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EXPERIMENTAL INVESTIGATION ON CONCRETE WITH PARTIAL REPLACEMENT OF FINE AGGREGATE BY GRANITE POWDER

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Abstract: *This project report summarizes the strength behavior of partial replacement of fine aggregate in concrete by Granite fine. Granite fines are the byproduct of granite industries while cutting huge granite rocks to the desired shapes. The granite powder from factory is carried by the water and stored in tanks. After evaporation of water the granite dust remained in the tank. Then it is transported and disposed on the land. The major problem of disposing the fines in land leads to various environmental hazards like pollution in air and land. The granite fines exhibit the properties of fine aggregate such as size, fineness and filler capabilities.*

Concrete is prepared with granite fines as a partial replacement of fine aggregate in different proportions namely 10%, 15%, and 20%. The various tests to be conducted on concrete such as compressive strength, split tensile strength and flexural strength. The tests values are computed and compared with the conventional concrete.

Keywords: Ordinary Portland cement, Fine aggregate, Coarse aggregate & Granite fines.

1. INTRODUCTION

Concrete is the most popular building material in the world. Construction Industry contributes huge amounts to Indian economy and concrete is one of the best materials used in construction. The ingredients used in it include Cement, Sand, Gravel and Water. Now-a-days sand is not easily available. The world wide consumption of sand as fine aggregate in concrete production is very high, and several developing countries have encountered some strain in the supply of natural sand in order to meet the increasing needs of infrastructural development in recent years. A situation that is responsible for increase in the price of sand, and the cost of concrete.

Expensive and scarcity of river sand which is one of the constituent material used in the production of conventional concrete. The use of Crushed Granite Fine (CGF) as an alternative to natural sand. The Granite fines use up to 20% as a partial replacement for natural sand in the production of concrete.

2. MATERIAL PROPERTIES

Material Used

- ✓ Cement
- ✓ Coarse Aggregate
- ✓ Fine Aggregate
- ✓ Replacement of Granite fines (partial Replacement of fine aggregate 10%, 15% & 20%)
- ✓ Admixture (Roff)
- ✓ Water

2.1 Cement:

The materials of cement was used in an ordinary Portland cement super grade (53grade) is used. This cement is most commonly used in concrete construction.

TABLE I. Physical Properties of Cement

S.NO	Properties Cement	Result
1	Specific Gravity	3.15
2	Standard consistency	30%
3	Initial Setting Time	32 mins
4	Final Setting Time	9.30 hrs

2.2. Coarse Aggregate:

Aggregates are the important and large used constituents in concrete. They give bond to the concrete, reduce

shrinkage and effect economy. One of the most important factors for producing workable concrete is good gradation of aggregates. Analysis of combined aggregates confirms the specifications for graded aggregates.

TABLE II Properties of Coarse Aggregate

S.NO	Properties of Coarse Aggregate	Result
1	Specific Gravity	2.90
2	Impact value	39.7
3	Water absorption	2.3
4	Bulk Density	0.75
5	Crushing Test	12.5
6	Flakiness Test	20.1
7	Elongation Test	26.00
8	Abrasion Test	14.2

2.3. Fine aggregate

Sand collected from nearby river is used for this project. The various properties of sand are tabulated in Table III.

TABLE III. Properties of Fine Aggregate

S.NO	Description	Value
1	Specific Gravity	2.89
2	Bulk Density	0.79
3	Sieve Analysis	Zone-III

2.5. Granite Powder

Granite belongs to igneous rock family. The density of the granite is between 2.65 to 2.75 g/cm^3 and compressive strength will be greater than 200MPa. Granite powder obtained from the polishing units and the properties were found. Since the granite powder was fine, hydrometer analysis was carried out on the powder to determine the particle size distribution. From hydrometer analysis it was found that coefficient of curvature was 1.95 and coefficient of uniformity was 7.82. The specific gravity of granite powder was found to be 2.5.

TABLE IV. Physical Properties of Granite Fines

S.NO	Description	Value
1	Specific Gravity	2.63
2	Bulk Density	0.72
3	Sieve Analysis	Zone-IV

2.6. Water

Water is an important ingredient of the concrete as it actually participates in the chemical reaction with cement. In general, water fit for drinking purpose is suitable for mixing concrete. Impurities in the water may affect setting time, strength, shrinkage of concrete or promote corrosion of reinforcement. Locally available drinking water was used in the present work.

