

Study of Split Tensile Strength of Concrete by Partial Replacement of Granite Dust Powder in Cement

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ABSTRACT: The substitute of granite dust powder in cement has been investigated. The granites are available in specific paperwork inclusive of saddletan, mediumtan, Santana, brown, terraze; light grey, uncommon earth etc., In this research work we are using the mild gray granite dust powder and includes the experiment examine of the usage of regionally available granite dust powder as a partially replacement in cement to gain maximum tensile strength of concrete. Granite industries generate a lot amount of waste in particular within the shape of powder in the course of sawing and polishing method, which pollutes and reasons damage to the environment. Granite dust powders have been acquired from exclusive factories which include Nan-jangud, Mysore district, Karnataka and Hebbal industrial vicinity. The use of granite dust powder in concrete leads to scarcity of natural aggregate. Because of this reason the granite dust powder is utilized as a partial replacement in cement with 0%,5%,10%,15%,20%,25% and 30% of the substitution and M20 grade concrete are used these were casted and tested for split tensile strength

KEYWORDS: Split tensile strength, Granite dust powder (GDP), Water-cement ratio.

I. INTRODUCTION

Around India the granite stone industry produces around 20 million tons of granite waste out of that 75-80% will be the rejected at industry site and 30-45% in the form of cutting and 5-7% granite slurry at polishing units. Concrete is homogenous material of fine aggregate, coarse aggregate, cement and water with given proportion. Concrete is widely used as construction material in all over country; its annual global production is about 3.8 billion m³. Leaving the waste material to directly can cause the environmental problem. Hence the utilization/reuse of waste material has been emphasized. Waste can be used to produce new products or can be used as admixtures so that natural resources are used more efficiently and environment is protected from waste deposited. Granite waste is an industrial waste which is obtained from the granite polishing industry while cutting and shaping the stones in powder form. Granite dust powder which is a by-product of granite processing factory was studied by many researchers for its use in concrete and mortar production as sand replacing or cement replacing material. Granite slurry can be used as building material in the form of granite dust powder and it as been accepted in the industrially advanced countries.

II. RELATED WORK

The following section gives a brief background and some of the important pertinent studies that were carried out to the considered work, Y. **Yashwath kumar** [5] in his research work used granite powder waste as partial substituent to cement in concrete and examined the performance of concrete made with granite waste powder as a partial replacement of cement in 5 to 20%. The compressive strength for different percentage of granite powder is compare with standard concrete. In his work he achieved the maximum compressive strength in 10% replacement of granite dust powder. But higher re-placement of cement by GDP gives lower strength the effect of GDP on various other properties of concrete has also been evaluated. **SRINIVASA C H**[8] in his research work he replaced cement by granite dust powder as 5 to 40% with an increment of 5% the compressive strength is archived for 10% for 28 days when compare to normal concrete. **Dr T FLEIX KALA**[6] studied the "Effect of granite powder on strength properties of concrete" in his work he replaced cement by GDP as 25 to 100% with increment of 25% and the compressive strength achieve for 25% for 90 days and comparison is done with the normal concrete.

Dr G ELANGO VAN [7] studied the "Experimental studies of concrete by partial replacement of cement with



GDP” he replaces the cement by GDP in 5 to 20% with increment of 5% the compressive strength archive for 15% in 28 days. In this experimental work, the main objective is that granite dust powder is partially replaced in cement with 0%, 5%, 10%, 15%, 20%, 25% and 30% and the moulds were casted and cured for 3, 7 and 28 days. The compression strength test is conducted and tested for 3, 7, and 28 days. The results are compared with the normal concrete.

III. METHODOLOGY

A. MATERIALS CONSIDERED FOR WORK

Cement: Cement is a fine powder, which when mixed with water and allowed to set and harden, is capable of uniting fragments or masses of solid matter together to produce a mechanically strong material. The most commonly used cement is ordinary Portland cement of 53 grade conforming to IS: 12269. The tests conducted on cement are Standard Consistency, Specific Gravity, Fineness and Setting time.

Fine Aggregate: Locally available free of debris and nearly riverbed sand is used as fine aggregate. The fractions ranges from 4.75 mm to 150 micron are termed as fine aggregate. The sand particles should also pack to give minimum void ratio, higher voids content leads to requirement of more mixing water. In the present study the sand conforms to zone I as per the Indian standards. The tests conducted on fine aggregates are Fineness, Specific Gravity and Water absorption.

Coarse Aggregates: The fractions above 4.75mm are termed as coarse aggregate. The crushed aggregates used were 20mm nominal maximum size and the tests conducted on coarse aggregates are Fineness, Specific Gravity and Water absorption.

