Replacement of Fine Aggregate From Industrial Waste And Stone Dust For Various Properties

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Abstract: ***Now a day rapid growth of industrialization gave birth to numerous kind of waste byproduct which are environmentally hazard and create problems of storage. The proper use of waste material fundamentally affects our environment and economy. Over a period of time waste management has become more complex and challenging problem in India affecting the environment. Over 300 million tone of industrial waste are being produced per annual by agricultural industrial process in India. If some of industrial waste material found suitable use as fine aggregate in concrete making not only cost of construction can be cut down but also safe disposal of waste material can be achieve. In this paper we are partially use of industrial waste and stone dust as a fine aggregate and achieve better strength of concrete.***

Keywords: ***Industrial, waste, concrete, environment, material, India.***

1. INTRODUCTION

With the rapid growth of construction industries consumption of construction material increased. Again with the industrial development waste material generation is occurring in a massive quantity. In this present work the main objective is to determine the acceptability of stone dust and industrial waste as replacing substance of both binding material and fine aggregate in mortar and also road construction in respect to normal strength.

The use of stone dust in concrete as partial replacement of fine aggregate will be an alternative material instead of conventional fine aggregate. This project deals with replacement of fine aggregate with the replacement of industrial waste from Gallant industry and stone dust from stone crushing unit such as 0%,10%,20%,30%,40%,and 50% respectively.

In this paper we are focused towards increasing the strength, durability and workability of concrete by reducing natural fine aggregate and increasing industrial waste and stone dust in concrete respectively.

2. OBJECTIVE AND SCOPES

1. To effectively utilize the waste material from the Gallant industries.
2. To reduce the problem of disposal of industrial waste.
3. To prove that the industrial waste from Gallant industries can be a replacement for fine aggregate.
4. To replace the fine aggregate by industrial waste in different ratio such as 0%, 10%, 20%, 30%, 40%, and
5. 50% in M20 mix concrete.
6. To determine the compressive strength and compare it with the conventional concrete.
7. To determine the various properties of industrial waste sand and stone dust.

3. METHODOLOGY AND MATERIALS

(1) Cement: The cement used was a Portland Pozzolana Cement (PPC).

S. No.	TESTS	RESULTS
1	Fineness Test	97.00% finer than 90 micron sieve
2	Standard Consistency Test	34% by weight of cement
3	Initial Setting Time Test	48minutes
4	Final Setting Time	15 hours (900 minutes)
5	Soundness Test	3 mm deformation on Le-chatelier test
6	Compressive Strength Test(1 Days)	11.00 MPa
7	Compressive Strength Test(7 Days)	17.00 MPa
8	Compressive Strength Test(14 Days)	24.00 MPa
9	Compressive Strength Test(28 Days)	43.00 MPa
10	Specific Gravity Test	3.15

(2) The various test results for experiments on Portland Pozzolana cement are shown in tabulated form are as follows:

(3) Coarse aggregate: Coarse aggregate was used with 16 mm nominal size conforming to IS: 383-1970 Specifications.
The various test results also for coarse aggregate are shown in tabulated form are as follows.

Properties of Coarse aggregate

S.No.	Property	Value
1	Waterabsorption	0.5%
2	Specific gravity	2.68
3	Fineness modulus	6.17
4	Impact value	12.4
5	Crushing value	21.7

(1) Industrial waste: The Industrial waste was obtained from the Gallant Espat Pvt Ltd, Gida Gorakhpur district, Uttar Pradesh.

Properties of Fine aggregate

S.No.	Property	Value
1	Waterabsorption	0.5%
2	Specific gravity	2.67
3	Fineness modulus	2.54

(4) Stone dust: Stone dust was obtained from the Local crushing unit Gorakhpur, Uttar Pradesh.

