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EXPERIMENTAL STUDY ON CONCRETE USING FOUNDRY SAND AS PARTIAL REPLACEMENT FOR FINE AGGREGATES

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Abstract – *Foundry sand is a waste material obtained from casting industry which is dumped extensively. In the present study we have partially replaced the fine aggregates by foundry sand. The tests conducted on hardened concrete were compressive strength and tensile test. The casted specimen were tested for 7 and 28 days.*

Key Words: Foundry Sand (FS), Compressive Strength and Tensile Strength.

1. INTRODUCTION

Foundry sand is high quality silica sand that is a by-product from the production of both ferrous and nonferrous casting industries. These waste cause environmental problems. Hence reuse of these materials can be emphasized. Hence the use of this waste material can be emphasized. The properties of foundry sand depends on the casting process and from the industry sector from which it is generated. In modem foundry practice, sand is typically recycled and reused through many production cycles. The foundry Industry estimates that approximately 100 million tons of sand is used in production annually, of that 6-10 million tons are discarded annually and are available to be recycled into other products and are used in other industries. The automotive industries and its parts are the major generators of foundry sand. (About 95% of estimated used foundry sand).

This study presents the information about the civil engineering applications of foundry sand, which is technically sound and is environmentally safe. Use of foundry sand in various engineering applications can solve the problem of disposal of foundry sand and other purposes.

2. OBJECTIVES

- To investigate the utilization of Used Foundry Sand as Fine aggregate and influence of Foundry Sand on the Strength of concrete made with different replacement levels
- To determine the compressive strength, tensile strength and their results are studied and compared with control mix concrete.
- To effectively utilize the waste material from the Foundries and reduce the problem of disposal.

3. EXPERIMENTAL WORK

In the present study M25 grade of concrete is used. In the study fine aggregates is replaced by foundry sand by various percentage. The foundry sand content is varied by 0%, 10%, 20%, 30% and 40%. The Mix with 0%(M1) of Foundry sand is considered as Control Mix .The casted specimen were kept for 7 and 28 days of curing. The casted specimen were tested for compressive strength and Tensile strength.

Preliminary tests were conducted on the material used.

Cement: In this study Ordinary Portland Cement of 53 grades is used.

Table -1: Preliminary test results of Cement

SL.NO	Properties	Results
1	Normal Consistency	29.3%
2	Specific Gravity	3.10
3	Initial setting time	110 Min
4	Final setting time	270 Min

Fine Aggregates: In this study Fine aggregates of 4.75mm down size is used.

Table -2: Preliminary test results of Fine Aggregates

SL.NO	Properties	Results
1	Specific Gravity	2.70
2	Water absorption	1.28%
3	Fine Modulus	2.806
4	Grading Zone	Zone - II

Coarse Aggregates: In this study Coarse aggregates of 20mm down size is used.

Table -3: Preliminary test results of Coarse Aggregates

SL.NO	Properties	Results
1	Specific Gravity	2.71
2	Water absorption	0.64
3	Fine Modulus	7.03
4	Surface Moisture	Nil

Foundry Sand:

Table -4: Preliminary test results of Foundry Sand

SL.NO	Properties	Results
1	Specific Gravity	2.42
2	Water absorption	0.43%

Table-5: Mix Proportion

MIX	CEMENT (Kg/m^3)	FA (Kg/m^3)	CA (Kg/m^3)	FS (Kg/m^3)
M1 (0% FS)	385	645	1055	0
M2 (10% FS)	385	580.5	1055	64.5
M3 (20% FS)	385	516	1055	129
M4 (30% FS)	385	451.5	1055	193.5
M5 (40% FS)	385	387	1055	258

4. RESULTS AND DISCUSSION

A. WORKABILITY (SLUMP TEST)

The measured slump values of natural sand with waste foundry sand with constant water/cement ratio, i.e., w/c ratio (0.52) are 120, 100, 80, 45, and 35 mm for different mixes such as M-1 (0% FS), M-2 (10% FS), M-3 (20% FS), M-4 (30% FS), M-5 (40% FS) respectively.

