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Effect of Granite Dust & M-Sand on Strength Properties of Conventional Concrete

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Abstract: Concrete Industry is one of the most growing industry in all over world. It mainly consists of Cement, which gives the major impact on environment by producing CO_2, during cement production. The main aim of this study is to minimize CO2 emission, by producing an alternative cementitious material which can also reduce energy consumptions. Another, constituent material of concrete is Fine Aggregate. The scarcity of fine aggregate leads to developed its alternative material. As, we know India is one of the country which produces huge amount of dimensional stone and it is found locally very easily and abundantly, we aim to use this stone in place of cement as well as fine aggregate. In this work, we used Granite dust as partial replacement of cement at various replacement percentage ranging from 0%,5%,10%,15% & 20%. Alongside, we used M-Sand with a variation percentage 0%,10%,20%,30%,40%,50% & 100%. To understand the fresh properties of concrete, Slump Cone Test, V-Bee Test & Compaction Factor test was performed. To determine the hardened properties of concrete, Compressive Strength, Density, Water Absorption, Flexure Test & Split Tensile Strength were performed. Test results showed that concrete with high M-Sand content provides better results than controlled concrete and Granite powder can be used up to 10% with suitable M-Sand replacements.

Keywords: Granite Dust, Manufacturing Sand, M-30, Fresh Properties, Hardened Properties Introduction

I. INTRODUCTION

Concrete is the basic ingredient for the construction industry for its low cost other than any material. Concrete industry uses the most natural resources, which is high energy consuming, inversely give impact on environment. Cement industry contributing the most in emission of CO_2. Fine aggregate is another strength increasing component of concrete. The commonly used fine aggregate is natural river sand. The consumption of natural river sand is very high due to the extensive use of concrete and the demand of natural river sand is high in countries owing to growth of the country. 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. Manufactured sand (MS) is an approach to improve natural resource efficiency. India is having abundant productivity of dimensional stones. Namely, Granite & Marble are the most used stones in country. Marble is having lesser strength than granite. In this, study we used, Granite powder and M-Sand, which is produced from Granite Stone. Granite powder obtained during cutting stage. It is a waste product. We aimed to developing two new alternative material, which can be used in residential work also locally available, economical and don’t compromise with the strength also. The objective of reduction of cost of construction can be met and it will help to overcome the problem associated with its disposal including the environmental problems of the region.

II. LITERATURE REVIEW

Felix Kala and Partheeban [1] scrutinized the utilization of granite powder as fine aggregate in high performance concrete. In their study, the fine aggregate was replaced with the granite powder. Of all the mixtures considered, concrete with 25% Granite Powder (GP25) was found to be superior to other mixtures. Mechanical properties such as compressive strength, split tensile strength and modulus of elasticity in all the ages at both curing temperature of 32oC and 38oC were higher than that of the reference mix. There was an increase in strength as the days of curing increased.

The result suggested that the proper use of the granite powder could produce high performance concrete. At any rate both granite stone and granite powder in concrete are the best choice, where they are available. Shewaferaw Dinku Belay [2] found that the hardened properties of the concrete mixes with partial replacement of natural sand with manufactured sand achieved higher compressive strength.

Using manufactured sand in partial or full replacement to natural sand does not cause any significant cost variation. He also stated that the use of manufactured sand is more suitable for high strength concrete production. Prakash Rao and Giridhar Kumar [3] inferred that the concrete cubes with crusher dust developed about 17% higher strength in compression, 7% more split tensile strength and 20% more flexural strength than the concrete cubes and beams with river sand as fine aggregate. Logan Andrew Thomas [4] concluded that at the age of 28 and 56 days, specimen moist cured for 7 days exhibited the highest compressive strength and elastic modulus.

Among the three different curing methods, 1-day heat curing generally resulted in the lowest strength. The continually moist-cured specimens which were never allowed to dry out exhibited modulus of rupture values in some cases twice as great as the values attained from the 7-day moist-cured specimens.

The equation published in ACI 363R-92 provided a good estimate of the modulus of rupture and the elastic modulus regardless of the curing method or the compressive strength. The average Poisson's ratio measured from the test specimens was 0.17 which is within the range generally assumed for normal-strength concrete (0.15 - 0.25).

This finding suggests that it is adequate to use the same Poisson's ratio for HSC as that of normal strength concrete. Felix Kala [5] experimentally investigated the use of locally available granite powder as fine aggregate and partial replacement of cement with admixtures in the production of HPC with 28 days strength to the maximum of 60 MPa. The influence of the water cement ratio and curing days on mechanical properties for the new concrete mixes were premeditated.

The percentage of granite powder added by weight was 0, 25, 50, 75 and 100 % as a replacement of sand used in concrete and cement was replaced with 7.5 % silica fume, 10 % fly ash, 10 % slag and the dosage of superplasticiser added 1 % by weight of cement. The test results show clearly that granite powder as a partial sand replacement has beneficial effects on the mechanical properties of high performance concrete. Of all the six mixtures considered, concrete with 25 % of granite powder (GP25) was found to be superior to other percentages of granite powder concrete as well as conventional concrete and no admixtures concrete for all operating conditions.

Hence the following conclusions are made based on a comparison of GP25 with the control concrete, CC. The mechanical properties like the compressive strength, split tensile strength, modulus of elasticity and flexural strength, particularly for all ages higher than that of the reference mix, CC as mentioned below. There was an increase in strength as the days of curing increased. Compressive strength is 6.12 to 22.14 % greater than that of CC. Split tensile strength is 14.88 to 21.95 % higher than that of CC. Modulus of elasticity is 8.85 to 18.89 % higher than that of CC.

