Second International Conference on Nexgen Technologies
Sengunthar Engineering College, Tiruchengode, Namakkal Dist. Tamilnadu (India)
8th - 9th March 2019 www.conferenceworld.in ISBN : 978-93-87793-75-0

EXPERIMENTAL STUDY ON CONCRETE BY REPLACEMENT OF CEMENT WITH GRANITE DUST POWDER

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ABSTRACT
Nowadays, concrete made with Portland cement is probably the most widely used man made material in the world. But concrete production is one of the concerns worldwide that impact the environment with major impact being global warming due to CO_2 emission during the cement production. For the controlling purpose of CO_2 emission and alternative usage of cement industrial wastes are used. Hence an attempt is made to replace the cement by granite dust powder in concrete. In this study, the possibility using granite dust powder in concrete production was examined by studying the effects of blending of granite dust powder with cement on the performance of fresh and hardened concrete. Granite dust powder was used in concrete as a cementetious material as a partial replacement of cement. Replacement of cement was made by level of 20%, 40%, 60%, 80%, 100% by weight of cement. For each replacement workability, compaction factor and strength test is conducted. Compressive strength after 7 and 28 days curing was obtained. From the test results it was found that the concrete at the level of 40% partial replacement of cement with granite dust powder has better workability and compressive strength of 7 and 28 days curing. The granite dust powder is free of cost. Hence its seems to be economical.

1.INTRODUCTION:

Concrete is a composite construction material composed preliminary of aggregate, cement and water. Concrete is the most widely used construction material. It is the material of choice where strength, performance durability, impermeability, fire resistance and abrasion resistance are required.

It is so closely associated now with every human activity that it touches every human being in his day to day living. M-sand is the major part in the concrete; therefore it results in environmental effects such as ground water decrease, soil erosion and many others.Due to the recent spurt in construction activity brought out by the current economic boom, the cost of construction has been increasing up by 15 % every year, a major factor for this escalation in the cost is the price of raw materials like cement, steel, timber, aggregates etc. as conventional natural resource are being depleted, the cost of these materials are increasing. Current scientific date tells us that the plasticity and hardened state properties are affected greatly by the type of aggregate used. Different types of aggregates that are commonly used

are natural sands gravels, crushed rocks and manufactured aggregates. Concrete is a heterogeneous mixture of cement, fine and coarse aggregates.

Granite waste is an industrial waste which is obtained from the granite polishing industry in a powder form Rasipuram, Namakkal district is produced and collected. This waste is easily carried away by the air and hence causes problems to human health and environment.

With the enormous increase in the quality of waste needing disposal, coupled with acute shortage of dumping sites, and sharp increase in the transportation and dumping costs the quality of environment, has got seriously deteriorated preventing sustainable development. As granite powder waste is a fine material, it will be easily carried away by the air and will cause nuisance causing health problems and environmental pollution. Granite powder waste (GPW) is a fine material; it gets easily carried away by air and causes nuisance and health problems as well as environmental pollution. The major effects of air pollution are lung diseases and inhaling problems with the majority of people living in and around being affected the worst. In this present work, GPW to cement. To find in this investigation have used granite waste as a partial replacement to different percentage the compressive strength, split tensile strength and flexural strengths of concrete have been determined. By doing so, the objective of reduction of cost construction can be met and it will help to overcome the environmental problem associated with its disposal including the environmental problems of the region.

2. REVIEW OF LITERATURE:

Several industrial wastes, such as flyash, quarry dust waste, recycled aggregate, used soft drink bottle caps as fibre reinforced concrete have been tried by various researches. These results have been encouragingly increased in terms in improvement in strength parameters like compressive strength, split tensile strength and flexural strength.

HANIFI BINICIETAL (2007) is determined the mechanical properties of concrete containing marble dust and limestone. Seven concrete mixtures were produced in three series with control mixes having 400 kg cement content. Fine aggregate was replaced with marble dust and limestone. The replacement percentage of marble dust was 5% and 10% and it replacement percentage of limestone dust was 15%. The compressive strength of concrete cubes were found on 7^{th}, 28^{th}, 56^{th}, 90^{th} days. Sodium sulphate resistance was found after 3 months. Also, abrasion resistance and water peneteration of concrete were investigated. Results indicated that marble dust and limestone dust.

