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BEHAVIOUR OF CONCRETE WITH GRANITE POLISHING POWDER ON PARTIAL REPLACEMENT OF CEMENT

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Abstract: **The theme of the experimental investigation is to find the use of naturally available waste material as a partial replacement of cement resulting in improving the test results. the manufacturing of cement process involves emission of CO_2 for every tone of cement approximately four hundred kilograms of CO_2 is released in to the atmosphere. For a considerable amount in the environment resulting in global warming, thus investigation of these partial substituents in cement reduces this ill effect making an environment free construction. Granite polishing powder is industrial by product generated from the polishing industries. These byproducts are left largely unused and are hazardous material to human health problem. The granite polishing powder is used in 90 micron sieve of a particle size is used to whole project. The objective of this thesis is to find optimum percentages up to which this pozzolanic waste material can replace OPC-53 grade cement obtain the maximum test results. It is proposed to study the cement is partial replaced the material of 0%, 5%, 10%, 15% and 20% by weight of cement, curing periods as 14, 28, 56 and 90 days. The impact shared on the utilization of granite polishing powder on compressive strength, split tensile strength of M_{30} grade of concrete can be studied.**

Key words: Cement, Granite Polishing Powder, Fine aggregate, Coarse aggregate and Water.

I. INTRODUCTION

Concrete is the most important in the construction field. It is obtained by combining adequate of synthetic materials, gravel and water. The terms concrete from Latin "concrete ", which means it develops together. Concrete consists of three basic compounds, cement, first class and coarse admixtures. Concrete mix design is the science of deciding relative proportions of concrete ingredients to achieve the desired properties in the most economical way. The concrete being used as 2nd most essential material in the world and most of the companies are in need of economical concrete by replacing cement by cementations material. Concrete is the most important component used in the construction industry throughout the work. Due urbanization the use of cement in the construction industry gets increased rapidly. During the production process Co_2 is emitted into the atmosphere which causes damage to the environment. As a matter of fact, concrete is the frequently mentioned material in the construction industry. It is a versatility durability and economical have made it the world's most used construction material, because it can be designed for strength from 10 N/mm^2 up to 100 N/mm^2 which is regarded as its grade. A good number of building failures are traceable to concrete incompetence among several other factors.

In recent years, environmental destruction and global warming have become major problem. Heightening concern about worldwide ecological issue, changeover the large scale manufacturing, mass-waste, mass-utilization, society of the past to a zero-emission society is presently seen as essential. For reducing the pollution we used the Granite Polishing Powder as the percentage replacement of the cement. Concrete is a strong and tough material. Compared to many other engineering material such as steel, rubber, etc. Concrete requires less energy input for its manufacture. Currently a large number of mineral admixtures, which are waste product of other industries are being beneficially used in making quality concrete. Concrete is the most preferred material.

1.1 CONSTITUENT MATERIALS USED

The constituents cloth used are ordinary Portland cement 53 Grade, Granite polishing Powder, Fine aggregate, Coarse aggregate, and water. The endorsed substance has been described below.

1.2 GRANITE POLISHING POWDER

Mainly deriving the "Granite" as, the term "Granite" means "grain" in the Latin word "Granum" because of its granular nature. Here granite an entirely new surface. It removes a small layer of granite; the layer that is dull. This is also called stone polishing compound offers is easy and quick way to put gleam of granite while removing minor scratches and stains. If using it dry, choose a buff polishing pad to work the polish over the surface of the granite in a steady, circular pattern. Granite, from igneous rock, is a very hard, crystalline and primarily composed of feldspar, quartz, accompanied by one or more dark mineral. It is visibility in homogenous in texture. Granite is the hardest building stone, and granite slab and granite tiles occupy a prominent place among dimensional stone. Due to its hardness, resistance to wearing, capacity to take minor polish, fascinating colors and textural patterns, granite slabs and granite tiles are extremely popular. Granite polishing powder are also called stone polishing compound, powder offers a quick and easy way to put a fresh gleam on granite while removing minor scratches and stains. If using it dry, choose a buff polishing pad to work the polish over the surface of the granite steady, circular pattern. This of polish focus on from this point is polish that gives the granite an entirely new surface. It removes a small layer of granite, the layer that is dull, scratched and stained to reveal fresh, smooth stone beneath.

1.2.1 Production in India of Granite:

Indian granite stone industry currently produce around 17.8 million tons of solid granite waste, out of which 12.2 million tons are rejected at the industrial sites, 5.2 million tons are the form of cuttings/trimming or undersize material and 0.4 million tons are form of a slurry/powder are at the processing and polishing unit.