Flexural strength is 12.5 to 22.22 % higher than that of CC. The water absorption was about 8 to 14.2 % less than that of conventional concrete mixture. Prince Arulraj et al.[6] carried out an experimental investigation on use of granite powder as an alternative material for fine aggregate in concrete production.

The percentages of granite powder added by weight to sand by weight were 0, 5, 10, 15, 20 and 25. To improve the workability of concrete 0.5 % Superplasticiser was added. This attempt has been done due to the exorbitant hike in the price of fine aggregate and its limited availability due to the restriction imposed by the government of Tamil Nadu. Fifty four cubes and 36 cylinders were cast. Compressive strength and split tensile strength were found.

The test results indicate that granite as replacement sand with granite powder has a beneficial effect on the mechanical properties such as compressive strength and split tensile strength of concrete. Balamurugan MR [7] examined the possibility of using stone waste as replacement of Pozzolana Portland Cement in the range of 5%, 10%, 30%, 40% and 50% by weight of M 25 grade concrete.

They reported that stone waste of marginal quantity as partial replacement to the cement had beneficial effect on the mechanical properties such as compressive strength values for 7, 14, 28 days were less than the ppc cement.

The literature survey encompasses many studies with partial replacement of natural river sand with M-Sand and partial replacement of cement by granite powder. But , there is no significant research on using both as an alternative material. This research work enlightenment that work.

III. EXPERIMENTAL PROCEDURE

A. Materials

In this study, Ordinary Portland cement was used and replaced partially with granite dust at various percentages which were 0%, 5%,10%,15% & 20% by weight of cement properties are listed in Table-1. It has been observed that 50% of particles had a diameter of 7µm and 90% of particle had a diameter lower than 50 µm and a specific gravity of 2.55. The value of Blaine fineness was 1.50m^2/g. The concrete mixture consisted of natural river sand, Coarse aggregate & Manufacturing Sand. The cement to water ratio of 0.40 was maintained in all batches and Admixture dosage were changed to maintain the same workability.

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TABLE – I CEMENT PROPERTIES

Parameters	Results Obtained	Requirement as per IS 269	Parameters	Results Obtained	Requirement as per IS 8112
Physical Analysis			Chemical Composition		
Normal Consistency	27%		Loss on Ignition (% by mass)	1.8	Not More than 5.0%
Fineness	285 m^2 / kg	225 (Minimum)			
Setting Time (Minutes)			Magnesia (MgO) (% by mass)	0.9	Not More than 6.0%
Initial	125	30(Minimum)			
Final	280	600(Maximum)	Sulphuric Anhydride (SO3) (% by Mass)	2.7	Not More than 3.5%
Compressive Strength (MPa)					
72 ± 1h (3 Days)	32.2	23.0 (Minimum)	Chloride Content (% by Mass)	0.021	Not More than 0.1% (for general purpose) & not more than 0.05% for pre-stressed structures
168 ± 2h (7 Days)	41.1	33.0 (Minimum)			
672 ± 4h (28 Days)	56.3	43.0 (Minimum)	Insoluble Residue (% by mass)	0.4	Not More than 5%
Soundness					
Le-Chatelier Expansion (mm)	1.0	10.0 (Maximum)	*Specific Gravity of Cement is = 3.15		
Auto-Clave Expansion (%)	0.08	0.8 (Maximum)			

TABLE –II PERCENTAGE PASSING VALUES FOR COARSE AGGREGATE

IS Sieve Size	Cumulative % Passed	% passing for grading Zone-III (IS-383,Table-4)	Cumulative % weight Retained
12mm	100	100	0
10mm	89.57	85-100	10.43
4.75mm	9.77	0-20	90.23
2.36mm	4.78	0-5	95.22

TABLE –III PERCENTAGE PASSING VALUES FOR FINE AGGREGATE

IS Sieve Size	Cumulative % Passed	% passing for grading Zone-II (IS-383,Table-4)	Cumulative % weight Retained
4.75mm	96	90-100	4
2.36mm	91	85-100	9
1.18mm	81	75-100	19
600micron	66	60-79	34
300micron	18	12-40	82
150micron	2	0-10	98
	Fineness modules 2.46		246

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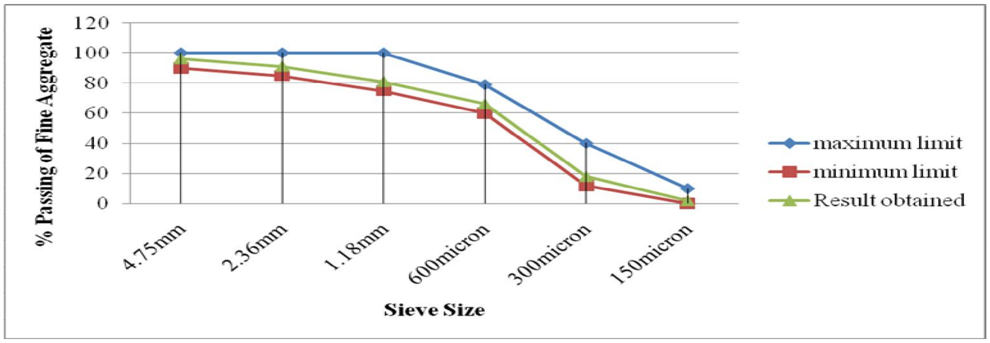

