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Experimental Investigation on Partial Replacement of Fine Aggregates by Granite Dust with Coconut Shell Powder in a Concrete Paver Block

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ABSTRACT
Utilising industrial waste is necessary for the advancement of technologies. The cost of traditional building materials is rising daily. Research into substitute building materials is thus important. In this experimental study, the concrete paver blocks are made with waste granite and coconut shell powder. Large amounts of trash are produced by the granite processing industry. A concrete paver block contains fine aggregate in place of some of the discarded granite. India is the third-largest producer of coconuts worldwide. Coconut produces a lot of garbage. Coconut shell powder is a possible building material that also helps to solve the solid waste problem. The fine aggregate is replaced by granite powder in amounts of 0%, 15%, 25%, 35%, and 45% to create the paver block, and 5% coconut shell powder is added to each proportion. All test specimens underwent a compression strength test after 28 days of cure. On the basis of the compressive strength test on specimens of various proportions with waste granite and powdered coconut shell, traditional paver blocks are compared. The concrete with 25% replacements is shown to have remarkable strength. Consequently, recycled materials like granite and coconut shell powder are used in manufacturing.
Keywords: Granite powder, Coconut shell Powder, recycled material, compressive strength.

I. INTRODUCTION

In the construction sector, concrete is crucial. Due to its dependability, adaptability, and affordability, it is widely used. Fine aggregate is a necessary and most frequently utilised component of a concrete mix. Typically, river sand is used to describe fine aggregate. Granite is a rock that is hard, huge, dense, and compact. To increase the strength of the concrete, use granite powder as a fine aggregate. You can also experiment with different combinations by substituting 5% of the coconut shell powder for 0%, 15%, 25%, 35%, and 45% of the M Sand, respectively. To promote the usage of granite powder in order to mitigate the negative environmental effects brought on by the excessive use of M-sand. to investigate the effects of replacing varied amounts of M-sand with granite powder on the workability and strength attributes of a concrete mix. To determine the ideal percentage of M-sand replacement with granite powder for concrete that produces exceptional mechanical qualities. to compare the results of conventional concrete and concrete made with granite powder at 28 days characteristic compressive strength.

II. STUDY OF MATERIAL PROPERTIES

2.1 CEMENT

The most commonly used cement in construction today is Portland cement and hence ordinary Portland cement of 53 grades has been selected for the investigation. The cement according to the Indian specification must satisfy the IS code IS: 8122-1989. Specific gravity of cement equal to 3.15, Fig 2.1 cement

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Table 1 Chemical Composition of Cement

CHEMICAL COMPONENTS	% OF CONTENT
Lime (Cao)	64.2
Silica (SiO2)	21.4
Alumina (Al2O3)	34.9
Iron Oxide (Fe2O3)	3.8
Alkalies(K2O)	0.44
Magnesium Oxide (MgO)	1.10
Sulphur Trioxide (SO3)	2.10

2.2 GRANITE POWDER

Granite Powder which belongs to the igneous rock family. This waste was collected from the polishing industries. The chemical composition of granite powder is shown in the table 2 and table 3 shows the various properties of granite powder.

Fig 2.1 Granite powder

CHEMICAL COMPONENTS	% OF CONTENTS
Silica (SiO2)	72.67
Alumina (Al2O3)	16.78
Ferric Oxide(Fe2O3)	2.49
Titanium Dioxide (TiO2)	0.08
Maganese Oxide (MnO)	0.05
Calcium Oxide(CaO)	1.4
Sodium Oxide(Na2O)	3.17
Potash(K2O)	2.32

Table 2 Chemical Composition of Granite Powder.

SI.NO	PARAMETERS	TEST RESULTS
1	Specific Gravity	2.65
2	Fineness modulus	2.52
3	Grading	Zone II

Table 3 Properties of Granite Powder.

