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The Study of Early Days of Strength of Light Weight Concrete using Waste Foundry Sand and Manufactured Sand by Fine Aggregate

Mr. Aniruddha S. Jangale[1], Prof. M. R. Nikhar[2], Prof. M. M. Lohe[3]
PG Scholar, Department of Civil Engineering[1]
Guide, Assistant Professor, Department of Civil Engineering[2]
Co-Guide, Assistant Professor, Department of Civil Engineering[3]
Bapurao Deshmukh College of Engineering, Sevagram, Wardha, Maharashtra, India

Abstract: *Light weight Concrete or formed concrete is a versatile material which consist primarily of a cement based mortar mix with 20 % of volume air. Lightweight concrete can be defined as a type of concrete which includes an expanding agent in that it increases the volume of the mixture while giving additional qualities such as nailbility and lessened the dead weight. It is lighter than the conventional concrete. An Investigation on strength parameters on light weight concrete using foundry and manufactured sand replacing fine aggregate. Manufactured sand differs from natural sea and river dredged sand in its physical and mineralogical properties. These can be both beneficial and detrimental to the fresh and hardened properties of concrete. This paper presents the results of a laboratory study in which manufactured sand produced in an industry sized crushing plant was characterized with respect to its physical and mineralogical properties. The influence of these characteristics on concrete work ability and strength, when manufactured sand completely replaced natural sand in concrete.*

Keywords: Light weight Concrete, Manufactured sand, Waste Foundry Sand, conventional concrete & Compressive & Flexural Strength.

I. INTRODUCTION

The main specialties of lightweight concrete are its low density and thermal conductivity. Its advantages are that there is a reduction of dead load, faster building rates in construction and lower haulage and handling costs. Lightweight concrete maintains its large voids and not forming laitance layers or cement films when placed on the wall. This research was based on the performance of lightweight concrete. However, sufficient water cement ratio is vital to produce adequate cohesion between cement and water. Insufficient water can cause lack of cohesion between particles, thus loss in strength of concrete. Likewise too much water can cause cement to run off aggregate to form laitance layers, subsequently weakens in strength. Construction and has an economical advantage.

Foundry as a waste for disposal known as Waste foundry sand. In India, an estimated 2 million tons of waste foundry sand is produced every year. Use of waste foundry sand as a partial or total replacement for fine aggregate in concrete leads in production of economic, light weight and high strength concrete. Concrete is a material which is composed of coarse aggregate, fine aggregate, cement, admixtures and water these each material in concrete contributes its strength. So, by partial or percentage replacing of material affects different properties of concrete. By using such waste material which harms the environment can be used for the development of low cost and eco- friendly building materials. In this study an experimental investigation is carried out by varying percentage of fine aggregate with used foundry sand to produce low cost and eco-friendly concrete.

Manufactured sand is an alternative for river sand. Due to fast growing construction industry, the demand for sand has increased tremendously, causing deficiency of suitable river sand in most part of the word. Due to the depletion of good quality river sand for the use of construction, the use of manufactured sand has been increased. Another reason for use of M-Sand is its availability and transportation cost. Since manufactured sand can be crushed from hard granite rocks, it can be readily available at the nearby place, reducing the cost of transportation from far-off river sand bed. Thus, the cost of

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construction can be controlled by the use of manufactured sand as an alternative material for construction. The other advantage of using M-Sand is, it can be dust free, the sizes of m-sand can be controlled easily so that it meets the required grading for the given construction.