Fig-1 Gradation curve of Fine Aggregate

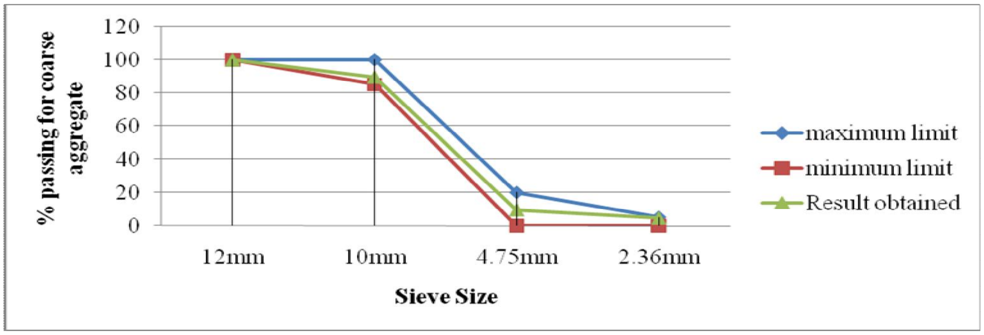

Fig-2 Gradation curve of Coarse Aggregate

Table IV Percentage Passing Values For Manufacture Sand

IS Sieve Size	Cumulative % Passed	% passing for grading Zone-II (IS-383,Table-4)	Cumulative % weight Retained
4.75mm	93	90-100	7
2.36mm	89	75-100	11
1.18mm	68	55-90	32
600micron	44.9	35-59	60
300micron	22.6	8-30	77.4
150micron	9.5	0-10	90.5

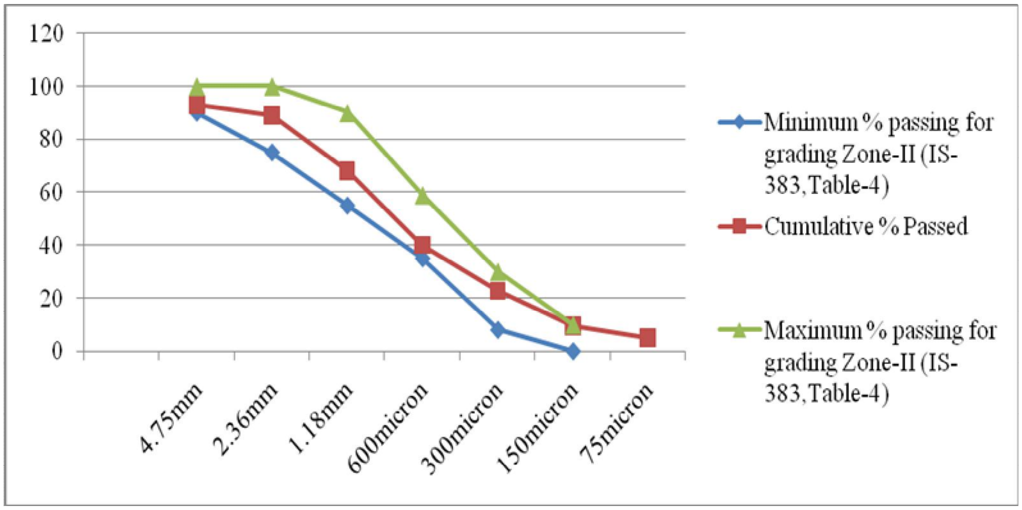

Fig-3 Gradation curve of Manufacturing Sand

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Table V Physical & Chemical Properties Of Manufacturing Sand

Bulk density	1505.0 kg/m3
Close packing density	1728 kg/m3
Apparent density	2647.8 kg/m3
Bulk voidage	43.14%
Crushing value	15.54%
Powder content	4.9%
Clay lump content	0.4%
Fineness modulus	2.69

B. *Mixture Proportions & Test Specimens*

Total Five series were casted. In each series, 6 replacements were done. In First series, Granite Powder percentage kept at 0% and M-Sand percentages are varying 10%, 20%, 30%, 40%, 50% & 100%. In Second series Granite Powder percentage increased up to 5% and M- Sand replacement percentages are kept same. In further series, Granite powder increased up to 20% with an interval of 5%. Mix design were done as per IS: 10262 along with IS: 456 guidelines. The compressive strength tests were performed at 7 days & 28 days on 150mm x 150mm x 150mm Cube, the flexural strength test was done on 100mm x 100mm x 500mm Beam at 28 days after curing, in accordance with IS: 516. Split Tensile Strength was done cylinder having diameter 150mm and length 300mm, tested after 28 days, in accordance with IS: 5916. The values are provided in the result table are average of 3 values. The maximum load at failure was recorded for each specimen.

