Research Article

Assessment and exploration of waste foundry sand in micro silica blended concrete using STS and CS tests

Deepak Varshney[1], Hemant Singh Parihar[2],

Deepak Varshney1, Hemant Singh Parihar2,
1Assistant Professor, Department of Civil Engineering, GLA UNIVERSITY, Mathura, 281406(UP).
deepak.varshney@gla.ac.in
2Assistant Professor, Department of Civil Engineering, GLA UNIVERSITY, Mathura, 281406(UP),
hemantsingh.parihar@gla.ac.in

Correspondence:
Hemant Singh Parihar
1Assistant Professor, Department of Civil Engineering, GLA UNIVERSITY, Mathura, 281406(UP).
deepak.varshney@gla.ac.in

ABSTRACT

The deficiency of sand in the river made a novel interest in the researchers. The contributions regarding sand of river diminishment and requirement for exploitation made scientific management of resources available. Here, the sand from foundry could be utilized in the form of partial substitution of fine components or overall substitutes of fine components and the addition of supplementary to attain divergent concrete properties. The concrete has been substituted with optimal aggregate & micro silica has been substituted partially with foundry sand that is of waste. The STS & CS tests has been performed during 28 & 7 days. The highest strength has been attained at substitution of 15% of sand taken from foundry. When compared with plain cement concrete, blended concrete containing micro silica has exhibited greater improvements.

Key words: Compressive strength (CS), Foundry sand, Micro silica, Split tensile strength (STS), Waste foundry sand (WFS).

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INTRODUCTION

The deficiency of filling space of land besides with its ever-enhancing cost and waste material usage and the by-products became a fascinating replacement for disposing. The WFS has been considered as such by-product of company [1-5]. The non-ferrous & ferrous metal casting companies generate huge amount of by-product tons all over the universe [6-8]. Nearly 2 million WFS tons has been generated in India every year [9] [10]. The term WFS has been taken as metal casting company by-product and resourcefully utilized as filling material of land for several years [11] [12]. However, utilization of WFS & filling of land became an issue because of fast enhancement in cost of disposal [13-15].

INTENTS OF CURRENT ANALYSIS

For examining the impact of WFS as fine aggregate partial substitute on the M40 grade concrete properties.
For optimizing the content or amount of micro-silica

EXPERIMENTALPROGRAM

Materials

The amounts of materials utilized in this simulation study are coarse & fine aggregate, WFS, micro-silica and cement.

Cement

The cement of Portland having 53 confirming grades to IS: 12269-1987 has been utilized

Fine Aggregate

The sand from river has been utilized in the form of fine aggregate in the present investigation.

Coarse Aggregate (CA)

The machine smashed the angular metal granite possessing nominal size of 20mm from source has been utilized as CA.

WFS

The WFS has been locally attained from uppal Hyderabad in MAK casting company. The WFS has been utilized as partial substitution of finest aggregate. [16-18]

Table 1 Physical Properties of WFS

S.No.	Property	Outcomes of test
1	Fineness-modulus (FM)	1.66
2	Specific-gravity (SG)	2.35
3	Bulk density (kg/m^3) - Loose ense	1230 1350

Micro Silica

Amorphous Micro Silica of Grade 920-D was obtained

from Elkem Materials.

OBSERVATIONS AND DISCUSSIONS

Compressive Strength

The compressive strength is determined for the cast specimens and furnished in table2.

