AN EXPERIMENTAL STUDY ON PARTIAL REPLACEMENT OF GRANITE POWDER IN FINE AGGREGATE

Name: DODDA NAGARAJU (15641D2022) M.tech (structural engineering) ,Vaagdevi college of engineering ,bollikunta,Warangal Urban

Guide: Dr.S.Sunil Pratap Reddy, Head of the Department, Civil engineering , Vaagdevi college of engineering , Bollikunta, Warangal Urban

ABSTRACT

Concrete mixture consists of cement, fine and coarse aggregates. India possesses a wide variety of stones such as granite. Here, the properties of granite chips are studied and compared with the conventionally used aggregate material. Since granite is a lighter material compared to aggregates, its use in concrete will lead to reduced self weight on members and hence reduced dead load on columns and eventually, the foundation system. Methods/Statistical Analysis: Concrete cubes and cylinders of standard dimensions of M20 grade are cast. Four mix ratios are adopted, ranging from fully conventional concrete to concrete with coarse aggregate completely replaced with granite chips. Compressive strength and split tensile strength tests were conducted on all the test specimens at 7-days, 21-days and 28-days time periods. Findings: Based on the compressive strength test and split tensile strength test in the laboratory on various proportions with granite chips as coarse aggregate and it is compared with the conventional concrete. Applications/Improvements: It is concluded that concrete with 10% replacement of granite chips possesses great strength and since granite chips, considered here are recycled materials, this usage is not only beneficial stability.

key words : granite, compressive strength, split tensile

INTRODUCTION

Granite it is the plutonic igneous rock because it is formed due to solidification of magma at great depths. The word "granite" comes from the Latin granum. It is a holocrystalline and leucocratic rock because it is completely crystalline and light coloured rock. It is acidic rock because it is very rich in silica content (nearly 72%). Granite is compact, dense, massive and

hard rock. Granite is mainly composed of only primary minerals such as feldspar and quartz. Granite is generally medium to coarse grained rock. The granitic rocks which are of deep seated origin are seen on the earth's surface because of long, continued erosion for millions of years of overlying rocks or tectonic activity.

Chemical composition

Name	Percentage
SiO2	72.04%
Al2O3	14.42%
K2O	4.12%
Na2O	3.69%
CaO	1.82%
FeO	1.68%
Fe2O3	1.22%
MgO	0.71%
TiO2	0.30%
P2O5	0.12%

Physical properties of granite

1. Granite is massive , unstratified , and dense having specific gravity 2.6 to 2.8 ; density = 2500 to 2650 kg/cu.m ; therefore it is very strong and competent (compressive strength = 1000 to 2500 kg/sq.cm)
2. Granite is massive and formed from melt it is neither porous (porosity is <1%) nor permeable (absorption 0.5 to 1.2%)
3. There is no saturation or percolation by water is possible. Therefore, the rock will not become weak in the presence of water and also it remains durable.
4. The constituent minerals of granite are very hard. This make the rock though and resistant to abrasion. (Hardness coefficient = 18).

LITERATURE REVIEW

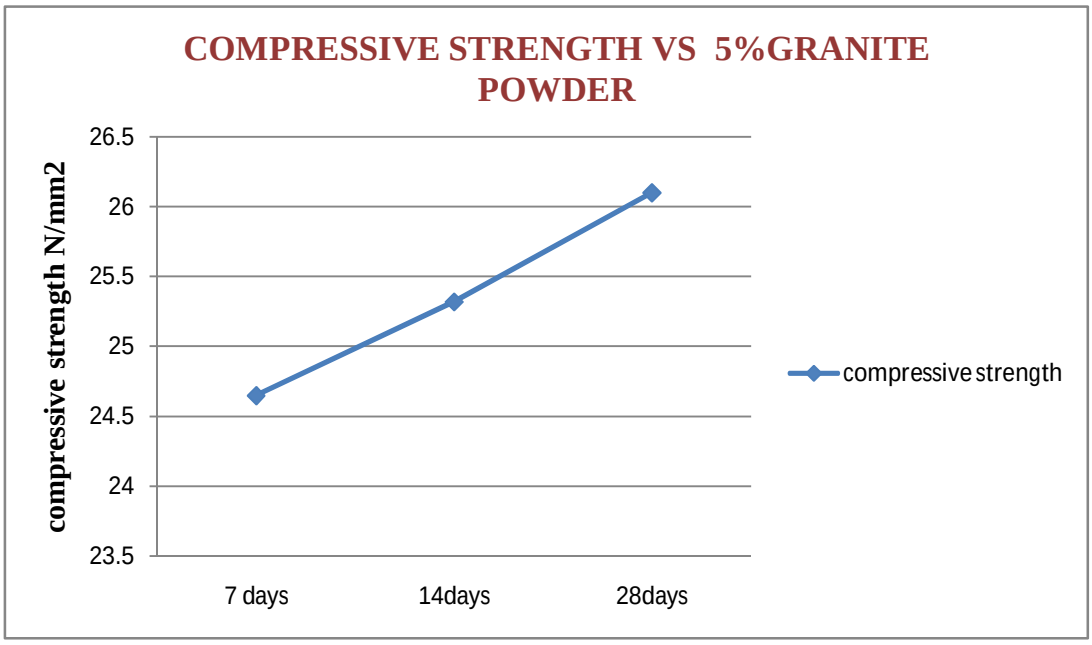
K. ShyamPrakash and Ch. Hanumantha Rao , et. al, results of experimental investigations conducted, it is concluded that the quarry dust can be used as a replacement for fine aggregate. It is found that 40% replacement of fine aggregate by quarry dust gives maximum result in strength than normal concrete and then decreases from 50%. The compressive strength is quantified for varying percentage and grades of concrete by replacement of sand with quarry dust.