TABLE VI MIX DESIGN FOR 1 CUM CONCRETE

Mix No	Cement	Replacement By GP	GP Qty (kg)	Cement Qty (Kg)	Fine Agg	Rep By M-Sand	M-Sand Qty	FA Qty	CA Qty	SP	W/C
SCC M0	402.5	0%	0	402.5	703.45	0.000	0	703	1183	1.0	0.4
SCC M1	402.5	0%	0	402.5	703.45	10%	70.345	633	1183	1.0	0.4
SCC M2	402.5	0%	0	402.5	703.45	20%	140.69	563	1183	1.0	0.4
SCC M3	402.5	0%	0	402.5	703.45	30%	211.035	492	1183	1.0	0.4
SCC M4	402.5	0%	0	402.5	703.45	40%	281.38	422	1183	1.0	0.4
SCC M5	402.5	0%	0	402.5	703.45	50%	351.725	352	1183	1.0	0.4
SCC M6	402.5	0%	0	402.5	703.45	100%	703.45	0	1183	1.0	0.4
SCC M110	402.5	5%	20.125	382.375	703.45	10%	70.345	633	1183	1.2	0.40
SCC M111	402.5	5%	20.125	382.375	703.45	20%	140.69	563	1183	1.2	0.40
SCC M112	402.5	5%	20.125	382.375	703.45	30%	211.035	492	1183	1.2	0.40
SCC M113	402.5	5%	20.125	382.375	703.45	40%	281.38	422	1183	1.2	0.40
SCC M114	402.5	5%	20.125	382.375	703.45	50%	351.725	352	1183	1.2	0.40
SCC M115	402.5	5%	20.125	382.375	703.45	100%	703.45	0	1183	1.2	0.40
SCC M210	402.5	10%	40.25	362.25	703.45	10%	70.345	633	1183	1.4	0.40
SCC M211	402.5	10%	40.25	362.25	703.45	20%	140.69	563	1183	1.4	0.40
SCC M212	402.5	10%	40.25	362.25	703.45	30%	211.035	492	1183	1.4	0.40
SCC M213	402.5	10%	40.25	362.25	703.45	40%	281.38	422	1183	1.4	0.40
SCC M214	402.5	10%	40.25	362.25	703.45	50%	351.725	352	1183	1.4	0.40
SCC M215	402.5	10%	40.25	362.25	703.45	100%	703.45	0	1183	1.4	0.40

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TABLE VI MIX DESIGN FOR 1 CUM CONCRETE

Mix No	Cement	Replacement By GP	GP Qty (kg)	Cement Qty (Kg)	Fine Agg	Rep By M-Sand	M-Sand Qty	FA Qty	CA Qty	SP	W/C
SCC M310	402.5	15%	60.375	342.125	703.45	10%	70.345	633	1183	1.6	0.40
SCC M311	402.5	15%	60.375	342.125	703.45	20%	140.69	563	1183	1.6	0.40
SCC M312	402.5	15%	60.375	342.125	703.45	30%	211.035	492	1183	1.6	0.40
SCC M313	402.5	15%	60.375	342.125	703.45	40%	281.38	422	1183	1.6	0.40
SCC M314	402.5	15%	60.375	342.125	703.45	50%	351.725	352	1183	1.6	0.40
SCC M315	402.5	15%	60.375	342.125	703.45	100%	703.45	0	1183	1.6	0.40
SCC M410	402.5	20%	80.5	322	703.45	10%	70.345	633	1183	1.8	0.40
SCC M411	402.5	20%	80.5	322	703.45	20%	140.69	563	1183	1.8	0.40
SCC M412	402.5	20%	80.5	322	703.45	30%	211.035	492	1183	1.8	0.40
SCC M413	402.5	20%	80.5	322	703.45	40%	281.38	422	1183	1.8	0.40
SCC M414	402.5	20%	80.5	322	703.45	50%	351.725	352	1183	1.8	0.40
SCC M415	402.5	20%	80.5	322	703.45	100%	703.45	0	1183	1.8	0.40

C. Experimental procedures

1) Fresh Properties

Concrete slump test is to determine the workability or consistency of concrete. The slump is carried out as per procedures mentioned in IS: 1199 – 1959. The mould for the test is in the form of the frustum of a cone having height 30 cm, bottom diameter 20 cm and top diameter 10 cm. The tamping rod is of steel 16 mm diameter and 60cm long and rounded at one end. The internal surface of the mould was cleaned and oil applied. Than the mould was placed on a smooth horizontal non- porous base plate. Mould was filled with the prepared concrete mix in 4 approximately equal layers. Each layer has been tempted with 25 strokes of the rounded end of the tamping rod in a uniform manner over the cross section of the mould. For the subsequent layers, the tamping should penetrate into the underlying layer. Excess concrete removed and surface leveled. Raised the mould from the concrete immediately and slowly in vertical direction. Measured the slump as the difference between the height of the mould and that of height point of the specimen being tested.

Compaction factor test is the workability test for concrete conducted in laboratory. The compaction factor is the ratio of weights of partially compacted to fully compacted concrete. Compaction factor apparatus consists of trowels, hand scoop (15.2 cm long), a rod of steel or other suitable material (1.6 cm diameter, 61 cm long rounded at one end) and a balance. Concrete sample has been placed gently in the upper hopper to its brim using the hand scoop and leveled it. After covering the cylinder, trapdoor has been opened at the bottom of the upper hopper so that concrete fall down into the lower hopper. Opened the trapdoor of the lower hopper and allowed the concrete to fall into the cylinder below. Weight the cylinder with concrete to the nearest 10 g. This weight is known as the weight of partially compacted concrete (W1). Empty the cylinder and then refill it with the same concrete mix in layers approximately 5 cm deep, each layer being heavily rammed to obtain full compaction. Level the top surface. Weigh the cylinder with fully compacted. This weight is known as the weight of fully compacted concrete (W2).Find the weight of empty cylinder (W).