Granite dust powder: Granite is mixture of angular particles; colour can range from white to red black and colour in between, ranging in size from pebbles to boulders. The various test were conducted on the GDP are Standard Consistency, Specific Gravity and Setting time.

Water: Water available from the local sources conforming to the requirements of water for concreting and curing as per IS: 456-2000.

B. MATERIAL PROPERTIES

Table -3.1: Physical properties of cement

SL No.	Particulars	Obtained Values
01	Residue	4%
02	Consistency	34%
03	Specific gravity	3.10
04	Setting time	45min 300min
	Initial settingtime	
	Final settingtime	

Table -3.2: Physical Properties of Fine aggregates and Coarse Aggregates

SL No.	Particulars	Obtained Values (fine aggregates)	Obtained Values (coarse aggregates)
01	Sieve analysis	2.68	4.41
02	Specific gravity	2.65	2.7
03	Water absorption	0.6%	0.3%



Table -3.3: Physical properties of Granite dust powder

SL No.	Particulars	Obtained Values
01	Specific gravity	2.62
02	Consistency	35%
03	Setting time Initial setting time Final setting time	80 min 420 min

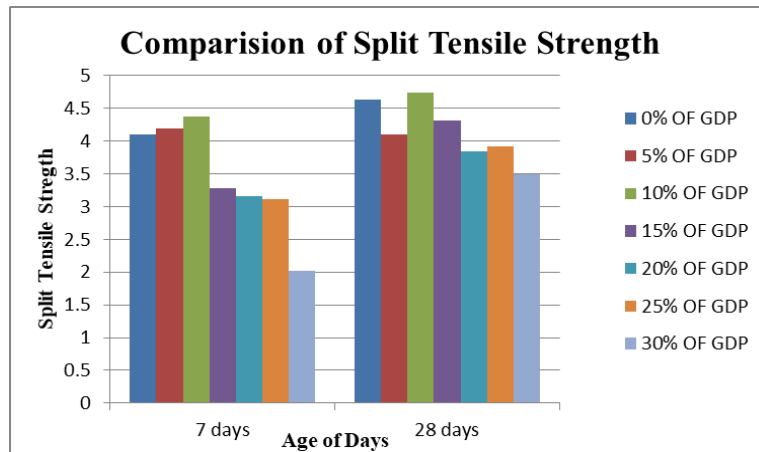
The process of casting concrete which consists of selection of materials such as cement, fine aggregate, coarse aggregate and Granite dust powder. Concrete cube is prepared for M20 mix designed for plain concrete. GDP is used as partial replacement in cement with 0%,5%,10%,15%,20%,25% and 30%. Materials are mixed by considering the proportions as per the mix design. The mould of dimension 150x150x150 mm in 03 layers in which each layer of height approximately 50mm. In each layer compaction is done by using tamping rod/shake table. Moulds are prepared for different proportions as per the design IS: 10262 – 2009. The moulds are cured for 7 & 28 days under no dry condition until they are tested. The concrete cube specimens are tested at the age of 7 & 28 days of curing period. Split tensile tests are carried out on the concrete cube specimens in a tensile test rig and the values are recorded .

IV. EXPERIMENTAL RESULTS

Table 4.1: Test results of M₂₀ grade concrete with 0%,5%,10%,15%,20%,25% and 30% replacement of GDP with cement for 7 and 28 days.

SL. NO.	% REPLACE MENT OF GRANITE DUST POWDER	AGE IN DAYS	7 DAYS	28 DAYS
01	0%	SPLIT TENSILE STRENGTH IN MPA	4.098	4.627
02	5%		4.200	4.100
03	10%		4.370	4.539
04	15%		3.288	4.320
05	20%		3.155	3.847
06	25%		3.110	3.915
07	30%		2.016	3.498

Graph – 4.1: M₂₀ concrete grade with 0%, 5%, 10%, 15%, 20%, 25% and 30% replacement of GDP in cement and their Split Tensile strengths at 7 and 28 days.



The above graph indicates that the split tensile strength for 7 and 28 days with 0%, 5%, 10%, 15%, 20%, 25% and 30% replacement of GDP with cement. The strength increases for 28 days with 10% replacement of GDP when compared with normal concrete i.e., 0% replacement of GDP with cement.

V. CONCLUSION

Based on the split tensile strength test, the following are the conclusions obtained,

- ❖ The Maximum Split tensile strength is obtained when 10% of GDP was replaced incement.
- ❖ The Split tensile strength for 15%, 20%, 25% and 30% replacement of GDP is not increased. There is little variation in the strength when compared with normal concrete. The optimum result is obtained for 10% replacement of GDP with cement.
- ❖ By addition of GDP into cement, proper utilization of granite waste can be achieved.

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