B.Vidivelliet.al had studied on flyash concrete using SEM analysis as partial replacement to cement and had reported a significant increase of 20% compressive strength respectively.

M.L.V. Prasad had studied mechanical properties of fiber reinforced concretes produced from building demolished waste and observed that target mean strength had been achieved in 100% recycled concrete aggregate replacement.

M.Mageswariis using the combination of waste Sheet Glass Powder (SGP) as fine aggregate and Portland cement with 20% optimum replacement of fly ash as cementations binder offers

an economically viable technology for high value utilization of industrial waste. Using of SGP in concrete is an interesting possibility for economy on waste disposal sites and conservation of natural resources. Natural sand was partially replaced (10%, 20%, 30%, 40% and 50%) with SGP and 20% optimum replacement of fly ash in Portland cement. Compressive strength, Tensile strength and Flexural strength up to 180 days of age were compared with those of concrete made with natural fine aggregates. The test results indicate that it is possible to manufacture low cost concrete containing SGP with characteristics similar to those of natural sand aggregate concrete provided that the percentage of SGP as fine aggregate up to 30% along with fly ash 20% optimum in cement replacement can be used respectively.

DebarataPradhan has determined the compressive strength of concrete in which cement was partially replaced with silica fume (0%, 5%, 10%, 15%, and 20%). The compressive strength test was conducted on age of 24 hours, 7 days and 28 days for 100 mm and 150 mm cubes. The results indicated that the compressive strength of concrete increased with additional of silica fume up to 20% replaced by weight of cement further addition of silica fume was found that the compressive strength may increase or decrease.

Amudhavalliis examined the performance of concrete made with silica fume as the partial replacement of cement. Cement was replaced with silica fume in steps of 0%, 5%, 10%, 15% and 20% by weight by M 35 mix. The reported from this percentage mixes in compressive strength, split tensile strength and flexural strength at age of 7 days and 28 days. The results indicated that use of silica fume in concrete has improved the performance of concrete in strength and durability aspects.

Faseyemi Victor Ajileye examined the usage of microsillica as a partial replacement of cement in concrete. Cement was replaced with coconut shell in steps of 0%, 5%, 10%, 15%, 20%, and 25%. The compressive strength and of the samples was recorded at the curing age of 3, 7, 14, 28 days. The results indicated that the compressive strength of concrete increased with additional of silica fume up to10% replaced by weight of cement further addition of microsillica was found that the compressive strength will be decreasing from 10% replacement of cement.

3. EXPERIMENTAL INVESTIGATION:

CEMENT: Ordinary Portland cement 53 grade of ultra tech brand confirming to B.I.S standards is used in the present investigation. Fineness test was conducted for cement and it was found to be 2.8% which conforms to IS 8122-1989.

GRANITE POWDER DUST: Granite waste was obtained from granite polishing industries at Karnataka, India. The specific gravity of granite waste dust was 2.53 respectively and its size was less than 90 microns. The fine ness modulus of granite waste was 2.43 respectively. Usage of granite dust in concrete reduces global warming and it is cost effective materials

COARSE AGGREGATE: Machine crushed angular Basalt metal obtained from namakkal was used as coarse aggregate. The coarse aggregate was free from clayey matter, silt and organic impurities. The coarse aggregate was also tested for specific gravity and it was 2.72.

Fineness modulus was 4.20. Aggregate passing through 12.5mm and retained from 4.75mm was used in the experimental work, which is acceptable according to IS 383-1970.

WATER: Water is the one of the most important ingredient after cement for making concrete. Mixing water should be very low to give low slump (0-5 cm) this locally available potable water, was used for mixing the concrete.

PREPARATION OF TEST SPECIMENS:

The granite powder collected from polishing units was dried. As per the mix proportions, given in table-1 the quantities of various ingredients were weighed. Initially cement and granite powder were mixed thoroughly. Further sand and coarse aggregate were added to the mix. Once all the materials were mixed well, Cubes of size150mmX150mmX150mm and cylinder were cast. The specimens were cured in curing tank for a period of 28days.

MIX DESIGN

Based on the physical properties of material and tested as per IS: 4031-1996, IS: 383-1970, M25 grade concrete mix was designed as per IS: 10262-2009.Mix proportion and its details are shown in table 1 and 2.