The Vee-Bee test gives an indication about the mobility and the compactibility aspect of the freshly mixed concrete. The Vee-Bee test apparatus consist of a Vee-Bee consistometer as per IS: 119 – 1959, Initially the sheet metal slump cone is placed inside the cylinder container that is placed in the consistometer. The cone is filled with four layers of concrete. Each concrete layer is one fourth the height of the cone. Each layer after pouring is subjected to twenty-five tamping with the standard tamping rod. The tamping is done with the rounded end of the rod. The strokes are distributed in uniform manner. This must be done in such a way theta the strokes conducted for the second and the subsequent layers of concrete must penetrate the bottom layers. Once the final layer has been placed and compacted, the concrete is struck off to make it in level with the help of a trowel. This makes the cone to be exactly filled. fter the preparation of the concrete cone, the glass disc attached to the swivel arm is moved and is placed on the top of the slump cone placed inside the cylindrical container. The glass disc has to be placed such that it touches the top of the concrete level and the reading is measured from the graduated rod. Now the cylindrical cone is removed immediately by raising the cone slowly in the vertical direction. The transparent disc on the top of the concrete is placed down to the new position and the reading is determined. The difference in the values measured . Now the electrical vibrator is switched on and at the same time we have to start the stop watch. The concrete is allowed to spread out in the cylindrical container. Until the concrete is remolded the vibration is continued. This stage is when the surface of the concrete becomes horizontal and the concrete surface completely adheres uniformly to the transparent disc. The time required for complete remolding in seconds is recorded. This time in seconds gives us the measure of workability of the fresh concrete. This time is expressed in Vee-Bee seconds.

D. Hardened Properties

Compressive strength test was done as per IS: 516-1959. Compressive strength of concrete cube test provides an idea about all the characteristics of concrete. This concrete is poured in the mould and tempered properly so as not to have any voids. After 24 hours these moulds are removed and test specimens are put in water for curing. The top surface of these specimen should be made even and smooth. This is done by putting cement paste and spreading smoothly on whole area of specimen. These specimens are tested by compression testing machine after 7 days curing or 28 days curing. Load should be applied gradually at the rate of 140 kg/cm2 per minute till the Specimens fails. Load at the failure divided by area of specimen gives the compressive strength of concrete.

Flexural test was done as per IS: 516-1959.Flexural test evaluates the tensile strength of concrete indirectly. It tests the ability of unreinforced concrete beam or slab to withstand failure in bending. It should be noticed that, the modulus of rupture value obtained by center point load test arrangement is smaller than three-point load test configuration by around 15 percent. Moreover, it is observed that low modulus of rupture is achieved when larger size concrete specimen is considered. Furthermore, modulus of rupture is about 10 to 15 percent of compressive strength of concrete. It is influenced by mixture proportions, size and coarse aggregate volume used for specimen construction.

Tensile strength was done as per IS: 5816-1970.The tensile strength of concrete is one of the basic and important properties. Splitting tensile strength test on concrete cylinder is a method to determine the tensile strength of concrete. 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.

IV. RESULT & DISCSSION

A. Fresh Properties

TABLE VII WORKABILITY PROPERTIES

Mix ID	GP Powder (%)	M-Sand (%)	Slump Value (mm)	Compaction Factor Test	Vee-Bee Test (Sec)
SCCM0	0%	0%	60	0.91	8.2
SCC M1	0%	10%	56	0.905	8.65
SCC M2	0%	20%	49	0.9	8.85
SCC M3	0%	30%	41	0.896	8.95
SCC M4	0%	40%	32	0.89	9.15
SCC M5	0%	50%	26	0.886	9.55
SCC M6	0%	100%	19	0.891	9.9
SCC M110	5%	10%	53	0.9	9
SCC M111	5%	20%	46	0.895	9.2
SCC M112	5%	30%	38	0.891	9.3
SCC M113	5%	40%	29	0.885	9.5
SCC M114	5%	50%	23	0.881	9.9
SCC M115	5%	100%	16	0.875	9.13
SCC M210	10%	10%	48	0.885	10.1
SCC M211	10%	20%	41	0.88	10.3
SCC M212	10%	30%	33	0.875	10.7
SCC M213	10%	40%	24	0.872	11.2
SCC M214	10%	50%	18	0.868	11.4
SCC M215	10%	100%	11	0.86	11.7

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SCC M310	15%	10%	44	0.85	13.1
SCC M311	15%	20%	36.5	0.845	13.7
SCC M312	15%	30%	28	0.838	13.9
SCC M313	15%	40%	19	0.82	14.3
SCC M314	15%	50%	13	0.81	15.1
SCC M315	15%	100%	6	0.8	16.5
SCC M410	20%	10%	40	0.78	19.1
SCC M411	20%	20%	31	0.7	19.7
SCC M412	20%	30%	22	0.7	21.5
SCC M413	20%	40%	13	0.67	22.7
SCC M414	20%	50%	6	0.65	23.5
SCC M415	20%	100%	2	0.6	25.6

Slump Test is important to measure workability of fresh concrete. Very dry mixes having slump 0 – 25 mm are typically used in road making, low workability mixes having slump 10 – 40 mm are typically used for foundations with light reinforcement, medium workability mixes with slump 50 – 90 mm, are typically used for normal reinforced concrete placed with vibration. We have designed to get slump of medium workability with 50mm-90mm. However, for control mix, 10% replacement of M-Sand with 0% GP and 5% GP with 10%M-Sand, we have achieved our desired slump. Other mixes are shown a sign of low workability, which can be used for foundation with light reinforcement.

Compacting factor tests are the most widely used workability tests for concrete. The degree of workability of concrete depends on the values of test results obtained from slump test and compacting factor tests. We have aimed to get a compaction factor value between 0.90-0.935. Which is having medium workability. It shows almost the same pattern shows in slump flow. For, control mix, 10% replacement of M-Sand with 0% GP and 5% GP with 10%M-Sand the CF results are 0.91, 0.905 & 0.90.Which satisfy the requirement of Normal reinforced concrete manually compacted and heavily reinforced sections with vibration. For 0.85-0.87 CF Group, we can use this as Roads, vibrated by hand-operated machines. Concrete may be manually compacted in roads using aggregate of rounded or irregular shape. Mass concrete foundations without vibration or lightly reinforced sections with vibration. For 0.78-0.80 CF, Roads vibrated by power-operated machines. At the more workable end of this group, concrete may be compacted in certain cases with hand-operated machines.

