Study on Properties of Concrete Using Stone Dust and Flyash as a Partial Replacement of Fine Aggregate & Cement

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Abstract-The main objective of this research is to investigate the use of fly ash and other is Stone dust as partial replacement of cement and concrete production. In this research we analyze the strength of concrete made with using these waste materials one is Fly ash and other is Stone dust. The Fly as his used as 20% replace by weight of cement and Stone Dust as the partial replacement of Fine Aggregate from 0%, 10%, 20%, 30% and 40%. The grade of the concrete here is M-30 grade.

Keywords: fly ash, Stone Dust, Mix Design, Compressive Strength Test, Flexure Test, Split Tensile Test.

I. INTRODUCTION

Concrete is the most widely used construction material in the world it is a mixture of cement, sand, coarse aggregate and water. Cement is binding material in the cement concrete and its role is to provide strength to concrete. Cement fills up voids existing in the fine aggregate and makes the concrete impermeable. Provides strength to concrete on setting and hardening and binds the aggregate into a solid mass by virtue of its setting and hardening properties when mixed with water. Fine aggregate consist of small angular or rounded grains of silica. It is commonly used as the fine aggregate in cement concrete. It fills the voids existing in the coarse aggregate it reduces shrinkage cracking of concrete. It helps in hardening of cement by allowing the water through its voids. To form hard mass of silicates as it is believed that some chemical reaction take place between silica of sand and constituents of cement, Coarse aggregate makes solid and hard mass of concrete with cement and sand .it increase the crushing strength of concrete.

Strength of Concrete

The strength of concrete is very much dependent upon the hydration reaction just discussed. Water plays a critical role, particularly the amount used. The strength of concrete increases when less water is used to make concrete, the hydration reaction itself consumes a specific amount of water. Concrete is actually mixed with more water than is needed for the hydration reactions. This extra water is added to give concrete sufficient workability. Flowing concrete is desired to achieve proper filling and the composition of the forms. The water not consumed in the hydration reaction will remain in the microstructure pore space. These pores make the concrete weaker due to the lack of strength-forming calcium silicate hydrate bonds. Some pairs will remain no matter how well the concrete has been compacted.

II. RELATED WORK

P.P.Shanbhag , V.G.Patwari JULY 2017, The present study is aimed at utilizing Waste marble powder and quarry sand as partial replacement of cement and fine aggregate in concrete and comparing it with conventional concrete. This experimental investigation is carried out in three phases in 1st phase M20 grade of concrete is produced by replacing cement with 0%, 5%, 10% & 15% of Marble Powder. In 2nd phase concrete is produced by replacing sand with 0%, 30%, 40% & 50% of quarry sand and in 3rd phase concrete is produced by replacing cement and fine aggregate in the percentage of 0%, 5%, 10% & 15% of Marble Powder and 0% , 30%, 40% & 50% of quarry dust respectively. It is found that the studies of concrete made of waste marble powder and quarry sand increases at 10% and 40% respectively. Therefore the quarry dust and waste marble powder should be used in construction works, then the cost of construction would be saved significantly and the natural resources would be used efficiently.

Mohammadreza Mirzahosseini and Kyle A. Riding. " June 2015, Have examined that the finely ground glass hs the potential for pozzolanic reactivity and can fill in as a supplementary cementitious material uniform structure, amorphous nature, and high silica content influenced ground to glass perfect for concentrate the impacts of glass write and molecule estimate on smooth material reactivity at various temperature. This investigation centers around how the blend of glass composes and particles sizes influences the microstructure and execution properties of cementitious framework containing glass cullet as a supplementary cementitious materials. They found that the response rate pozzolanicity and hydration degree capability of four arrangements of consolidated glass composes and sizes were examined utilizing isothermal calorimetric concoction shrinkage, thermo gravimetric investigation and examination of checking electron magnifying lens pictures, additionally compressive quality and water sorptivity were performed on mortar tests to connect reactivity of cementitious materials containing glass to the execution of cementitious blends. Results demonstrated that joined glass can expands response rate and show pozzolanic properties, particularly when particles of clear and green glass underneath 25 micron were utilized at a curing temperature of 50 degree Celsius. The synchronous impact of sizes and kinds of glass cullet (surface zone) on response rate of Glass Powder additionally can be represented through a straight option mirroring that the surface territory would fundamentally influence glass cullet reactivity. However execution properties a cementitious frameworks containing joined glass writes and measure carried on diversely as they took after the weaker segment of the two particles.

