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Nithin Kumar A., Sreenivasa Reddy K and Premchand K

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RESEARCH ARTICLE

EXPERIMENTAL STUDY OF PARTIAL REPLACEMENT OF WASTE FOUNDRY SAND ON STRENGTH PROPERTIES OF CONCRETE

Nithin Kumar A[1]., Sreenivasa Reddy K[2] and Premchand K[3]

[1,2,3]Department of Civil Engineering, Vardhaman College of Engineering, Hyderabad, India

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ABSTRACT

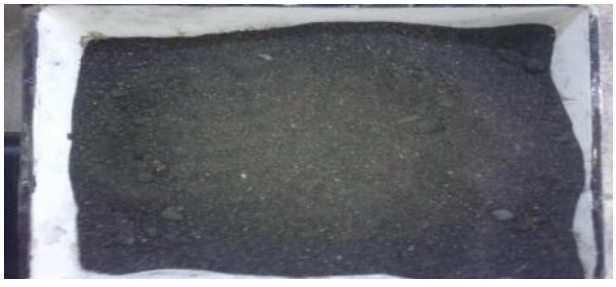
An acute shortage of river sand which is generally used as a fine aggregate in concrete has been affecting the construction sector. The scarcity has led to the skyrocketing price of sand, escalating construction costs. The situation has dashed the dreams of many in the lower- and middle-income groups to own a house. There were studies about the depletion of river sand and the need for scientific management and exploitation of the available resource. Following the shortage of river sand, some research institutions are searching alternatives that can be used for construction. Ferrous and non ferrous metal casting industries produce several million tons of byproduct in the world. In India, approximately 2 million tons of waste foundry sand is produced yearly. WFS is a major byproduct of metal casting industry and successfully used as a land filling material for many years. In an effort to use the WFS in large volume, research are being carried out for its possible large scale utilization in making concrete as partial replacement of fine aggregate. Foundry sand consists primarily of silica sand, coated with a thin film of burnt carbon, residual binder (bentonite, sea coal, resins) and dust. Foundry sand can be used in concrete to improve its strength and other durability factors. Foundry Sand can be used as a partial replacement of fine aggregates or total replacement of fine aggregate and as supplementary addition to achieve different properties of concrete. This experimental investigation was performed to evaluate the strength properties of concrete mixtures, in which river sand was partially replaced with Waste Foundry Sand by weight.and10% Cement was replaced with Micro Silica and Fine aggregate was partially replaced with waste foundry sand by weight. Compressive strength at 7 and 28 days, Split tensile test at 28 days and Flexural strength was tested at 28 days of curing.

INTRODUCTION

Waste Foundry Sand (WFS)

Waste foundry sand (WFS) is one of such as a industrial by-product. Ferrous and non ferrous metal casting industries produce several million tons of byproduct in the world. In India, approximately 2 million tons of waste foundry sand is produced yearly.

Foundry industry produces a large amount of by-product material during casting process. The ferrous metal casts in foundry are cast iron and steel, non ferrous metal are aluminum, copper, brass and bronze. Over 70% of the total by-product material consists of sand because moulds consist usually of molding sand, which is easily available, inexpensive, resistance to heat damage and easily bonded with binder and other organic material in mould. Foundry industry use high quality specific size silica sand for their molding and casting process. These WFS is black in color and contain large amount of fines. The typical physical and chemical property of WFS is dependent upon the type of metal being poured, casting process, technology employed, type of furnaces (induction, electric arc and cupola) and type of finishing process (grinding, blast cleaning and coating).



Corresponding author:* **Nithin Kumar A
Department of Civil Engineering, Vardhaman College of Engineering, Hyderabad, India

Waste Foundry Sand

The benefits of finding smarter reuse options for waste foundry sand include reduced tonnage to landfill and associated disposal costs possible source of revenue from waste converted to a valuable by-product or raw material for another process reduced demand on sand and quarry resources.

Micro silica

During the last three decades, some new Pozzolana materials have emerged in the building industry as an off shoot of research aimed at energy conservation and strict enforcement of pollution control measures to stop dispersing the materials into the atmosphere. Micro silica (other names have been used are silica dust, condensed micro silica or silica fume) is one such Pozzolana, which has been used as a partial replacement of Portland cement due to its versatile properties. The availability of high range water-reducing admixtures (super plasticizers) has opened up new ideas for the use of micro silica as part of the cementing material in concrete to produce very high strength cement (> 100 MPa).

Experimental Program

In the present experimental program standard cubes of size (150x150x150mm) conforming to IS : 10086-1982 were casted and tested for compressive strength, standard cylinders of size 150mm diameter and 300mm height conforming to IS : 10086-1982 were casted and tested for split tensile strength and standard beams (100x100x500mm) were casted and tested for finding the flexural strength property of plain cement concrete and binary blended concrete.