The workability of fresh concrete is a composite property, which includes the diverse requirements of stability, mobility, Compactability, Placeability and Finishability. There are different methods for measuring the workability. Each of them measures only a particular aspect of it and there is really no unique test, which measures workability of concrete in its totality. This test gives an indication of the mobility and to some extent of the Compactibility of freshly mixed concrete. Our results indicate that the concrete is ranging from semi stiff to stiff.

B. Hardened Properties

The compressive strength of concrete, commonly considered to be its most important characteristic, also gave good overall of the quality of the concrete and the structure of the hydrated cement paste. Table shows the calculated average result from 3 specimens at 7 days and 28 days of compressive strength and 28 days of split tensile strength along with 28 days of flexure strength. Figure, illustrates the test results of the compressive strength of concrete with a 0% replacement of Granite powder along with various replacement percentage of M-Sand compared to the control that does not contain GP & M-Sand. As expected, the replacement of the M-Sand affected the compressive strength at 7 days & 28 days. At 28 days, It gives best result 30% replacement and gives less value at 100% replacement. However at 40% replacement level it shows a good result. After, 30% replacement at every 10% replacement, the percentage reduction is 5% and it’s continued up to 100%.At, 5% Replacement of cement by GP, with 30% replacement of M-Sand , provides high strength.

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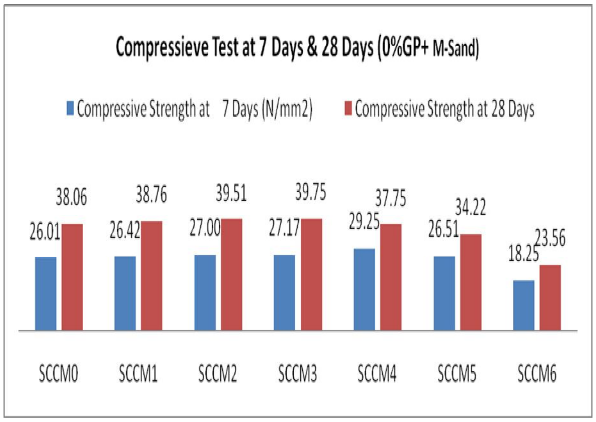


Figure: 4 (a)

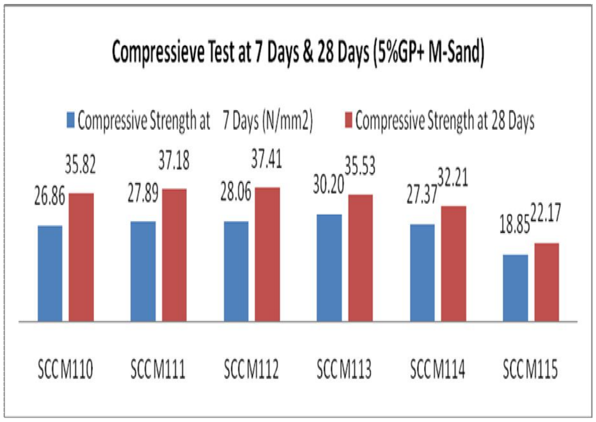


Figure: 4 (b)

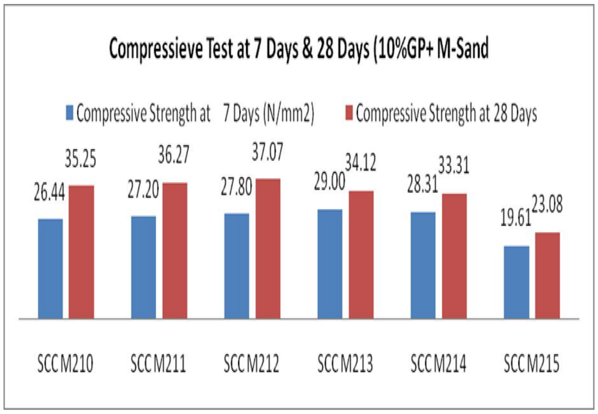


Figure: 4 (c)

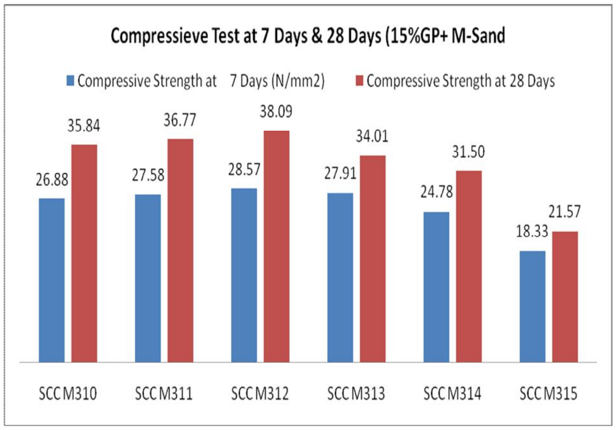


Figure: 4 (d)

Figure: 4 (a, b. c ,d & e) shows compressive strength of concrete at 7 days & 28 days with various replacement of M-Sand & Granite Powder

At, 10% Replacement of cement by GP, with 30% replacement of M-Sand, provides high strength. At, 15% Replacement of cement by GP, with 30% replacement of M-Sand, provides high strength than 5% & 10% replacements. At, 20% Replacement of cement by GP, with 30% replacement of M-Sand, provides high strength than other replacement levels of M-Sand with GP Powder 20% but it gives lower strength in accordance with the replacement percentage levels of Granite powder.