III. OBJECTIVES

• To find out alternative materials as partial replacement of cement and fine aggregate (sand).

IV. METHODOLOGY

Proportioning of a concrete mix means determining the relative amounts of materials (cement, aggregates, and water) required for batches of concrete of required strength. It can also be defined as the process of selecting suitable ingredients of concrete and determining their relative quantities with the object of producing, strength, workability and durability.

V. EXPERIMENTAL RESULTS

Compressive Strength Test

The result of the compressive strength with partial replacement of stone dust and without using flyash for 7, 14 and 28 days are shown for M-30 concrete and their graphical representation in the Figure.

Table 5.1 Compressive Strength of Different Mix of M-30 Concrete (with Flyash 20% & Cement 80%)

Designation	Compressive Strength in N/mm^2			Stone Dust %	Sand %	Cement %	Fly ash %
	7 Days	14 Days	28 Days				
A'$_1$ - 10	24.72	27.42	34.36	10	90	80	20
A'$_1$ - 20	25.96	28.90	37.80	20	80	80	20
A'$_1$ - 30	26.14	29.21	38.26	30	70	80	20
A'$_1$ - 40	28.80	30.60	39.96	40	60	80	20

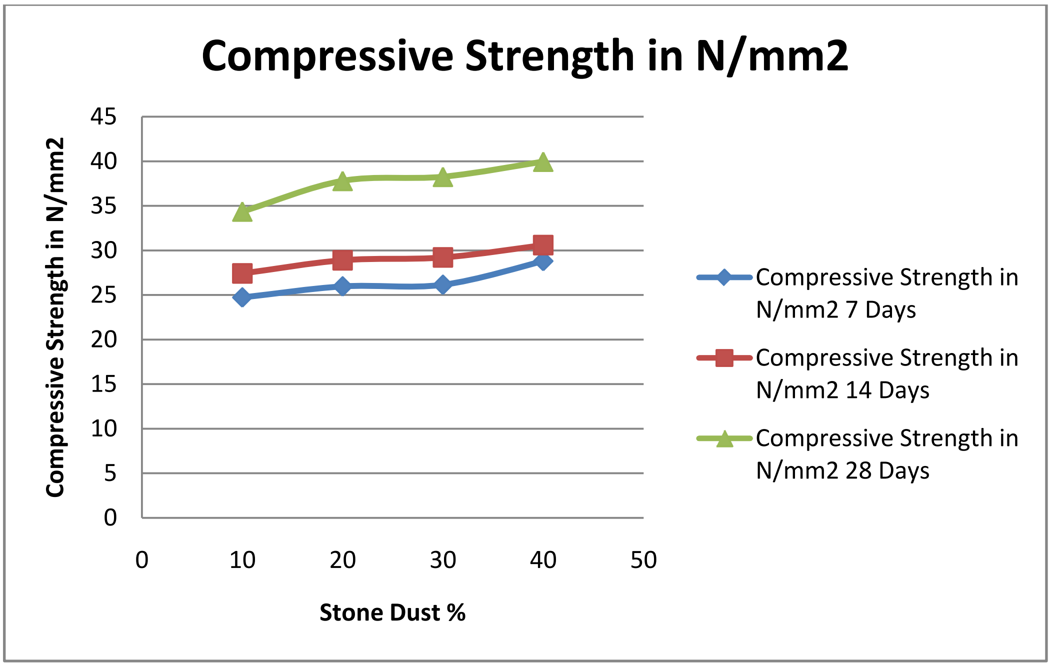

Figure 5.1 Compressive Strength of Different Mix of M-30 Concrete (with Flyash 20% & Cement 80%)

Flexure Strengh Test

The result of the flexure strength with partial replacement of stone dust and without using flyash for 7, 14 and 28 days are shown in for M-30 concrete and their graphical representation in the for M-30 Concrete. And by replacing

20% cement with fly ash along with stone dust is shown in the Table .