3. EXPERIMENTAL INVESTIGATION TEST ON HARDENED CONCRETE

1. The Compressive Strength

2. The Split Tensile Strength

3. The Flexural Strength

Compressive Strength Test

The concrete cubes were crushed at 7, 14, and 28 days in order to determine the compressive strength of the cubes. The compressive strength is determined by dividing the maximum of failure load of the specimen during the test by the cross sectional area of the specimen.

$$\text{Compressive strength} = \frac{P}{A} (\text{N/mm}^2)$$

Where,

P - Load (N)

A - Area (mm^2)

Split Tensile Strength:

Split tensile strength of concrete is usually found by testing plain concrete cylinders. Cylinders of size150mm x 300 mm were used to determine the split tensile strength. After curing, the specimens were tested for split tensile strength using a calibrated compression testing machine of 4000kN capacity. It can be observed that at a 10,15,20% replacement of granite powder, an optimum for 7,14 & 28 days.

Split tensile strength = $\frac{2P}{\pi dl}$ (N/mm²)

Where,

P - Load (N)

D - Diameter of specimen (mm)

L - Length of the specimen (mm)

Flexural Strength:

The determination of flexural strength is essential to estimate the load at which the concrete members may crack. The flexural strength at failure is the modulus of rupture.

The modulus of rupture is determined by testing standard test specimens of size 100 X 100 X 500 mm.

Flexural Strength = $\frac{3Pa}{bd^2}$ (N/mm²)

Where,

P - Load (N)

a - Diameter of specimen (mm)

b - Breath of the specimen (mm)

d - Depth of the specimen (mm)

RESULT AND DISCUSSIONS

Table V. Compressive Strength of Conventional Vs Granite Fine Concrete:

SL.NO	Mix (%)	Average compressive strength (N/mm²)		
		7 days	14 days	28days
1	0	19.24	24.15	33.6
2	10	21.92	24.15	35.84
3	15	21.16	24.44	34.66
4	20	20.45	23.70	30.95

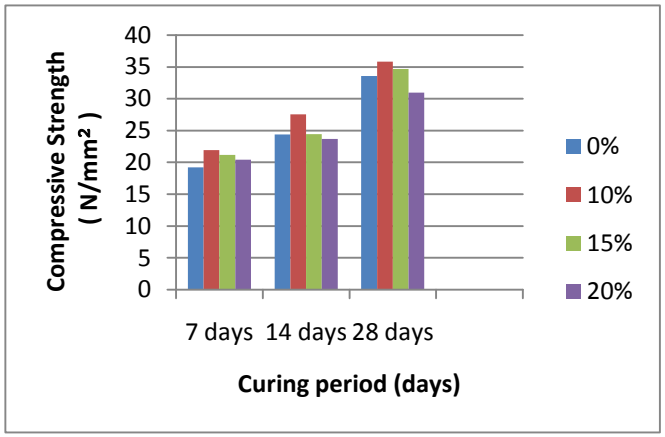

Chart: 1 Compressive Strength of Conventional Vs Granite Fine Concrete

Table: VI The Split Tensile Strength of Conventional Vs Granite Fine Concrete

SL.NO	Mix (%)	Average split tensile strength (N/mm²)		
		7 days	14 days	28days
1	0	2.21	2.49	3.44
2	10	2.78	2.92	3.83
3	15	2.63	2.87	3.72
4	20	2.35	2.68	3.10

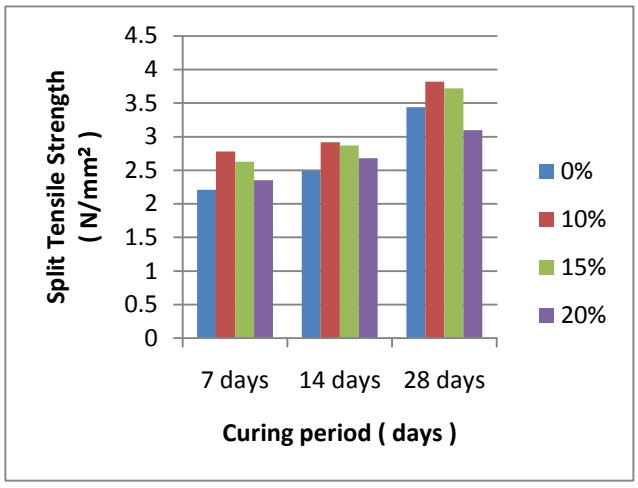

Chart:2 Split Tensile Strength of Conventional Vs Granite Fine Concrete

Table: VII Flexural Strength of Conventional Vs Granite Fine Concrete

S.NO	Mix (%)	Average Flexural strength (N/mm²)		
		7 days	14 days	28days
1	0	3.025	3.326	6.27
2	10	3.17	4.75	7.12
3	15	3.18	4.46	6.95
4	20	3.10	4.27	5.89