The Flexural strength of concrete was tested using the two-point loading test method. Flexure test indicated that 30% replacement of M-Sand gives better result at any other replacement. Also, it indicates that 15% replacement of cement with granite dust provides a good result in respect of flexure strength.

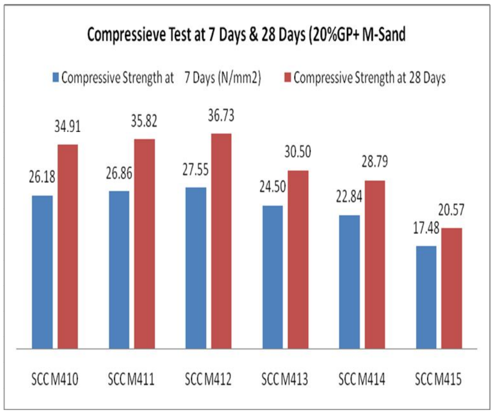


Figure: 4 (e)

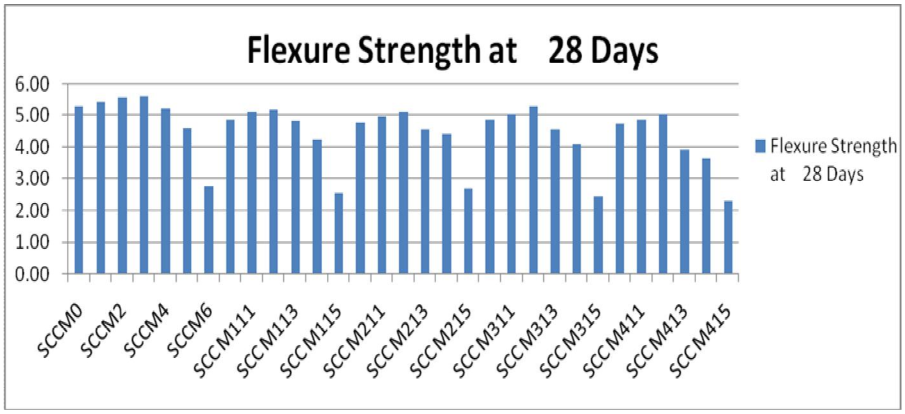


Figure: 5 Flexture Strength at 28 Days

Split tensile strength results are also shows the same pattern obtained in flexure strength. It gives 20% more strength increment when we use M-Sand. Also at 15% replacement of cement with GP, increases the strength respectively other percentages. Due to ITZ character it provides more strength.

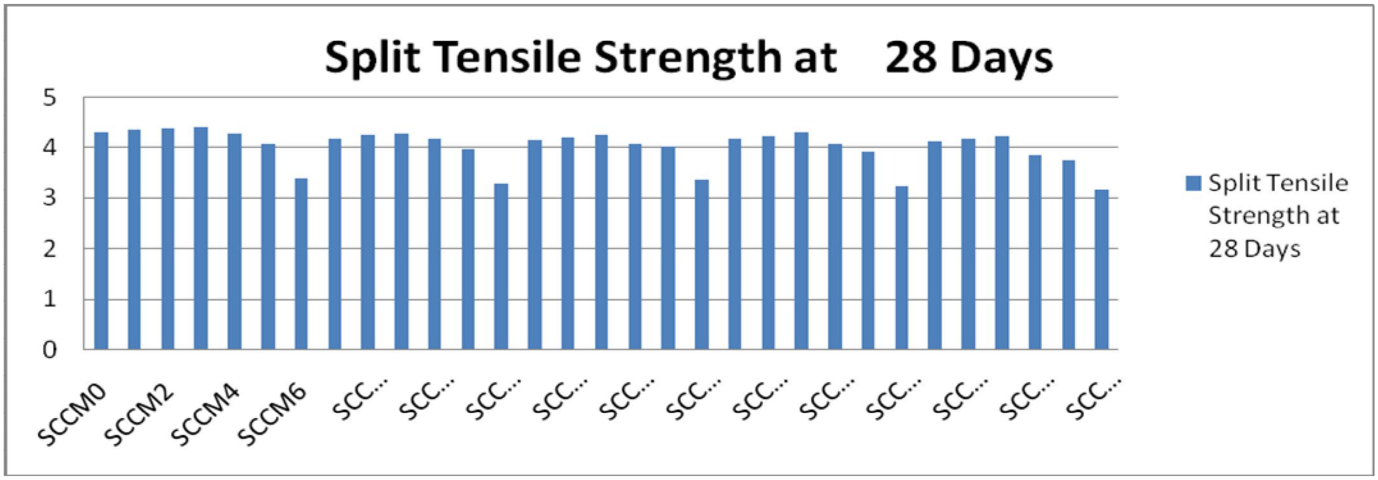


Figure: 6 Tensile Strength at 28 Days

V. CONCLUSION

Granite powder particles are having diameter more than cement particle size and less than fine aggregate, which makes the concrete more denser and increased packing density.

Due to higher packing density it can be predict that water permeability will be less as it is less porous than controlled concrete.

