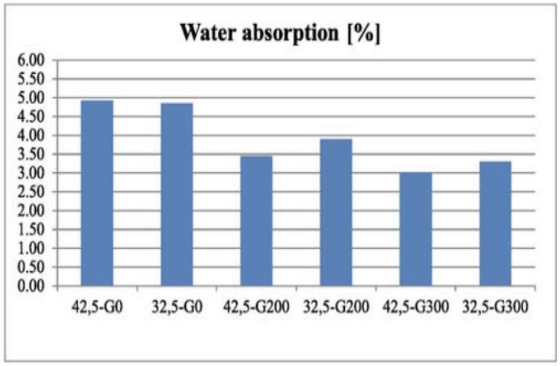

Fig 5. Water absorption

E. Penetration of Water

We have observed the specimens with (16 x 16 x 16 cm) this is done with approx. 6-7 cubes of specimens. We have placed for 1 month, then will examine the penetration [11] of water. Then we have put it in device to check the penetration of water apply the pressure at 520kPa for 70hrs. At a particular time, specimen break down and we have the testing result of penetration of water.

When we mix the granite dust having the lower capacity for penetration of water then volume of pore will start decreasing that will leads to low water penetration.

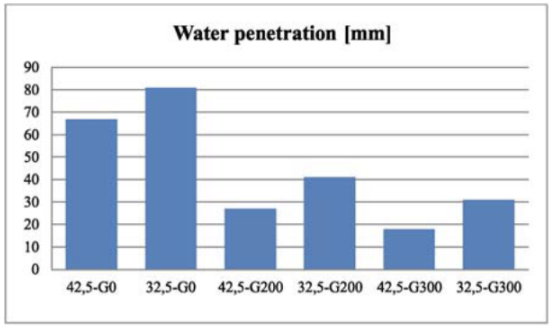

Fig 6. Penetration of Water

IV. CONCLUSION

We have observed and examine the test results of our testing while reusing the granite dust [10] as a substitute of sand. While using the granite dust it will lead to the increase in the development of construction industry and workability. It will also helpful in increasing the density of the mixture of concrete. From microstructure [9] view we came to a solution that smaller the crystal higher will be its crystallization process. Also helpful in increasing the compressive strength of the concrete mixture.

As we see today the river sand is depleting day by day this is because of river erosions which also affect the environment. Due to erosion of river there is a lack or shortage of river sand in the industry of construction. Now we have to find the substitute of river sand, so that river erosion is reduced and we can prevent the environment.

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