Table 2 Compressive Strength of Concrete with Waste Foundry Sand

S. No.	ID of Mix	CS measured in (MPa)	
		7	28 days
1	WF0	36.39	52.14
2	WF5	38.97	56.08
3	WF10	40.37	58.26
4	WF15	42.60	60.74
5	WF20	40.48	58.76
6	WF25	37.76	55.86

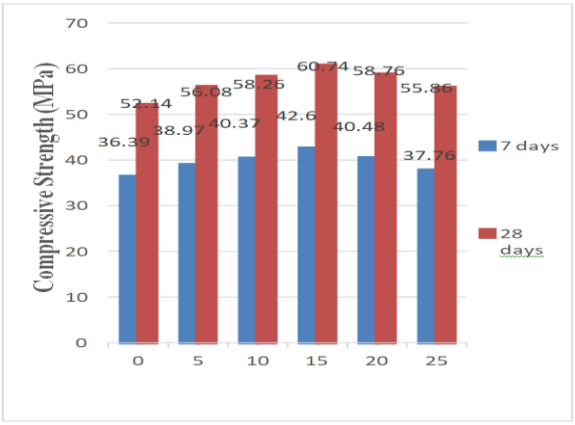

Fig. 1 CS of Foundry-Sand at divergent ages

STS

The STS is determined for cast specimens & furnished in table 3.

Table .3. Split Tensile Strength of concrete with Waste Foundry sand

S. No.	Mix ID	Split Tensile Strength (MPa)	
		7 days	28 days
1	WF0	3.52	5.05
2	WF5	3.77	5.42
3	WF10	3.84	5.54
4	WF15	4.13	5.82
5	WF20	3.80	5.52
6	WF25	3.53	5.22

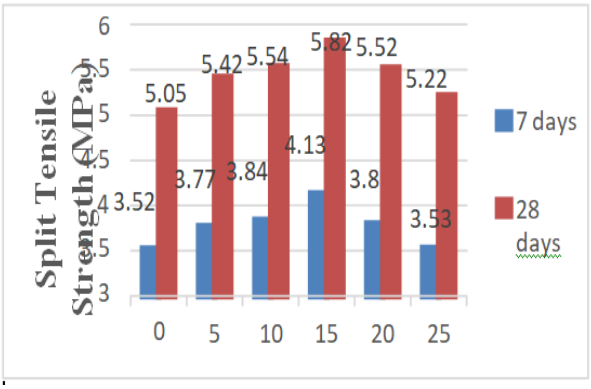

Fig. 2Split tensile strength of Concrete with Foundry Sand at different ages

The compressive strength of concrete with micro silica at different ages.

Table 4 Compressive Strength of Waste Foundry Sand

S. No.	Mix ID	Compressive Strength (MPa)	
		7 days	28 days
1	MS0	36.39	52.14
2	MS5	41.88	60.27
3	MS7.5	43.89	61.83
4	MS10	44.91	64.53
5	MS15	38.88	57.19

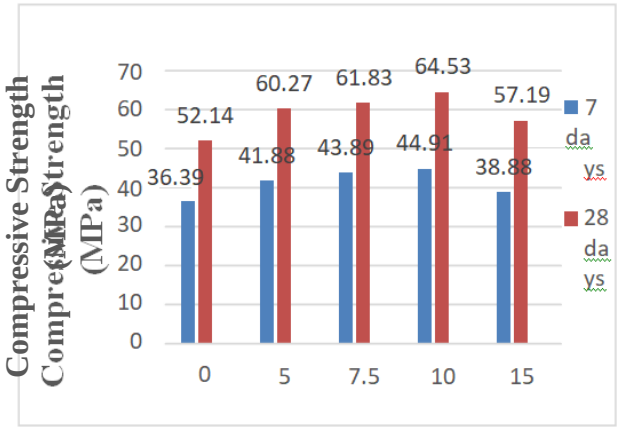

Figure.3. Compressive Strength of Concrete with Micro Silica at Different Ages

Table 4 concrete STS with Micro-silica at divergent ages

S. No.	Mix ID	STS measured in (MPa)	
		7	28 days
1	MS0	3.52	5.05
2	MS5	4.10	5.84
3	MS7.5	4.25	6.02
4	MS10	4.40	6.35
5	MS15	3.79	5.58