Sieve Analysis Chart for Waste Foundry Sand

IS sieve size	Weight retained (gms)	Cumulative Weight Retained (gms)	Cumulative Percentage weight retained	Cumulative Percentage Passing
4.75mm	7	7	0.70	99.30
2.36mm	10	17	1.71	98.29
1.18mm	10	27	2.72	97.28
600µ	80	107	10.77	89.23
300µ	493	600	60.42	39.58
150µ	293	893	89.92	10.08
pan	100	993	-----	-----

TEST RESULTS

Test results of binary blended concrete
Compressive Strength of Various Concrete Mixes with Different Percentage of Micro Silica at Different Ages

Compressive Strength of Various Concrete Mixes with Different Percentage of Micro Silica at Different Ages

S.No.	Mix ID	Compressive Strength (MPa)	
		7 days	28 days
1	MS5	37.10	55.10
2	MS10	38.43	58.22
	MS15	37.32	57.47

Workability of Concrete Mixes with Micro Silica and Various Percentages of Waste Foundry Sand

S.No.	Mix ID	Slump (mm)
1	MS10WF0	78
2	MS10WF20	72
3	MS10WF40	66
4	MS10WF60	58

Compressive Strength of Concrete Mixes with Micro Silica and Various Percentage of Waste Foundry Sand at Different Ages

S.No.	Mix ID	Compressive Strength (MPa)	
		7 days	28 days
1	MS10WF0	36.36	58.96
2	MS10WF20	37.77	61.48
3	MS10WF40	38.43	62.66
4	MS10WF60	33.10	52.14

Split Tensile Strength of Various Concrete Mixes with Micro Silica and Different Percentages of Waste Foundry Sand

S.No.	Mix ID	Split Tensile Strength (MPa) 28 days
1	MS10WF0	5.16
2	MS10WF20	5.30
3	MS10WF40	5.58
4	MS10WF60	5.02

Flexural Strength of Various Concrete Mixes with Micro Silica and Different Percentage of Waste Foundry Sand

S.No.	Mix ID	Flexural Strength (MPa) 28 days
1	MS10WF0	7.5
2	MS10WF20	6.9
3	MS10WF40	6.4
4	MS10WF60	6.0

CONCLUSIONS

When percentage of waste foundry sand was increased beyond 40% the mix started losing its workability. Replacement of fine aggregate with waste foundry sand showed increase in the compressive strength of plain concrete of grade M40 up to 40% and then there was a considerable decrease in the strength. Maximum strength was achieved at 40%.Binary Blended Concrete mix containing 60% waste foundry sand was still workable. For Binary Blended Concrete mix at 60% replacement of fine aggregate, strength of 52.14 MPa was achieved at 28 days which is more than the target strength. Binary Blended Concrete incorporating micro silica showed better performance when compared to plain concrete.

Scope for Further Investigations

Further research can be carried out to study the durability properties of concrete incorporating waste foundry sand as a partial replacement of fine aggregate. The investigation of concrete incorporating waste foundry sand can be carried out with addition of different types of fibers like steel fibers, recron fibers, synthetic fibers, dura fibers, natural fibers and glass fibers and with different aspect ratio. Further research can be carried out to study the properties of concrete with partial replacement of fine aggregate with waste foundry sand and partial replacement of cement with different mineral admixtures like GGBS, flyash, metakaolin, rice husk ash etc, with addition of different percentages of fibers.

References

Rafat Siddique, Geert de Schutter and Albert Noumowe, (2008), "Effect of used-foundry sand on the mechanical properties of concrete", Construction and Building Materials, vol. 23, pp 976–980.

Yogesh Aggarwal, Paratibha Aggarwal, Rafat Siddique, El-Hadj Kadri and Rachid Bennacer, (2010), "Strength, durability, and micro-structural properties of concrete made with used-foundry sand (UFS)", Con struction and Building Materials, vol. 25, pp 1916–1925.

Gurpreet Singh and Rafat Siddique, (2011), "Effect of waste foundry sand (WFS) as partial replacement of sand on the strength, ultrasonic pulse velocity and permeability of concrete", Construction and Bui lding Materials, vol. 26, pp 416–422.

Khatib JM and Ellis DJ., (2001), "Mechanical properties of concrete contain ing foundry sand". ACI special publication (SP-200), Am erican Concrete Institute; pp. 733–748.

Siddique R., Gupta R and Kaur I., (2007), "Effect of spent foundry sand as partial replacement of fine aggregate on the properties of concrete". In: 22 nd International conference on solid waste technology and management, Widener University, Philadelphia, USA.

Gurpreet Singh and Rafat Siddique, (2011), "Abrasion resistance and strength properties of concrete containing waste foundry sand (WFS)", Construction and Building Materials, vol. 28, pp 421–426.

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