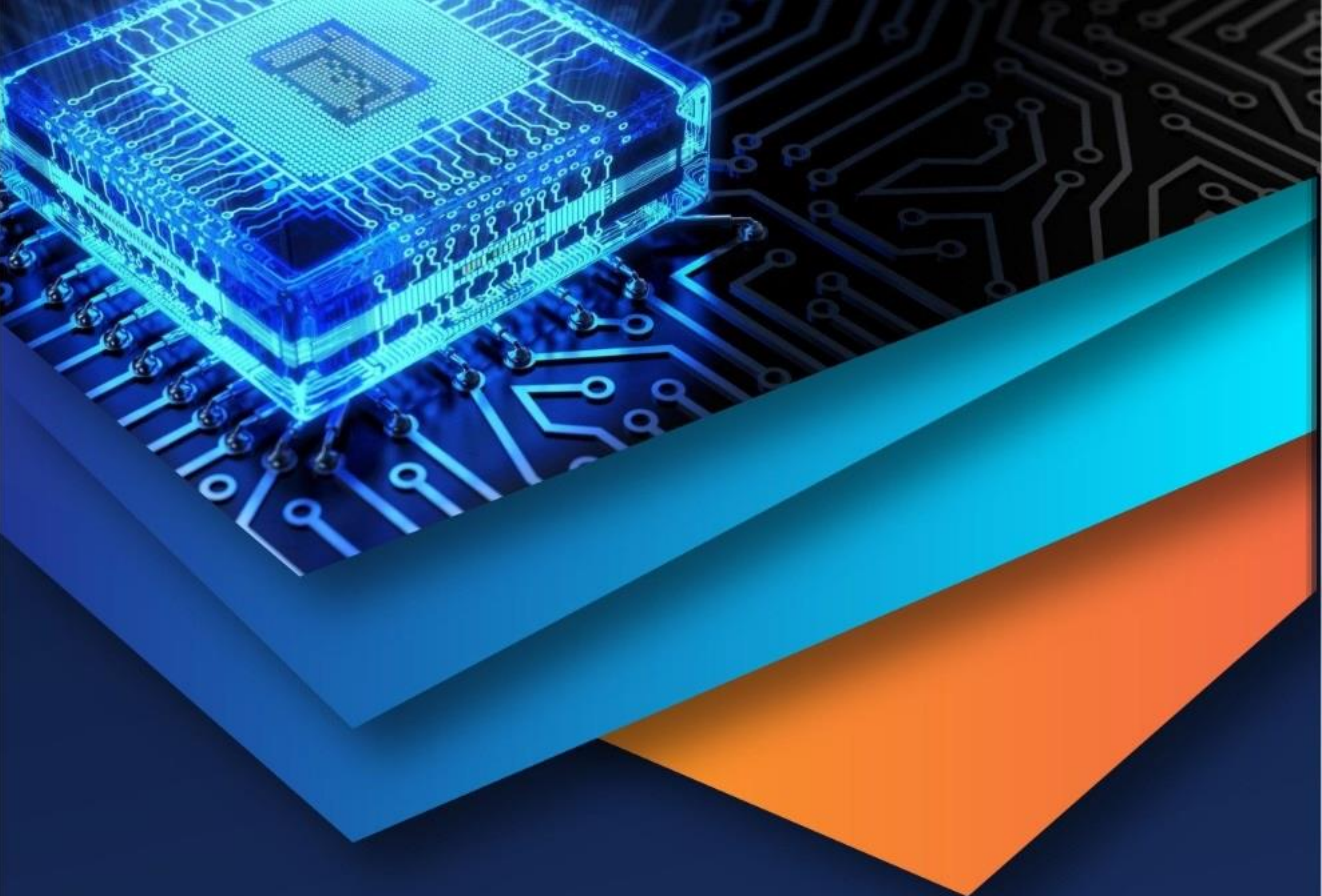
During Flexure & tensile test data analysis, we found there is a strong positive correlation between them. R^2=0.995.

Granite powder is acted as good replacement along with 30% replacement of M-Sand. M-Sand gives more strength than controlled concrete at various percentage level as shown in result.

This all are the initial tests, durability test need to be performed to understand long-term behaviour of concrete.

REFERENCES

[1] MuraliKrishnan¹ S, Kala TF, Asha P, Elavenil S. Properties of Concrete using Manufactured Sand as Fine Aggregate. International Journal of ChemTech Research. 2018;11(03):94-100.
[2] Belay SD. THE USE OF MANUFACTURED SAND IN CONCRETE PRODUCTION: TEST RESULTS AND COST COMPARISON (Doctoral dissertation, Addis Ababa University).
[3] Prakash Rao DS, Giridhar Kumar V. Investigations on concrete with stone crusher dust as fine aggregate. Indian concrete journal. 2004;78(7):45-50.
[4] Logan AT. Short-term material properties of high-strength concrete.
[5] Kala DT. Effect of granite powder on strength properties of concrete. International Journal of Engineering and Science. 2013 May 8;2(12):36-50.
[6] Arulraj GP, Adin A, Kannan TS. Granite powder concrete. IRACST–Engineering Science and Technology: An International Journal (ESTIJ). 2013 Feb;3(1):193-8.
[7] Balamurugan MR, Karthickraja MR. An experimental investigation of partial replacement of cement by industrial waste (Hypo Sludge). International Journal of Engineering Research and Applications. 2014 Apr;4(1):430-5.
[8] Neville AM. Properties of concrete. London: Longman; 1995 Jan.
[9] Shetty MS. Concrete Technology Theory & Practice, Published by S. CHAND & Company, Ram Nagar, New Delh. 2005.
[10] IS-10262. Indian Standard Code for Concrete Mix Proportioning Guidelines (First Revision).
[11] IS: 516. Method of tests for strength of concrete.
[12] IS 5816. Method of Test Splitting Tensile Strength.



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