Properties of Stone dust

S.No.	Property	Value
1	Waterabsorption	0.6%
2	Specific gravity	2.67
3	Fineness modulus	2.54

Experimental Design: The experiment was conducted to get strength of concrete cubes by partial replacement of fine aggregate from industrial waste and stone dust such as 0%, 10%, 20%, 30%, 40%,and 50%. For each batch 9 cubes was made to check the compressive strength at 7, 14 and 28 days. For concrete, workability test, compressive strength test and green density tests are performed. The complete details of the tests are provided in a tabulated form below:

Test on cement	Size of cubes	No. Of cubes
Compressive strength test	7.05 cm X 7.05 cm (50 cm^2 face)	9

Compressive Strength Test	Size of cubes	No. Of cubes
0%	15 cm X 15 cm X 15 cm	9
10%	15 cm X 15 cm X 15 cm	9
20%	15 cm X 15 cm X 15 cm	9
30%	15 cm X 15 cm X 15 cm	9
40%	15 cm X 15 cm X 15 cm	9
50%	15 cm X 15 cm X 15 cm	9

Experimental Design: The experiment was conducted to get strength of concrete cubes by partial replacement of fine aggregate from industrial waste and stone dust such as 0%, 10%, 20%, 30%, 40%,and 50%. For each batch 9 cubes was made to check the compressive strength at 7, 14 and 28 days. For concrete, workability test, compressive strength test and green density tests are performed. The complete details of the tests are provided in a tabulated form below:

4. RESULTS AND DISCUSSION

The results for workability test (slump test) for various percentage of industrial waste replacement on Concrete are as follows:

S.No.	Industrial Waste Replacement	Slump @ time
Units	Percentage	mm @ minutes & seconds
1	0%	14 mm @ 5minutes & 15seconds
2	10%	18mm @ 5minutes & 00seconds
3	20%	26mm @ 5minutes & 40seconds

4	30%	37mm @ 6minutes & 30seconds
5	40%	56mm @ 5minutes & 45seconds
6	50%	64mm @ 6minutes & 10seconds

The results for Green Density Test for various percentage of Industrial waste replacement on Concrete are as follows:

S.No.	Industrial waste replacement (%)	Green weight(kg)	Green Density(KN/m^3)
1	0%	8.14	24.06
2	10%	8.45	25.03
3	20%	8.63	25.57
4	30%	8.79	26.04
5	40%	8.96	26.55
6	50%	9.13	27.05

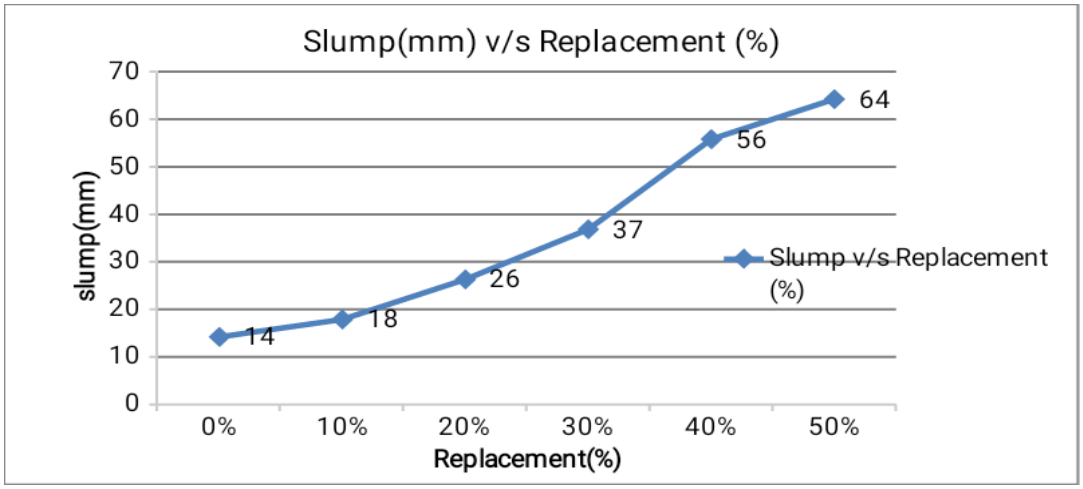
The results for compressive strength Test of concrete for various percentage of industrial waste replacement on concrete as follows:

S.No.	Industrial Waste Replacement	COMPRESSIVE STRENGTH		
Units	Percentage	MPa	MPa	MPa
		7 DAYS	14 DAYS	28 DAYS
1	0%	13.55	18.89	26.81
2	10%	15.26	21.88	26.32
3	20%	16.15	21.29	27.48
4	30%	18.40	23.53	27.64
5	40%	22.80	28.29	32.79
6	50%	26.00	33.22	36.52