2.3 COCONUT SHELL POWDER

Coconut shell has high strength and modulus properties. It has added advantage of high lignin content. High lignin content makes the composites more weather resistant. It has low cellulose content due to which it absorb less moisture as compare to other agriculture waste. Coconuts being naturally available in nature and since its shells are non-biodegradable;

Fig 2.2 Coconut Shell Powder

III. DESIGN MIX AND METHODOLOGY

3.1 MIX DESIGN FOR M25 GRADE

Cement	=	550 kg/m3
Water	=	156liters
Fine aggregate	=	889kg/m3
Coarse aggregate	=	1001kg/m3
Water-cement ratio	=	0.4

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Ratio	Cement	Fine Aggregate	Coarse Aggregate	Water/CementRatio 0.4
	550 kg/m^3	889 kg/m^3	1001 kg/m^3	
	1	1.61	1.82	

Table 4 Shows the Mix proportions of M25 Concrete Grade.

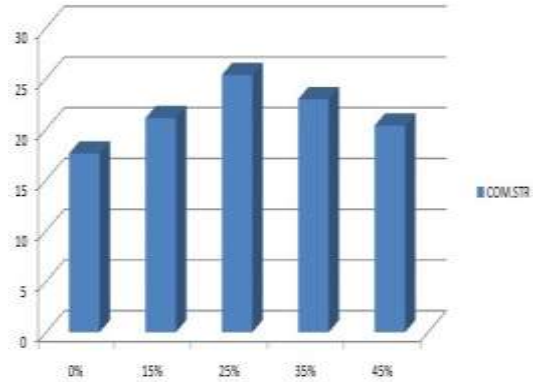
3.2 COMPRESSIVE STRENGTH TEST

The strength related tested were carried out on hardened conventional concrete 28days to ascertain the strength related properties such as cube compressive strength. If the bearing area of concrete unit is more than the bearing area of steel blocks, then separate steel plates are used. Bearing area of concrete units are capped with the Sulphur and granular materials coating or gypsum plaster capping. After placing the unit in testing machine, one-half of the expected maximum load is applied at a constant rate, and the remaining load is applied in not less than 2 minutes**.**

Fig 3.1 Compression Test for Paver Blocks

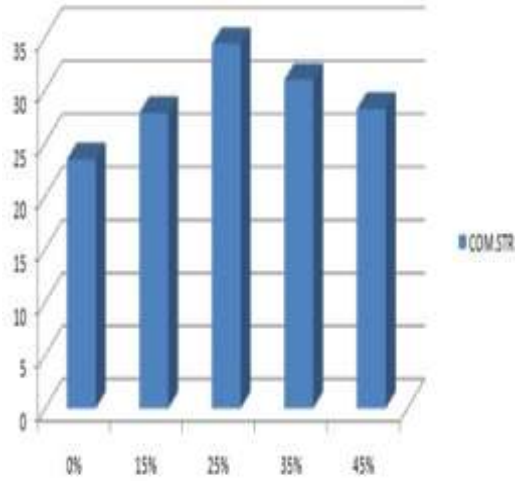
IV. RESULTS AND DISCUSSIONS

7th DAY TEST



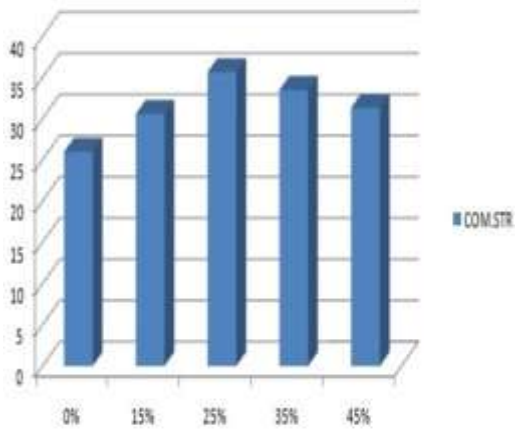
Graph 1 .7th day test on Paver Block.

14TH DAY TEST



Graph 2 . 14th day test on Paver Block

28TH DAY TEST



Graph 3. 28th day test on Paver Block

V. CONCLUSION

Based on the experimental investigation the following conclusions are drawn,

- According to the compressive strength test result 28 days strength has been studied which increases gradually at replacement of granite powder up to 25% and slightly decreases at 45% than the conventional concrete.
- The compressive strength of paver blocks is 25.99 N/mm^2 for conventional concrete and 35.68 N/mm^2 for Granite Powder concrete which is 9.69% more.
- From the above results, it can be concluded that M-Sand can be replaced with Granite Powder.
- Coconut Shell Concrete can be used in rural areas and places where coconut is abundant and may also be used where the conventional

aggregates are costly.

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