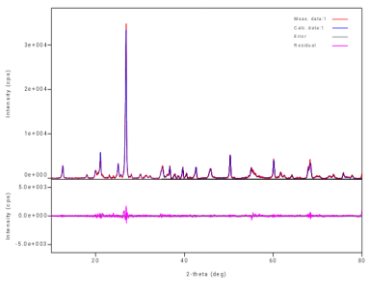

Fig:1 XRD Analysis of Granite Polishing Powder

II. LITERATURE REVIEW

V.Kamesh et.al (2017-March) [1] The main focus on this work as, "Study on Temperature Variation of Mortar Incorporated with Granite Powder". The Paper represents on the results of experimental investigation carried out to evaluate the temperature variation of cement mortar of 1:3, 1:4, 1:.5 mortar mixes in which granite powder as replaced with 10%, 20%, 30%, 40%, 50%, 60%, and 70% of granite powder. The temperature on the mortar premises is found to be less when compared to the outside environment. The test results revealed that the combined use of granite powder exhibited excellent performance due to efficient micro filling ability and pozzolanci activity.A. Arivumangal et.al (2017-March) [2]: The focus on the work as, "Fire Resistance test on Granite Powder Concrete". This paper representing they founded on the compressive strength concrete mixture at different testing ages are presented. The data presented shows that the compressive strength of all the granite powder concrete thermally treated at 70, 140, 210, and 280 c^0 for 1hour-2hours. It was observed that the compressive the 140, 210 and 280 c^0 for 1hour-2hours.it was observed that the compressive strength of granite powder specimen increased with the temperature to 70 c^0 and then decrease to 280c^0 temperature. Compressive strength of control concrete is 6per cent higher than that at 2 hour strength and that of granite powder concrete varies from 8-34per cent. Therefore granite powder concrete with the admixtures contributes immensely in enhancing the compressive strength of concrete is 1.23 times that of normal concrete. N. Elangovan et.al (2017-April) [3]: The focus on the work as, "Flexural Behavior of Concrete by Partial

Replacement of Cement, Fine Aggregate by Glass Powder and Granite Powder". This paper representing most of the glass sheet cutting industries was not properly recycled and also disposing their waste materials as landfills. In granite polishing industries also the waste granite powder was not disposed properly. These waste glass powder can be crushed finely and checked the possibility for incorporation into concrete as a pozzolanic material. It under goes beneficial pozzolanic reactions in the concrete and could replace up to20% of cement in some concrete mixes with satisfactory strength development. This thesis involves use glass powder 20% constantly as replacement of cement and to use granite powder 25% constantly as replacement of fine aggregate. The mechanical properties of glass and granite powder replaced concrete properties have been compared with the conventional concrete after the curing period of 7, 14, and 28 days, the grade of concrete used in this project is M_{20}, M_{30} and M_{40}. Waste glasses and granite wastes are to be used so the cost will be comparatively low when compared with normal concrete. M.U. Rizavi et.al (2017-May) [(4)]: The main focus on this work as "Review on /Investigation the Effect on Concrete by the Partial Replacement of Fine Aggregate with Granite powder". The granite powder waste can be utilizing 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, of the percentages of granite powder added by weight to replace sand were weight as 0%, 5%, 10%, 15%, 20%,and 25% and various tests such as compressive strength, split tensile strength, and flexural strength tests are investigated and these values are compared with the conventional concrete without granite fines. This is mainly gives the high strength and high performance concrete and also havea economical for construction work. C. Anu et.al (2017-May) [(5)]: The main focus on this work as, "Optimization of Granite and Iron Powder as Partial Replacement of Fine Aggregate in Concrete". This paper represents on the present experimental investigation on effect of addition of industrial by products as a partial replacement of fine aggregates on the mechanical properties of concrete such as compressive, split, tensile, and flexural strength. The fine aggregate has been replaced by granite and iron powder accordingly in the range of 5% increment level. Optimum value is obtained at 10% replacement level. Optimization is carried by 10%granite powder on various percentages of iron powder. At 20% replacement of iron powder better strength properties were obtained.

III. MATERIALS

3.1 CEMENT

Cement is used in the mostly used in the construction of raw material and manufacture material. It consists of mainly lime, silica, alumina, and iron oxide. Mainly using this cement as 53 grade of cement "Ordinary Portland Cement" conforming to IS: 12269-1987. Clinker is an artificial rock made by heating lime stone and other raw material in specific quantities to a very high temperature in a specially made kiln.