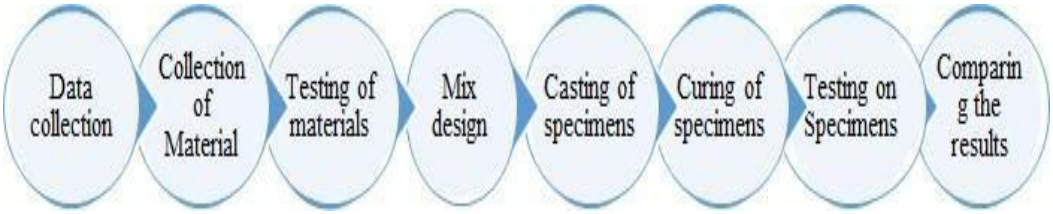
II. OBJECTIVES

- To find out the properties of replacement of M Sand & W.F. Sand with Fine Aggregate in light weight concrete.
- To prepare the mix design of light weight concrete using M Sand & W.F. Sand.
- To know the recommendable percentage of replacement of fine aggregate with M Sand & W.F. Sand to achieve a concrete of standard strength.
- To compare light weight concrete using M Sand & W.F. Sand with conventional concrete.
- To investigate the strength parameters (Compressive Strength and Flexural Test)

III. GAP FINDING

- M. Sand and WFS are not used in the making of light Weight concrete.
- M. Sand and WFS is not used in conventional concrete.
- For light weight concrete M-25 grade isn't the grade of research.
- M. Sand and WFS are not used as replacement material at a once.

IV. METHODOLOGY



V. MATERIAL PROPERTIES

5.1 Cement

In this Project, the cement used as OPC 53 grade cement available from Ultra-Tech Cement Company & A cement is a binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together.

Name Of Testing	Result
1. Fineness modulus	7 %
2. Consistency test	32%
3. Initial and final setting time	75 in & 290 min

5.2 Fine Aggregate

Aggregates for the concrete were obtained from approved suppliers conforming to the specifications of IS 383:1970 and were chemically inactive (inert), spotless and robust. The fine aggregate was tested as per the limits which is specified in IS: 2386 (Part-3):1963.

Name Of Testing	Result
1.Fineness modulus	2.52
2. Specific gravity	2.59
3.Silt Content	2%

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5.3 Coarse Aggregate

Course aggregates will be machine-crushed done of black trap or equivalent black tough stone and shall be stiff, robust, dense, durable, spotless or procured from quarries approved by the consultant.

Name Of Testing	Result
1.Fineness modulus	2.84
2. Specific gravity	2.78

5.4 Manufactured Sand

Manufactured sand (M-Sand) is artificial sand produced from crushing hard stones into small sand sized angular shaped particles, washed and finely graded to be used as construction aggregate.

Name Of Testing	Result
1. Fineness modulus	2.71
2. Specific gravity	2.56
3.Silt Content	2.4%

5.5 Waste Foundry Sand

Foundry sand is one of such waste material produced from foundry industries speeded all over the country.

Name Of Testing	Result
1. Fineness modulus	2.96
2. Specific gravity	2.42
3.Silt Content	1%

5.6 Foaming Agent

Aquatek – FOAM CON is a unique foam agent to produce lightweight concrete which is use as a roof insulation materials and for product of light weight precast block, the density varying between 320 – 2080 kg/m3

Aquatek–FOAM CON it is specially developed to provide the maximum thermal insulating effect in concrete. Foamed concrete is made from Aquatek–FOAM CON is light in weight does not increase the significantly the dead load on the Structure. It has good, mechanical stability and is excellent shock absorber.

VI. Mix Design of M 25 Grade

Material	M25Grade
Cement	404 kg/m3
Sand	659.41 kg/m3
Aggregate	1154.81 kg/m3
Water	211.9 lit.
w/c ratio	0.48

VII. Results and Discussions

7.1 Compressive Strength

The test was conducted on the cube specimen of size 150×150×150mm.

% of Mix.	Avg. Compressive Strength (N/MM^2)		Avg. Density (KG/M^3)
	7 Days	14 Days	
Conventional Concrete	16.74	22.67	2526
5 % Mix (WFS & M – Sand)	13.78	17.33	2046
10 % Mix (WFS & M – Sand)	12.44	16.30	1985