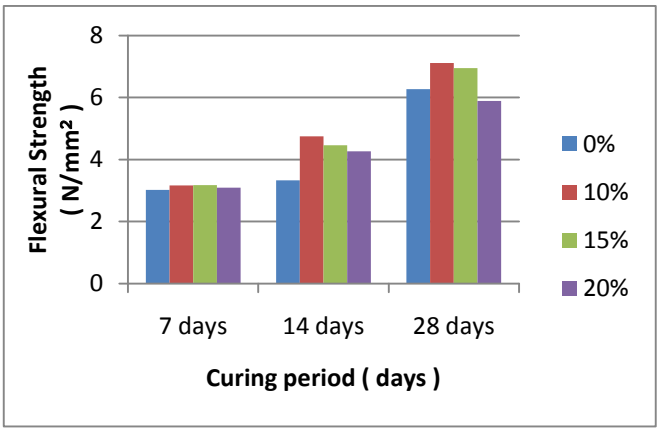

Chart:3 Flexural Strength Of Conventional Vs Granite Fine Concrete

RECOMMENDATION:

Based on the results of the test, it is recommended that 10% CGF is optimum for replacement Fine aggregate. it is as well economical for use in concrete works.

4. CONCLUSION:

This project Report suggests that the specimen cast with 10% replacement of fine aggregate by granite fines gives better compressive strength of 1.06% increased, Split tensile strength of 1.11% increased and Flexural strength of 1.14% increased. When to compare to conventional concrete. With addition of admixture.

The specimen cast with 15% replacement of fine aggregate by granite fines gives better compressive strength of 1.03% increased, Split tensile strength of 1.08% increased and Flexural strength of 1.01% increased .When to compare to conventional concrete.

The Replacement of granite fine at 20% gives less result when compare to conventional concrete. The management of waste granite powder is a main goal of this project. The granite fine concrete has better strength at 10% replacement. The Replacement of granite fine in concrete gives more Economical and provides better performance.

REFERENCE:

1. N.Kiran Kumar, Dr.B.Damodhara Reddy, Smt.S.Aruna Jyoth "An Experimental Investigation on Strength Of Granite-Fines Concrete"- International Journal of science & Technology; ISSN(online):2250-141X, Vol.4 Issue 2,September 2014.

2. DIGE S.S., Prof. G. N. Shete – "An Experimental Investigation Of Strength Of Granite Fines Concrete" SSN: 2455-2631,June 2016 IJSDR , Volume 1, Issue 6

3 .Karthik, Mr.KR.Keerthiraman –"Experimental Investigation On Concrete With Partially Replacement Of Cement And Fully Replacement Of Sand" International Journal of Advanced Research in Biology Engineering Science and Technology (IJARBEST), Vol. 2, Issue 4, April 2016, ISSN 2395-695X.

4. K.Chiranjeevi reddy, Y.Yaswanth Kumar,P.Poornima "Experimental Study on Concrete with Waste Granite Powder as an Admixture" K.Chiranjeevi reddy Int. Journal of Engineering Research and Applications, ISSN : 2248-9622,Vol. 5, Issue 6, (Part -2) June 2015, pp.87-93

5. A.Arivumangai1, T. Felixkala – "Strength and Durability Properties of Granite Powder Concrete" Journal of Civil Engineering Research 2014, 4(2A): 1-6DOI: 10.5923/c.jce.201401.01

6. Manasseh JOEL –"Use of Crushed Granite Fine as Replacement to River Sand in Concrete Production" Leonardo Electronic Journal of Practices and Technologies ISSN 1583-1078 Issue 17, July-December 2010p. 85-96

7 .O. S. Olaniyan, O.M. Afolabi and O.M. Okeyinka "Granite Fines as a Partial Replacement for Sand in Sandcrete Block Production" International

Journal of Engineering and Technology Volume 2 No. 8, August, 2012

8 .Dr.T. Felix Kala –"Effect of Granite Powder on Strength Properties of Concrete" Research Inventy: International Journal Of Engineering And Science Vol.2, Issue 12 (May 2013), Pp 36-50 Issn(e): 2278-4721, Issn(p):2319-6483

9. Dr.G.Prince Arulraj, Mr.A.Adin and Mr.T.Suresh Kannan – "Granite Powder Concrete" IRACST – Engineering Science and Technology: An International Journal (ESTIJ), ISSN: 2250-3498, Vol.3, No.1, February 2013

10. G.L. Oyekan and O.M.Kamiyo – "Effect Of Granite Fines On Structural And Hygrothermal Properties Of Sandcrete Block" Journal of Engineering and Application Sciences 3(9):135-741,2008 : ISSN: 1816-949X, 2008.

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