Table 5.2 Flexure Strength of Different Mix of M-30 Concrete (with Fly ash 20% & Cement 80%)

Designation	Flexure Strength in N/mm^2			Stone Dust	Sand	Cement	Flyash %
	7 Days	14 Days	28 Days	%	%	%	
A'$_2$ - 10	4.22	5.41	6.39	10	90	80	20
A'$_2$ - 20	4.36	5.32	6.69	20	80	80	20
A'$_2$ - 30	4.82	5.37	7.02	30	70	80	20
A'$_2$ - 40	4.98	5.38	7.25	40	60	80	20

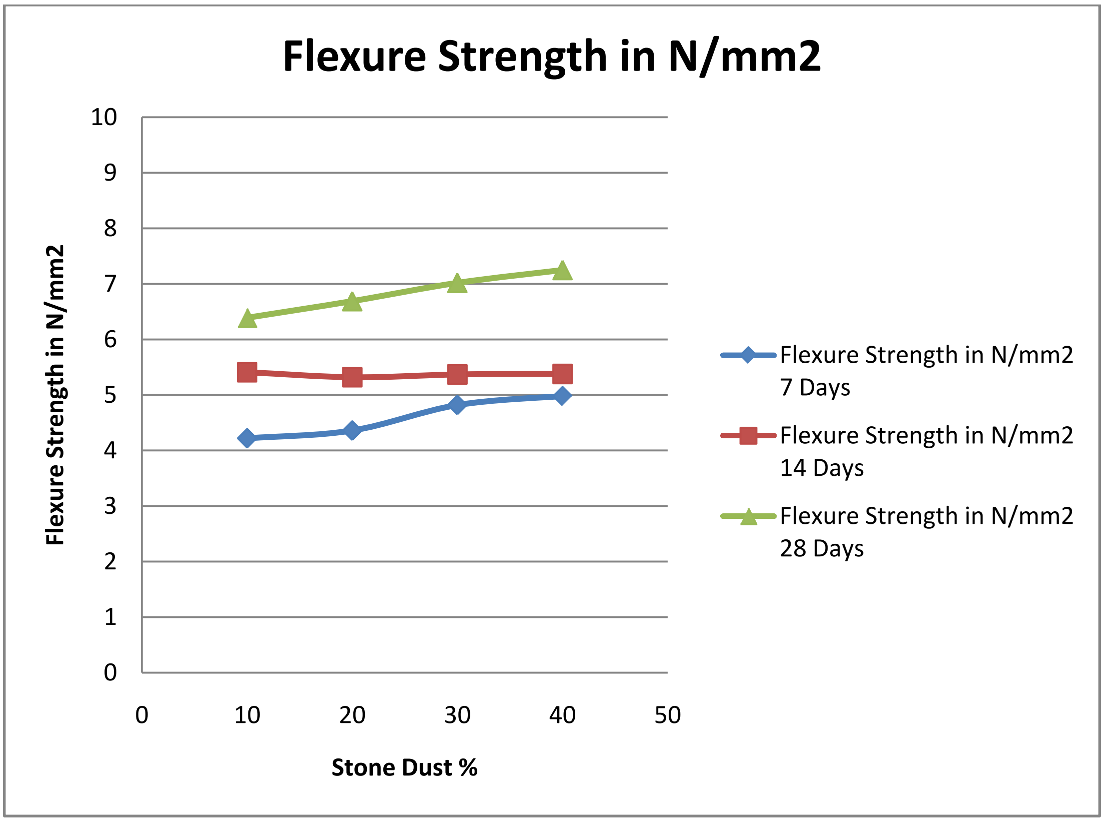

Figure 5.2 Flexure Strength of Different Mix of M-30 Concrete (with Fly ash 20% & Cement 80%)