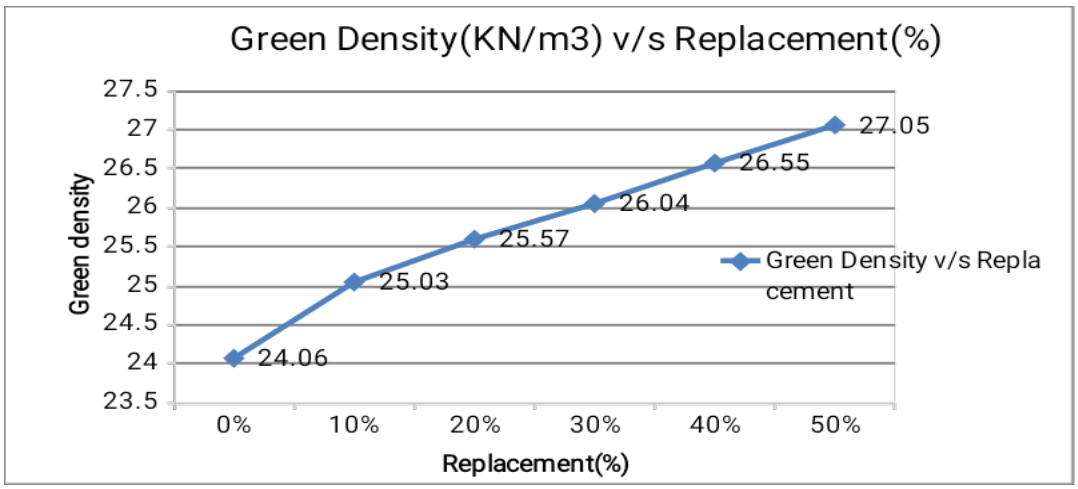
The results for compressive strength Test of concrete for various percentages of stone dust replacement on concrete as follows:

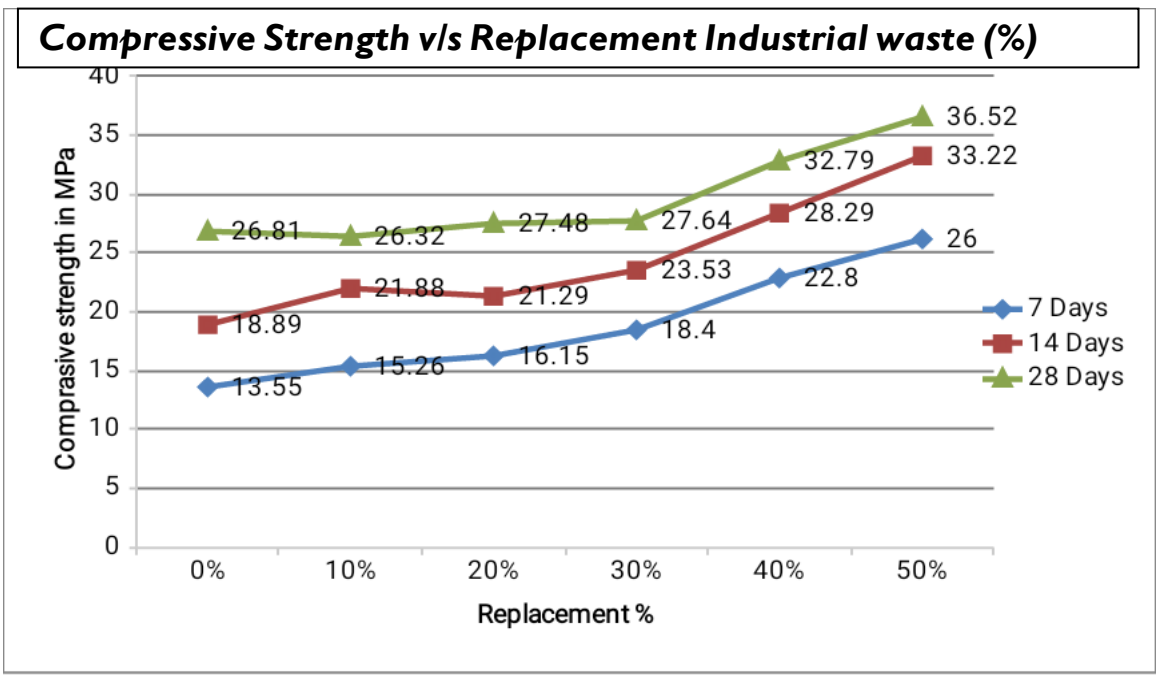
S.No.	Stone Dust Replacement	COMPRESSIVE STRENGTH		
Units	Percentage	MPa	MPa	MPa
		7 DAYS	14 DAYS	28 DAYS
1	0%	13.55	18.89	26.81
2	10%	14.32	19.20	26.23
3	20%	15.76	20.51	27.92
4	30%	16.71	21.35	28.64
5	40%	18.40	23.43	30.96
6	50%	16.43	20.37	27.28