Ravindra Nagar, Vinay Agrawal, Aditya Rana, Anshuman Tiwari, et. al, study investigates the feasibility of using granite cutting waste (GCW) as a partial substitute of river sand in high strength concrete based on strength, durability & micro structural attributes at 0.30, 0.35 and 0.40 water cement ratios (w/c) by substituting 0%, 10%, 25%, 40%, 55% and 70% river sand by GCW suggested that 25–40% river sand can be substituted by the GCW with a favourable influence on the investigated parameters. The optimum amount of GCW to be used in concrete depends significantly upon water-cement ratio of concrete.

Pradeep K. Goyal et. al study is conducted to investigate the viable use of marble granite residue (MGR) in concrete mixes. Sand is replaced with GD along with cement (OPC grade 43) is replaced with MP as 0%, 10%, 20%, 30% & 40% by weight for M25 grade of concrete.

COMRESSION TEST RESULTS ON 5% GRANITE POWDER AS FINE AGGREGATE

S.NO	AGE IN DAYS	LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (N/MM2)	AVG COMPRESSIVE STRENGTH (N/MM2)
1	7	555	24.65	25.35
2	14	570	25.32	
3	28	587	26.10	

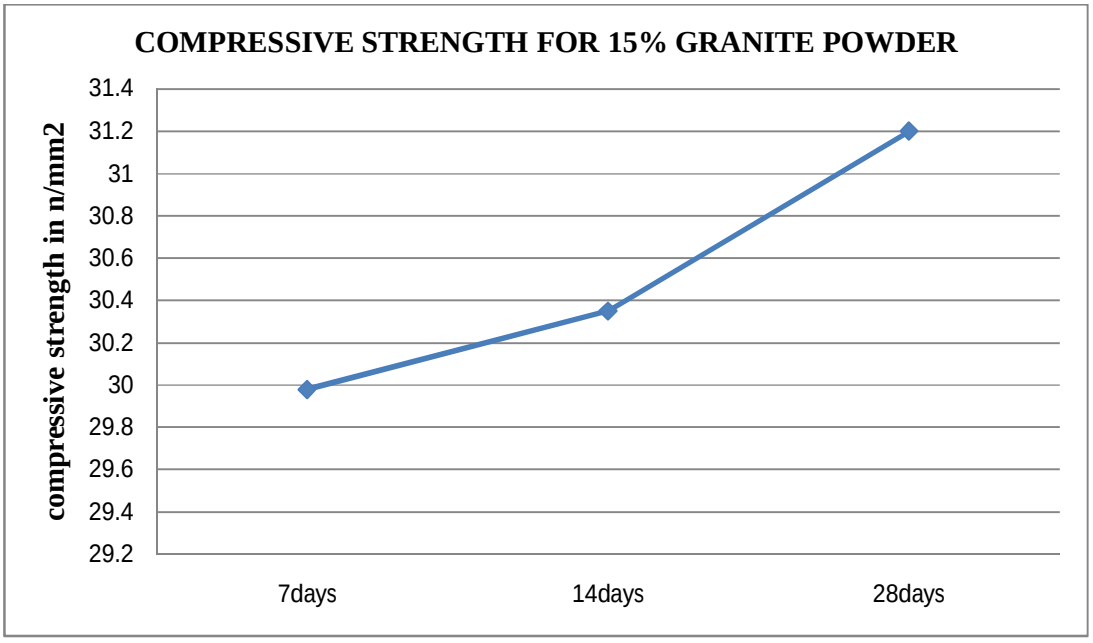


DISCUSSIONS:

Compressive strength of concrete has increased to 26.10 N/sq.mm at 5% granite powder.

