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WASTE FOUNDRY SAND IN CONCRETE

Anil Kumar[1], Bijo Sabu[2], Jishnu P.S[3], Manu Surendran[4], Lijina Thomas[5]

[1]Anil Kumar, UG Scholar, Mount Zion College Kadamanitta
[2]Bijo Sabu, UG Scholar, Mount Zion College Kadamanitta
[3]Jishnu PS, UG Scholar, Mount Zion College Kadamanitta
[4]Manu Surendran, UG Scholar, Mount Zion College Kadamanitta
[5]Lijina Thomas, Assistant Professor, Dept of civil Engineering, MZC college, Kerala, India

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Abstract – *India has an approximate pavement network of over 40, 00,000 kilometers. The innovative use of used foundry sand in concrete formulation as a fine aggregate replacement material is one such alternative to traditional concrete. The fine aggregate will be replaced by used foundry sand accordingly in the range of 10%, 20%, 30% & 40% by weight for different grades of concrete. Foundry sand is a by-product of ferrous and non ferrous metal. The present study gives the information about the civil engineering applications of foundry sand, which is technically sound and environmentally safe. Tests will be performed for compressive strength, split tensile strength and flexural strength for all replacement level of foundry sand for 7,14 and 28 days curing period.*

Key Words; Foundry Sand, Compressive strength, Split tensile strength, Flexural strength

1. INTRODUCTION

Foundry sand is high quality silica sand with uniform physical characteristics.There are other casting methods used, including die casting and permanent mold casting, sand casting is far most prevalent mold casting technique.

There are two basic types of foundry sand available, green sand (often referred to as molding sand) that uses clay as the binder material, and chemically bonded sand that uses polymers to bind the sand grains together. Green sand consists of 85-95% silica, 0-12%clay, 2-10% carbonaceous additives, such as sea coal, and 2-5% water. Green sand is the most commonly used molding media by foundries. Green sands also contain trace chemicals such as MgO, K2O, and TiO2.Chemically bonded sand consists of 93-99%silica and 1-3% chemical binder. Silica sand is thoroughly mixed with the chemicals; a catalyst initiates the reaction that cures and hardens the mass.There are various chemical binder systems used in the foundry industry. The most common chemical binder systems used are phenolic - urethanes, epoxy-resins, furfyl alcohol, and sodium silicates.

In this report we are finding the compressive strength, split tensile strength and flexural strength of M25 concrete using partial replacement of fine aggregate by foundry sand.

2. Material Properties

Table 1.Tests on cement.

Tests on cement		
Consistency		32%
Setting time	Initial	45 min
	Final	10 hours
Specific gravity		2.45

We are using Ultratech 53 Grade Cement.

Table 2.Tests on aggregate

Tests on aggregate			
Properties	Fine Aggregate	Coarse Aggegate	Foundry sand
Specific gravity	2.5	2.79	2.38
Fineness modulus	4.475	4.156	3.55
Water absorption		1.005	
Maximum moisture content	6%	Single line spacing	6%

2.1 MIX PROPORTIONS

Mix proportion ratio(1:1.01:2.001)						
Specimens	Cement(kg/m^3)	Fine aggregate(kg/m^3)	Foundry sand(kg/m^3)	Coarse aggregate(kg /m^3)	Water content(kg /m^3)	Water cement ratio(kg/m^3)
Conventional concrete	425.7	432	_	852.5	191.6	0.45
F10 concrete	425.7	423.36	42.36	852.5	191.6	0.45
F20 concrete	425.7	414.72	82.94	852.5	191.6	0.45
F30 concrete	425.7	406.08	121.82	852.5	191.6	0.45
F40 concrete	425.7	397.44	158.97	852.5	191.6	0.45

3. EXPERIMENTAL STUDY

3.1 COMPRESSIVE STRENGTH TEST

For cube test 15cm X 15cm X 15cm are used. Compressive Strength of concrete = Maximum compressive load / Cross Sectional Area.

FIG 1. Compressive strength test on cubes

3.2 SPLIT TENSILE STRENGTH TEST

The procedure based on the ASTM C496 (Standard Test Method of Cylindrical Concrete Specimen). (T = 2P/πLD). Where, T = Splitting tensile strength P = Maximum applied load L = Length, m D = Diameter.Tests are conducted only on optimum percentage replacement of fine aggregate by foundry sand

Fig 2.Split tensile strength test

3.3 FLEXURAL STRENGTH TEST

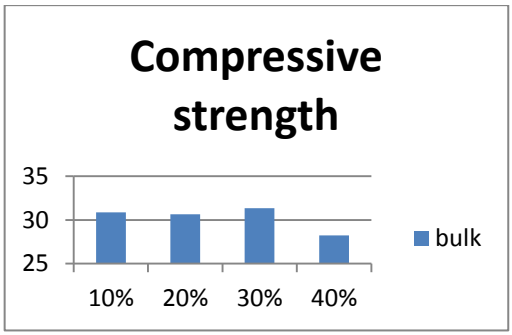
The flexural test on concrete is conducted using three point load test. It is conducted on prism and the dimensions are 100mm width, 100mm depth and 500mm span. The following equation is used to compute modulus of rupture, fr = 7.5 fc' .Where,fr = modulus of rupture fc' = concrete compressive strength.Tests conducted only on optimum percentage replacement of fine aggregate by foundry sand.