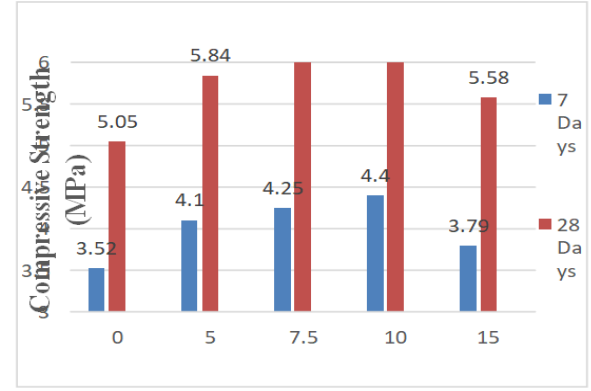

Figure.4. concrete STS with Micro-silica at

divergent ages.

S .No.	Mix ID	Split Tensile Strength (MPa)	Split Tensile Strength (MPa)
1	MS10WF0	7 days	28days
2	MS10WF5	3.58	5.16
3	MS10WF10	4.56	6.56
4	MS10WF15	4.63	6.65
5	MS10WF20	4.75	6.81
6	MS10WF25	4.78	6.94

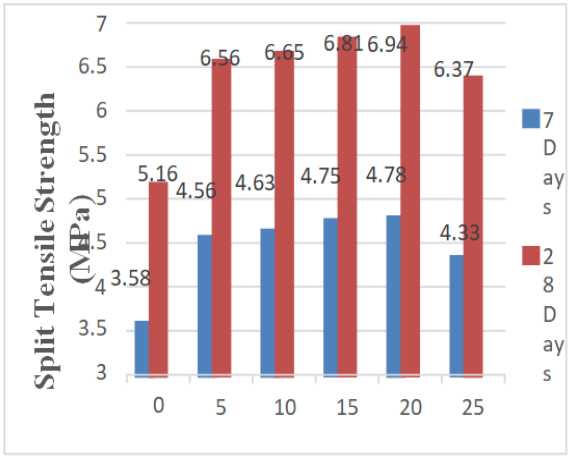

Figure.5. Concrete STS combines with Micro-Silica &divergent Percentages of WFS

CONCLUSIONS

Micro-silica & WFS are the effective replacements and results were found that enhanced former strength & ultimate strength of concrete.

a. The Highest concrete CS with 15% of waste foundry Sand over 7 days is 42.60N/mm^2. The strength enhanced by17.06%.
b. The Highest concrete CS with 15% of waste foundry Sand over 28 days is 60.74N/mm^2. The strength enhanced by16.49%.
c. The Highest concrete STS with 15% of waste foundry Sand over 7 days is 4.13N/mm^2. The strength enhanced by17.32%.
d. The Highest concrete STS with 15% of waste foundry Sand over 28 days is 5.82N/mm^2. The strength enhanced by15.24%.
e. The Highest concrete CS with 10% of Micro-silicaover 7 days is 44.91N/mm^2. The strength enhanced by 23.41%.
f. The Highest concrete CS with 10% of Micro-silicaover 28 days is 64.53N/mm^2. The strength enhanced by 23.76%.
g. The Highest concrete STS with 10% of Micro-silicaover 7 days is 4.40N/mm^2. The strength enhanced by25%.
h. The Highest concrete STS with 10% of Micro-silicaover 28 days is 6.35N/mm^2. The strength enhanced by 25.74%.
i. The Highest concrete CS with combined MS10% And WFS 20% for 7 days is 50.81N/mm^2.The strength enhanced by39.62%.
j. The Highest concrete CS with combined MS10% And WFS 20% for 28 days is 71.57N/mm^2.The strength enhanced by37.26%.
k. The Highest concrete STS with combined MS10% And WFS 20% for 7 days is 4.78N/mm^2.The strength enhanced by33.51%.
l. The Highest concrete STS with combined MS10% And WFS 20% for 28 days is 6.94N/mm^2.The strength enhanced by34.49%.

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