COMRESSION TEST RESULTS ON 15% GRANITE POWDER AS FINE AGGREGATE

S.NO	AGE IN DAYS	LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (N/MM2)	AVG COMPRESSIVE STRENGTH (N/MM2)
1	7	675	29.98	30.51
2	14	683	30.35	
3	28	702	31.20	

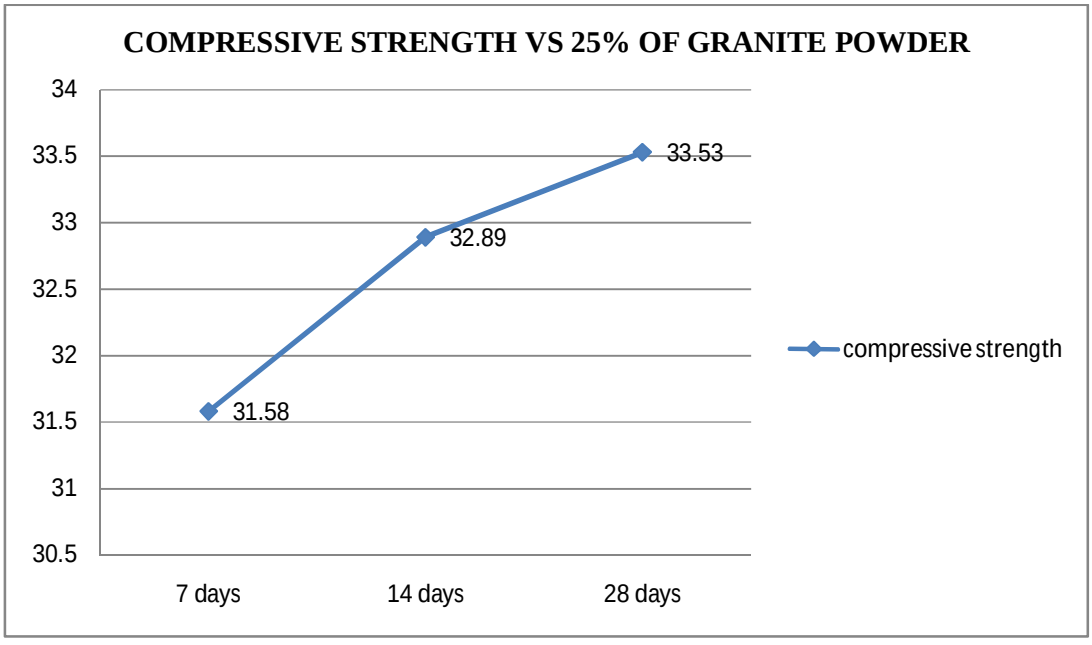


DISCUSSIONS:

Compressive strength of concrete has increased to 31.20 N/sq.mm at 10% granite powder.

COMRESSION TEST RESULTS ON 25% GRANITE POWDER AS FINE AGGREGATE

S.NO	AGE IN DAYS	LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (N/MM2)	AVG COMPRESSIVE STRENGTH (N/MM2)
1	7	711	31.58	32.67
2	14	740	32.89	
3	28	755	33.56	