Fig 3.Flexural strength test

4. RESULTS AND DISCUSSIONS

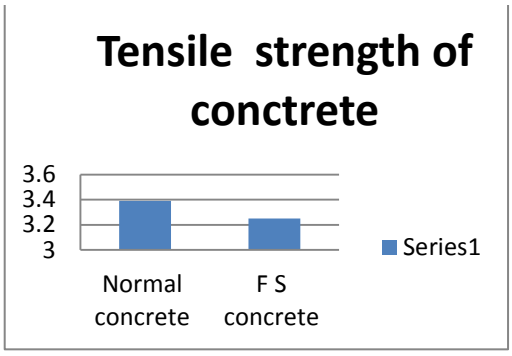
4.1 COMPRESSIVE STRENGTH

Compressive strength of normal concrete is founf to be 30.66 N/mm^2. The compressive strength of 10%,20%,30% replaced concrete has similar properties as that of conventional concrete.Compressive strength of 30% replacement of fine aggregate by foundry sand is 31.33 N/mm^2,which is similar to that of normal conrete.However in the case of 40%replaed concrete,compressive value decreaesss



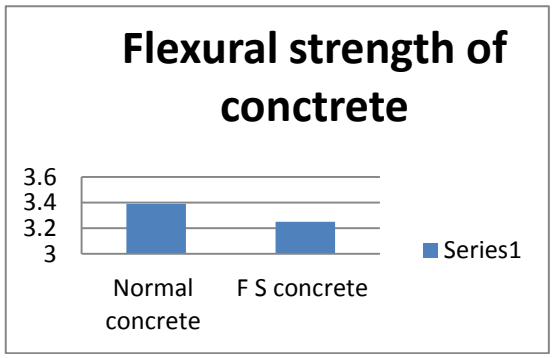
4.2 SPLIT TENSILE STRENGTH

Tensile strength of normal concrete is found to be 8.765 (N/mm^2).Tensile strength of 30% replacement of fine aggregate by foundry sandis 3.39 (N/mm^2)



4.3 FLEXURAL STRENGTH TEST

Flexural strength of normal concrete is 41.97(N/mm^2). Flexural strength of 30& replacement of fine aggregate by foundry sand is 41.52(N/mm^2)



5. CONCLUSIONS

Experimental investigations on 10%, 20%, 30% and 40% replacement of fine aggregate with foundry sand is done.The mechanical properties such as workability, compressive strength, tensile strength and flexural strength are determined and our conclusions are as follows:

1. The compressive strength of 10%, 20%, 30% replaced concrete has similar properties as that of conventional concrete. But in the case of 40% replaced concrete, the compressive strength was decreased.
2. The Tensile strength of the 30% replaced concrete is greater than normal concrete.
3. The Flexural strength of the 30% replaced concrete is similar to that of conventional concrete.
4. The Overall performance of the 30% replaced concrete is similar to that of normal concrete.
5. The 30% replaced concrete is an economic and eco-friendly concrete.
6. 30% replaced fine aggregate shows the exact same properties as that of normal concrete.

6. ACKNOWLEDGEMENT

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7. REFERENCES

1. **Collins, R. J. and S. K. Ciesielski**."Recycling and Use of Waste Materials and By-Products in Highway Construction", National Cooperative Highway Research Program Synthesis of Highway Practice 199, Transportation Research Board, Washington, DC, 1994.
2. **Ham, R. K., W. C. Boyle, E. C. Engroff and R. L. Fero.** "Determining the Presence of Organic Compounds in Foundry Waste Leachates," Modern Casting. American Foundrymen's Society, August, 1989.
3. **Javed, S., C. W. Lovell, and L. E. Wood.**"Waste Foundry Sand in Asphalt Concrete," Transportation Research Record 1437.Transportation Research Board, Washington, DC, 1994.
4. **Japed, S., and C. W. Lovell.“**Use of Waste Foundry Sand in Highway Construction". Final Report, Project No.C-36-50N, Purdue University, West Lafayette, Indiana, 1994.
5. **Johnson, C. K.** "Phenols in Foundry Waste Sand," Modern Casting. January, 1981.
6. 6. **Khatib J.M. and Ellis D. J.“**Mechanical Properties of Concrete Containing Foundry Sand.International Conference on Recent Advances in Concrete Technology."CANMET/ACI, 733-748- 2001.
7. **Khatib J.M., Baig. B., Menadi B, Kenai S.** "Waste Foundry Sand Usage In Concrete". Innovation & Valorization in Civil Engineering & Construction Materials- 2011.
8. **Kishore Kaushal,** "Concrete Mix Design for Road Bridges", INDIAN HIGHWAYS, Vol. 19, No. 11, pp. 31-37,Nov. 1991.
9. **Marc J. Goodhue, Tuncer B. Edil and Craig H. Benson.“**Interactionof Foundry Sands withGeosynthetics."Journal of Geotechnical AndGeoenvironmental Engineering / April 2001 / 353-2001.
10. **Naik T. R., Patel V. M., Parikh D.M. and Tharaniyll., M. P.** "Utilization of used foundry sand in concrete". Journal of Materials in Civil Engineering, 6(2), 254-263, 1991.
11. **Naik T. R., Rudolph K. N., Yoon-moon. C., Ramme p., W. Bruce and SiddiqueR.“**Precast Concrete Products Using Industrial By-Products."ACI Materials Journal.101 (3), 199-206, 2004.