3.1.1 Ordinary Portland cement(53-grade):

Ordinary Portland cement, 53 grade shall manufactured by intimately mixing together calcareous and, burning argillaceous or silica, alumina, iron oxides bearing materials them at a clinkering temperature and grinding the resultant clinker so as to produce a cement capable of complying with this standard. There was only one grade of OPC which is governed by IS12269:1987 higher grade cement were introduced in India.

TABLE:1
PHYSICAL PROPERTIES OF CEMENT:

S.No	Particulars	Results
1	Specific gravity	3.11
2	Initial setting time	32min
3	Final setting time	560min
4	Normal consistency	32%
5	Fineness	300m^2/kg

3.1.2 Granite Polishing Powder:

Granite is a common type of "felsic intrusive Igneous Rock. Strictly speaking, granite is an igneous rock with similar textures and slight variation in composition and origin. The density of granite is between 2.65 - 2.75 g /cm3. Granite

polishing powder was obtained from granite polishing industries at Madanapalli of Chittoor district in Andhra Pradesh, India.

TABLE: 2
PHYSICAL PROPERTIES OF GPP

S. No	Property	Value
1	Specific gravity	2.5
2	Bulk density	2.65-2.75 kg/m^3
3	Colour	Light white colour

Fig:2 Extraction of Granite Polishing Powder

TABLE: 3
CHEMICAL COMPOSITION OF GPP

S. No	Oxides	Percentages (%)
1	SiO_3	72.04
2	Al_2O_3	14.42
3	K_2O	4.12
4	Na_2O	3.69
5	CaO	1.82
6	FeO	1.68
7	Fe_2O_3	1.22
8	MgO	0.71
9	TiO_2	0.30
10	P_2O_5	0.12
11	MnO	0.05

Fig:3 Sieving of Granite Polishing Powder

3.1.3 Aggregates

Aggregate is a general term applied to those inert or chemically active material which, when bonded together by cement, form concrete. Most of the aggregates are naturally occurring aggregate such as crushed rock, gravel and sand. Aggregate is the major ingredient of concrete.

Fine Aggregate: The material less than 4.75mm size are called fine aggregate. Natural sand are generally used as fine aggregate. Sand may be obtained from pits, river, and lake or sea shore and may contain chlorides which may cause efflorescence, and may cause corrosion of reinforcement.

TABLE: 4
PROPERTIES OF FINE AGGREGATE

S. No	Particulars	Results
1	Zone	II
2	Grading size	4.75mm-0.075mm
3	Water absorption	7.5%
4	Fine modulus	2.28
5	Bulk density	1364.82kg/m^3
6	Specific gravity	2.72

Coarse Aggregate: The material greater than 4.75mm are known as Coarse Aggregate. Crushed stone and natural gravel are the common material used as coarse aggregate for concrete. Natural gravels can be quarried from pits where they been deposited by alluvial or glacial action, and are normally composed of flint, quartz, schist and igneous rocks.

TABLE: 5
PROPERTIES OF COARSE AGGREGATE

S. No	Particulars	Results
1	Type	Crushed angular aggregate
2	Specific gravity	2.74
3	Maximum size	20mm
4	Fine modulus	6.30
5	Bulk density	1582.87kg/m^3
6	Water absorption	0.7%

3.1.4 Water:

Water acts as lubricant for the fine and coarse grained aggregates and reacts chemically with cement to form the binding paste for the aggregate and reinforcement. Water is also used for curing the concrete after it has been cast into the forms. Water used for mixing and curing shall be clean and free form injurious amount of oils, acids, alkalis, salts, sugar, organic material and other substance that may be deleterious to concrete or steel.

3.2 WORKABILITY OF CONCRETE

The workability of concrete is defined as the easy of placement with resistance to segregation. It is indeed difficult to define workability without in some way involving the type of construction. Workability can be measured by the slump value, the compacting factor, or the ve be test. I have measuring of this my investigation as M30 grade of concrete by the workability test can be finding as the slump cone test. The slump value is 78%.

1. Slump cone test
2. Compaction factor test
3. Vee -Bee test

IV. METHODOLOGY:

4.1 MIXING

Through mixing of the material is essential for the production of uniform cement mortar and concrete. The mixing should ensure that the mass becomes homogeneous, uniform color and consistency. Mixing should be done over an impervious surface. Spread out the measured qualities of coarse aggregate and fine aggregate in alternate layers. Pour the cement on top of it, and mix them dry by shovel, turning the mixture over and over again until uniformity of color is achieved. This uniform mixture is spread over in thickness of about 20cm.