Characteristics compressive strength required in the field at 28 days =25Mpa
Maximum size of aggregate = 20 mm
Degree of workability = 0.90
Degree of quality control = Good
Type of exposure = Mild
Specific gravity of cement = 3.15
Specific gravity of coarse aggregate = 2.63
Specific gravity of fine aggregate = 2.6
Water absorption of coarse aggregate = 1.8%
Water absorption of fine aggregate = 1%

Table 1- Mix proportions of concrete with GP

Mix design	Nominal mix	Mix-1 kg	Mix-2	Mix-3 kg	Mix-4 kg	Mix-5 kg
% of GP	0	20	40	60	80	100
w/c ratio	0.4	0.4	0.4	0.4	0.4	0.4
Cement content (kg)	3.6kg	2.8kg	2.1kg	1.44kg	720g	0g
Fine aggregate(kg)	8.77	8.77	8.77	8.77	8.77	8.77
Coarse aggregate	17.42	17.42	17.42	17.42	17.42	17.42
Water (lit)	1.848	1.848	1.848	1.848	1.848	1.848

Table 2- Compaction factor

Mix	Slump value(mm)	Compaction factor
R	85	0.99
GD1	87	0.98
GD2	89	0.98
GD3	92	0.99
GD4	88	0.99

4. RESULTS AND DISCUSSION:

1. COMPRESSIVE STRENGTH

Table 3 Compressive strengths of cubes with different proportions of GPW in 7& 28 days

S.NO	%Replacement of cement with granite powder	Compressive strength in 7 days (N/mm^2)	Compressive strength in 28 days $(N/mm)^2$
1	0	18	35
2	20	22	37
3	40	26.5	42
4	60	24	38
5	80	20	30
6	100	10	20

2. SPLIT TENSILE STRENGTH

Split tensile strength of concrete is usually found by testing plain concrete cylinders. Cylinders of size 150mm x 300 mm were used to determine the split tensile strength. After curing, the specimens were tested for split tensile strength using The details of same are

represented in table 4.

Table 4 split tensile strength of cubes with different proportions of GPW in 7& 28 days

S.NO	%Replacement of cement with GP	Compressive strength in 7 days	Compressive strength in 28 days
1	0	2.6	3.2
2	20	2.7	3.6
3	40	2.9	4.4
4	60	2.9	3.8
5	80	2.2	3.6
6	100	2	2.5

5. CONCLUSION

From the experimental test results, Granite dust powder found to be better performance in workability and strength properties.

1. From the compression test results it is found that the concrete mix with 100% replacement of cement with Granite Dust Powder shows the higher compressive strength than the Reference concrete mix for both 7 days and 28 days curing.
2. From the experimental analysis, it is concluded that is 40% replacement of Granite Dust Powder, is found to be the most preferable one when compared with other mixes by analyzing its Compressive strength as 40.2 N/mm^2 and split tensile strength as 4.4 N/mm^2.
3. It is recommended as favorable mix for both Structural and Non- Structural applications.

REFERANCES

1. Safiuddin, M.; Raman, S. N., and Zain, M. F. N., "Utilization of Quarry Waste Fine Aggregate in Concrete Mixtures," Journal of Applied Sciences Research, V.3, 2007, pp. 202- 208.
2. G.Sreenivasa, General Manager (Business Development), UltraTech Cement Limited Bangalore, "Use of Manufactured Sand in Concrete and Construction-An Alternate to River Sand". NBM Media, India‟ s No1 ConstructionPortal

ISBN : 978-93-87793-75-0

3. T. Felix Kala and P. Partheeban, "Granite powder concrete". Indian Journal of Science and Technology, Vol. 3 No. 3 (Mar 2010) pp311-317
4. Hamza, K.K Aizboon, "Effect of using granite slurry in concrete", Construction and building materials, 10-2013, pp 1014-1020
5. Dr.T. Felix Kala, "Effect of Granite Powder on Strength Properties of Concrete" International Journal of Engineering and Science, Vol.2, Issue 12 (May 2013), Pp36-50
6. Dr.G.PrinceArulraj, "GRANITE POWDER CONCRETE", IRACST – Engineering Science and Technology: An International Journal (ESTIJ), Vol.3, No.1, February 2013 pp 193-198