Split Tensile Strengh Test

The result of the split tensile strength with partial replacement of stone dust and without using flyash for 7, 14, 28 and 56 days are shown in the Table 4.15 for M-30 concrete and their graphical representation in the Figure 5.3

Table 5.3 Split Tensile Strength of Different Mix of M-30 Concrete (with Flyash 20% & Cement 80%)

Designation	Split Tensile Strength in N/mm^2			Stone Dust	Sand	Cement	Fly ash %
	7 Days	14 Days	28 Days	%	%	%	
A'$_3$ - 10	3.12	3.75	4.17	10	90	80	20
A'$_3$ - 20	3.15	3.58	4.25	20	80	80	20
A'$_3$ - 30	3.18	3.74	4.36	30	70	80	20
A'$_3$ - 40	3.22	3.96	4.49	40	60	80	20

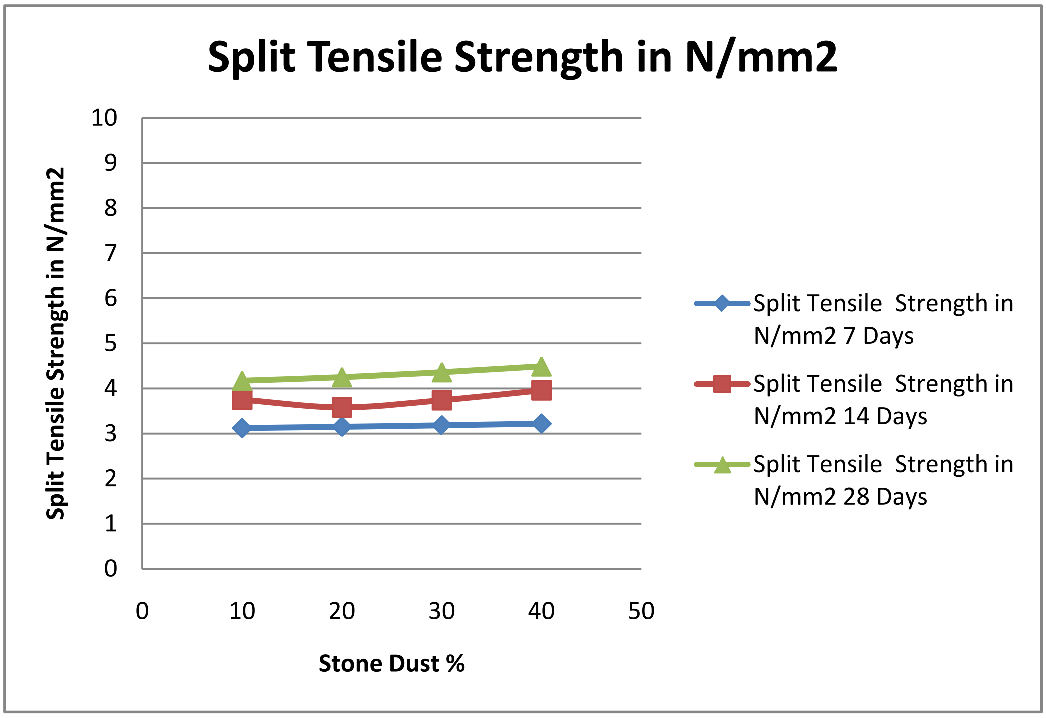

Figure 5.3 Split Tensile Strength of Different Mix of M-30 Concrete (With Flyash 20% & Cement 80%)

VI. CONCLUSION

- The stone dust is to be used as partial replacement of the natural sand.
- The use of stone dust in concrete is beneficial in different manner such as environmental aspects, non-availability of good quality of fine aggregate or rarely availability, strength quality etc.
- The use of fly ash in this study also saves the costly cement. Which is great saving in the construction material and also reduces the cost of construction?

Future Scope of Work

The study can by carry out by increasing the percentage of stone dust up to 100% and fully replacement of the fine aggregate.

The study can also be carry out by increasing the percentage of fly ash up to maximum level with or without stone dusts.

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