4.2 CASTING OF SPECIMENS:

A total of 156 specimens have been casted out of which 60 were cubes, 40 were cylinders, For each test 3 specimens were tested and average value is considered for the investigation. 150 mm ×150 mm ×150 mm Size cubes, standard cylinders of 150 mm dia ×300 mm height, were casted. The compressive strength and split tensile strength tests were done for the specimens at 14 days, 28 days, 56 days and 90days.

V. TESTINGS

5.1 COMPRESSIVE STRENGTH TEST:

The stress gives the compressive strength of cube of size as 150X150X150mm. This test can be conducted for the 14, 28, 56, and 90 days for each percentage can be conducted. The compressive strength of cement is judged by determining the compressive strength of cement and sand mortar. For this purpose, one part by weight of cement is mixed with three parts by weight of standard sand in dry conditions.

$$Fc=P/A \quad N/mm^2$$

Where

P = Ultimate load in N

A = Area of cross section in mm^2

F_c = Compressive strength force in N/mm^2

5.2 SPLIT TENSILE STRENGTH TEST:

The split-tensile strength tests of the stress gives the cylinders of size as 150X300 mm. This test can be conducted as each percentage and each curing days can be tested. The test specimen was placed in machine between two strip of 3mm thick and approximately 12 cm wide placed on the top and bottom of specimens.

$$F_t=2P/\pi DL$$

Where

P = ultimate load in Newton's

L = length of cylinder in mm

D = diameter of cylinder in mm

VI. RESULTS

TABLE: 5.1
COMPRESSIVE STRENGTH FOR GPP

S. No	% of GPP	14 Days	28 Days	56 Days	90 Days
1	0	27.03	31.13	35.8	34.87
2	5	29.03	32.93	36.8	37.60
3	10	28.46	27.70	28.90	35.80
4	15	23.80	26.75	26.45	35.50
5	20	22.17	25.94	26.44	32.30

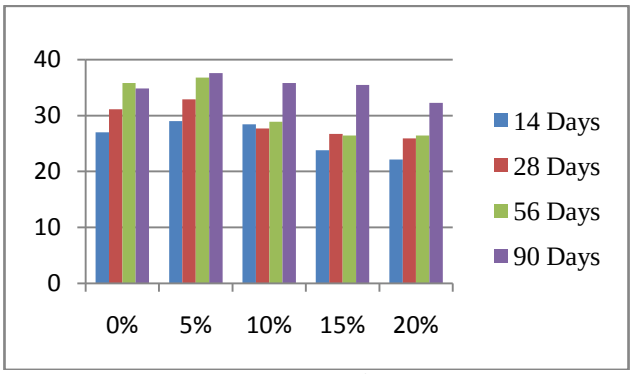

Fig:4 Compressive strength results for Normal concrete and GPP

TABLE 5.2
SPLIT-TENSILE STRENGTH

S. No	% of GPP	14 Days	28 Days	56 Days	90 Days
1	0	1.845	1.70	1.65	1.74
2	5	2.245	1.825	1.88	1.95
3	10	1.78	1.65	1.60	1.80
4	15	1.63	1.55	1.35	1.70
5	20	1.50	1.40	1.30	1.45

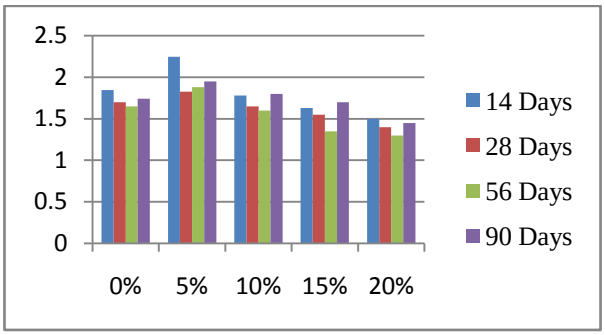

Fig:5 Split tensile strength results for Normal concrete and GPP

VII. CONCLUSION

- The compressive strength increases with replacement of 5% of Granite polishing power with natural cement.
- The Split tensile strength also increases with replacement of 5% of Granite polishing power with natural aggregate
- The strength for compressive strength for normal cement at 0% replacement the results are slightly low.

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