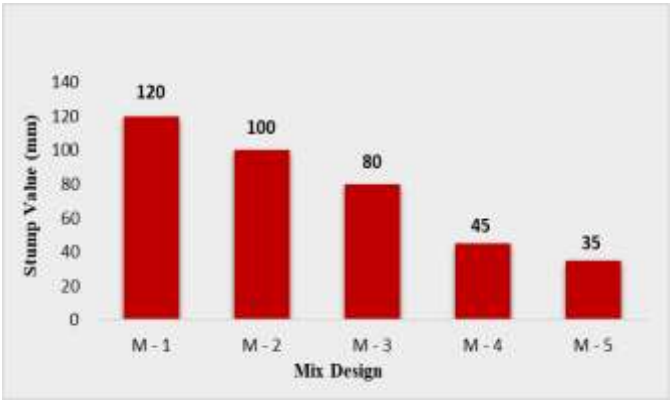

Figure 1: Slump Value

B. COMPRESSIVE STRENGTH

The casted cubes were tested for 7 and 28 days. The test result showed that compressive strength was optimum at 20% replacement of fine aggregate by Foundry sand.

Table-6: Compressive strength results for 7 and 28 days

MIX	COMPRESSIVE STRENGTH (N/MM^2)	
	7 DAYS	28 DAYS
M1 (0% FS)	22.66	31.11
M2 (10% FS)	24	33.92
M3 (20% FS)	24.83	34.07
M4 (30% FS)	23.92	33
M5 (40% FS)	23.22	32

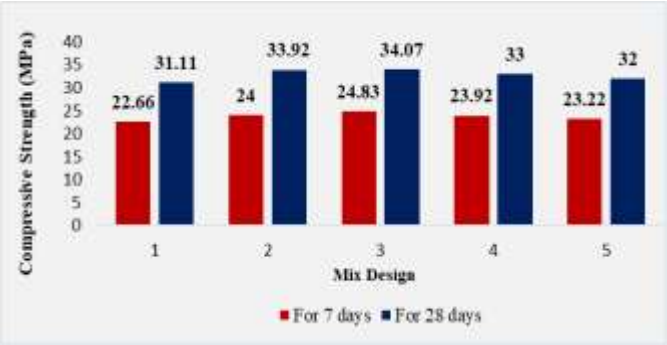

Figure 2: Compressive strength for 7 and 28 days

C. SPLIT TENSILE STRENGTH

The casted cylinders were tested for 7 and 28 days. The test result showed that compressive strength was optimum at 20% replacement of fine aggregate by Foundry sand.

Table-7: Split Tensile strength results for 7 and 28 days

MIX	SPLIT TENSILE STRENGTH (N/MM^2)	
	7 DAYS	28 DAYS
M1 (0% FS)	2.37	3.5
M2 (10% FS)	2.44	3.85
M3 (20% FS)	2.82	4.24
M4 (30% FS)	2.41	3.65
M5 (40% FS)	2.4	3.6

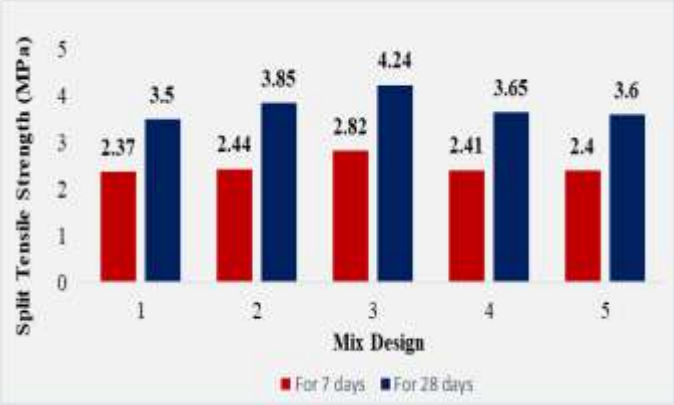

Figure 3: Split Tensile strength for 7 and 28 days

5. CONCLUSIONS

- It is observed that the slump value decreases with increase in percentage replacement of natural sand with Foundry Sand for the same w/c ratio
- Increased fineness require greater amount of water for the mix ingredients to get closer packing, results in decreased workability of the mix.
- Maximum compressive strength of concrete was achieved with 20% replacement of fine aggregate with Foundry sand
- Maximum splitting tensile strength of concrete was achieved with 20% replacement of fine aggregate with Foundry Sand.

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