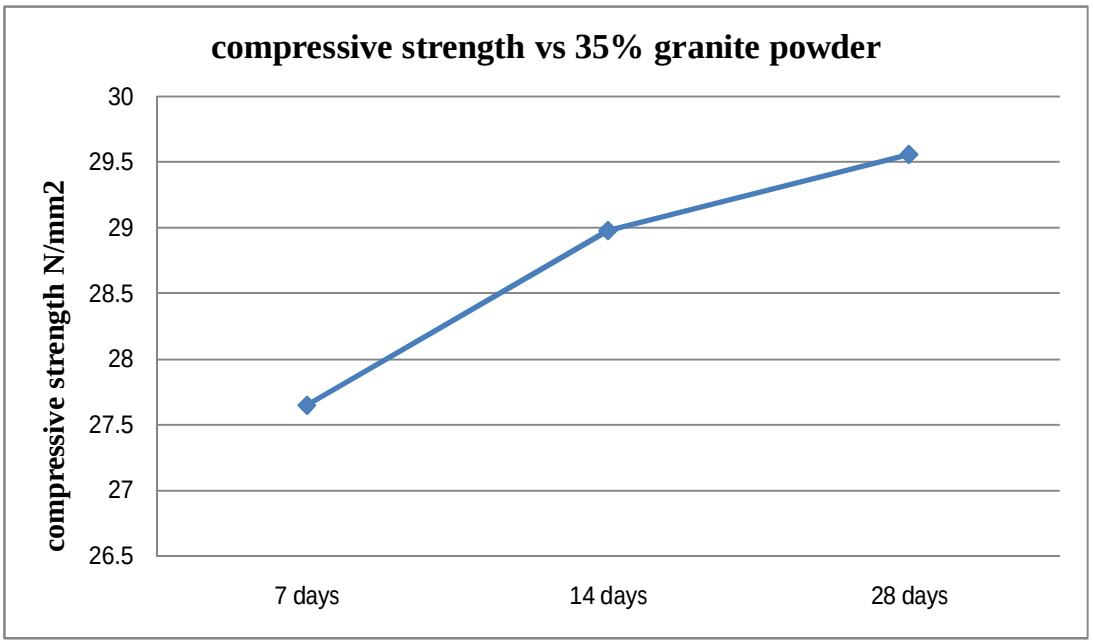


DISCUSSIONS:

Compressive strength of concrete has increased to 33.56 N/sq.mm at 25% granite powder.

COMRESSION TEST RESULTS ON 35% GRANITE POWDER AS FINE AGGREGATE

S.NO	AGE IN DAYS	LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (N/MM2)	AVG COMPRESSIVE STRENGTH (N/MM2)
1	7	622	27.65	28.73
2	14	652	28.98	
3	28	665	29.56	

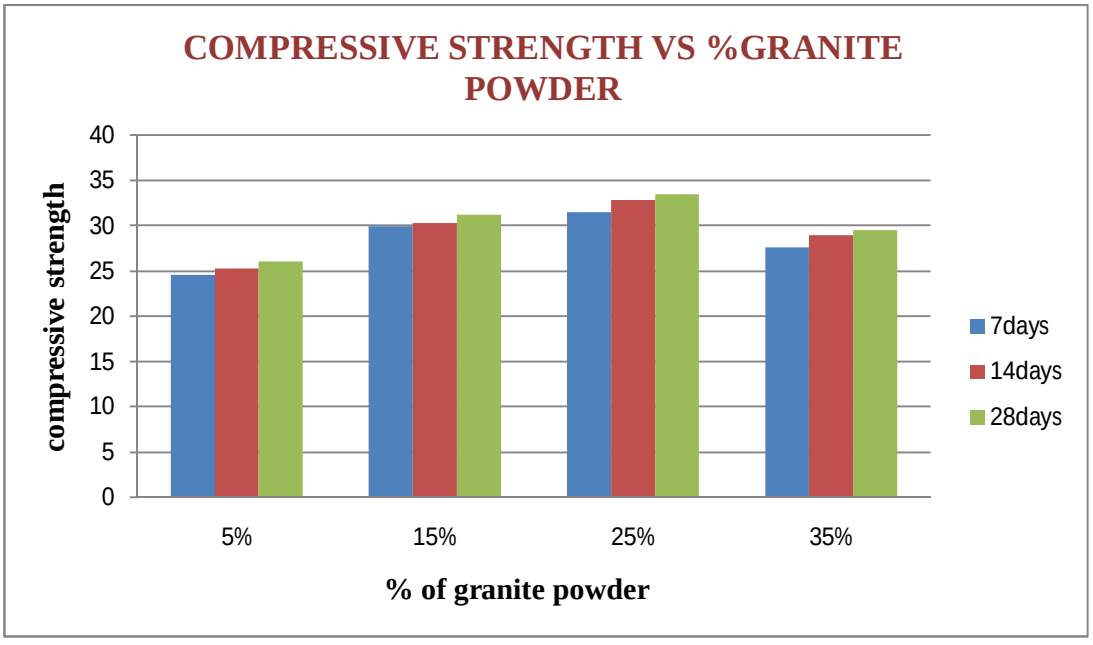


DISCUSSIONS:

Compressive strength of concrete has increased to 29.56 N/sq.mm at 35% granite powder.