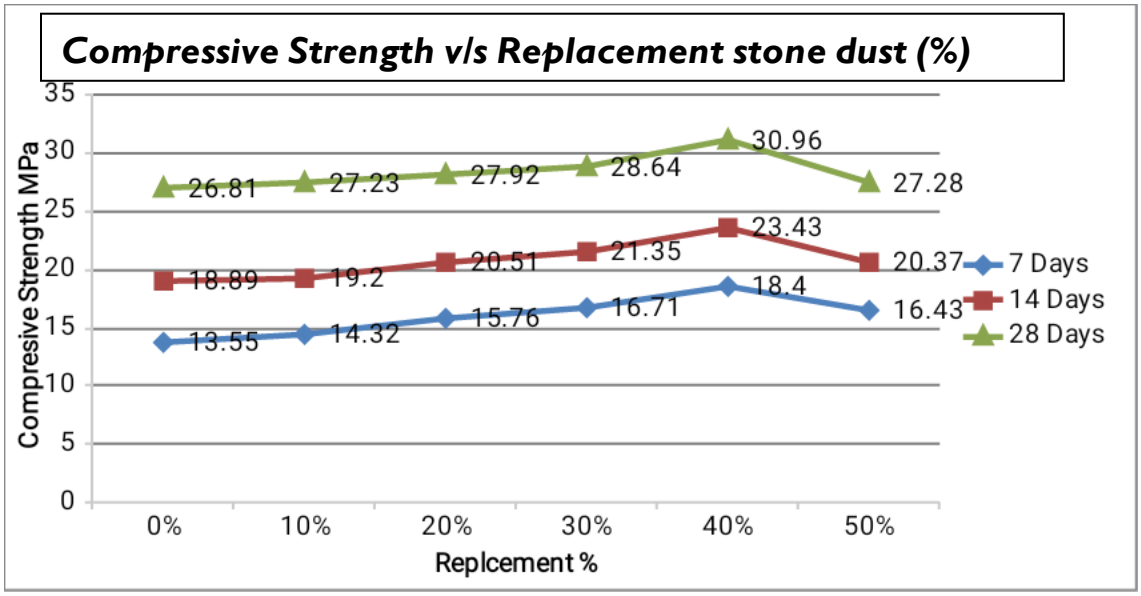
The results can be better understood using graphs for the same. So the graphs for all the tests on concrete are shown below:



The Slump values show that the Workability increases gradually by increasing the percentage content of Industrial waste replacement in PPC. It acceptable all value of slump at 0% to 50%. The Green density experimental results show that the green density of the concrete increases up to Industrial waste replacement 0% to 50% continuously







The compressive strength experimental values show that the compressive strengths are the maximum for 50% of replacement of PPC by industrial waste at 7, 14 and 28 days. The values increases up to 50 % and then decreases thereafter. So as an overall result, this can be stated that on replacing PPC by 50 % of industrial waste, we attain the maximum values which are acceptable and can be used for construction purpose without compromising the qualities of concrete.

The compressive strength experimental values show that the compressive strengths are the maximum for 40% of replacement of PPC by stone dust at 7, 14 and 28 days. The values increases up to 40% and then decreases thereafter. So as an overall result, this can be stated that on replacing PPC by 40 % of stone dust, we attain the maximum values which are acceptable.

5. CONCLUSIONS

From the above experiments performed by replacing fine aggregate (local sand) by industrial waste and stone dust in various proportions of 0%, 10%, 20%, 30%, 40% and 50%, it is observed that the replacement of fine aggregate with 50% of industrial waste from Gallant Espat Pvt Ltd is best suited in terms of Green Density, Workability and Compressive Strength. So it is highly recommended value for the replacement of fine aggregate with industrial waste for the economy with the best all positive results and also replacement of fine aggregate with 40% of stone dust has greater compressive strength and it can also be helpful in maintaining the economy of construction without compromising the qualities of it. In case of ordinary construction work 40% of replacement is the best one, while for construction of roads and for heavy construction the use of industrial waste a replacement level of 50.00% keeping an eye on safety and satisfaction of performance.

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