COMPARSION ON CUBE COMPRESSION TEST RESULTS OF DIFFERENT PERCENTAGES OF GRANITE POWDER

% of granite powder	AGE [days]	LOAD [N]	STRENGTH N/mm2	AVG COMPRESSIVE STRENGTH N/mm2
5	7	555	24.65	25.35
5	14	570	25.32	
5	28	587	26.10	
15	7	675	29.98	30.51
15	14	683	30.35	
15	28	702	31.20	
25	7	711	31.58	32.67
25	14	740	32.89	
25	28	755	33.56	
35	7	622	27.65	28.73
35	14	652	28.98	
35	28	665	29.56	

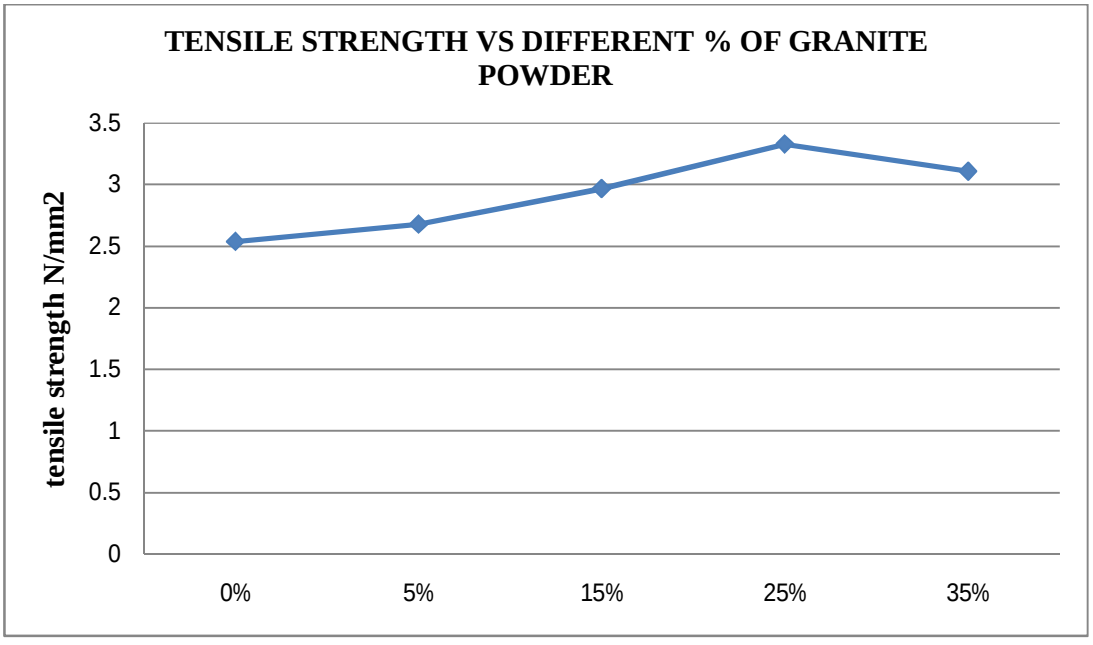


DISCUSSIONS

Finally, by comparing the different percentages of granite powder the compressive strength, at 28 days i.e., 32.67 N/sq.m

SPLIT TENSILE TEST FOR DIFFERENT % OF GRANITE POWDER

SL.NO	% OF GRANITE	LOAD AT FAILURE	TENSILE STRENGTH N/mm2
1	0	180	2.54
2	5	190	2.68
3	15	210	2.97
4	25	240	3.33
5	35	220	3.11



DISCUSSIONS

- The cylinder split tensile strength increases by 25% addition of granite powder as fine aggregate.

- The cylinder split tensile strength has decreased when addition of increase in percentage of granite powder as fine aggregate.

CONCLUSIONS

. The replacement of fine aggregate with granite powder by 25% will give the high strength properties compared to normal concrete.

. The compressive strength of the specimens increases in the percentage of the granite which results to increases in strength.

.With increase in the percentage of granite powder there will be decrease in the strength of concrete.

REFERENCES

1. A non-technological evaluation and norms study in stone waste and granite industry. Report of Ministry of Science and Technology. GOI, 1993.

2. Patel AN, Pitroda J. Stone waste in India for concrete with value creation opportunities. The International Journal of Latest Trends in Engineering and Technology. 2013 Mar; 2(2):113–20.

3. Agarwal RK. Modern stone waste processing techniques and their suitability for Indian condition. Jodhpur. A company report by Rajasthan Udyog. 2008.

4. T. Felixkala, P. Partheeban, 'Granite powder concrete' Indian Journal of Science and Technology vol.3,No.3(Mar 2010) ISSN: 0974-6846.

5. Kanmalai Williams C., Partheeban. P, Felixkala. T, 'Mechanical properties of high-performance concrete incorporating granite powder as fine aggregate' International Journal on Design and Manufacturing Technologies, vol.2, No.1, July 2008.

6. Job T (2005) Utilization of quarry powder as a substitute for the river sand in concrete. J. Structural Engg. 401-407.