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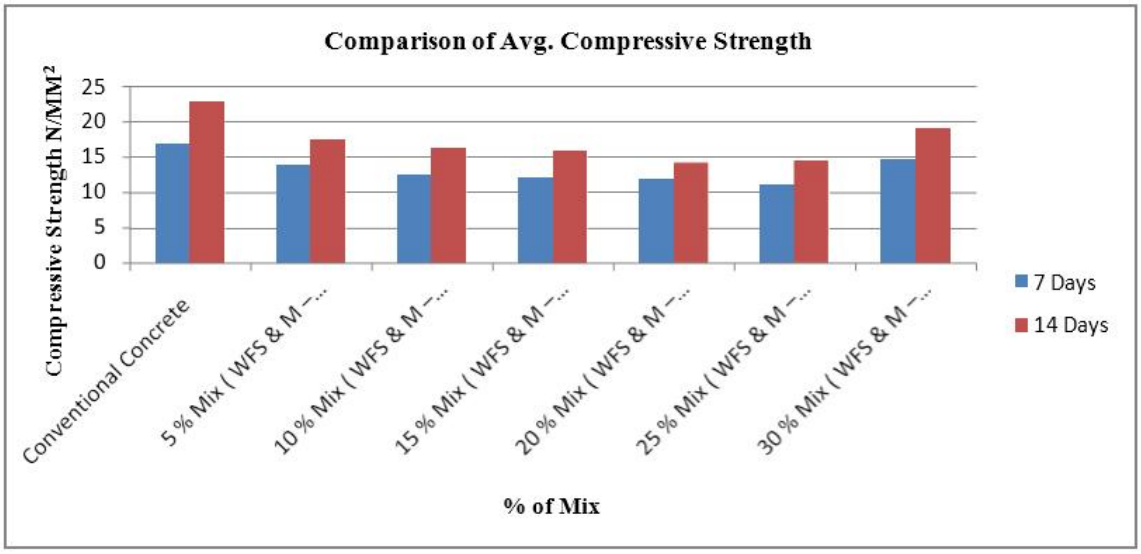
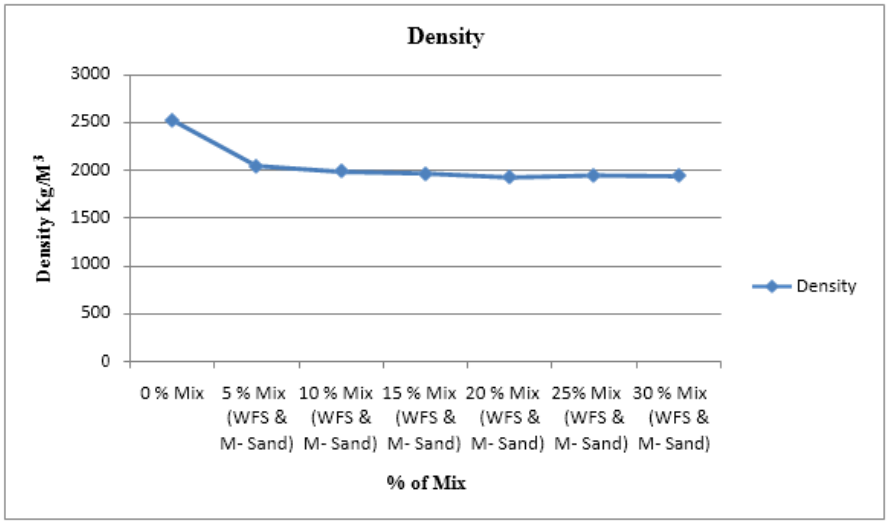
15 % Mix (WFS & M – Sand)	12.00	15.85	1968
20 % Mix (WFS & M – Sand)	11.85	14.22	1926
25 % Mix (WFS & M – Sand)	11.11	14.52	1946
30 % Mix (WFS & M – Sand)	14.67	19.11	1939



Comparison of Avg. Compressive Strength N/MM²

Observation: From this graph we can conclude that, the compressive strength of M25 Grade concrete for 5 % mix to 25 % Mix proportion found decrease in Strength at 7 & 14 days & above 25 % Mix proportion found slightly increase than the above mix proportions. The strength near about decrease as compare to normal/ Conventional Concrete.



Comparison of Concrete Density Kg/M³

Observation: From this graph we can conclude that, the density of M25 Grade concrete for 20 % mix proportion found minimum Concrete Density at 7 & 14 Days. The Density decrease near about 26 % as compare to normal/ Convectional concrete.

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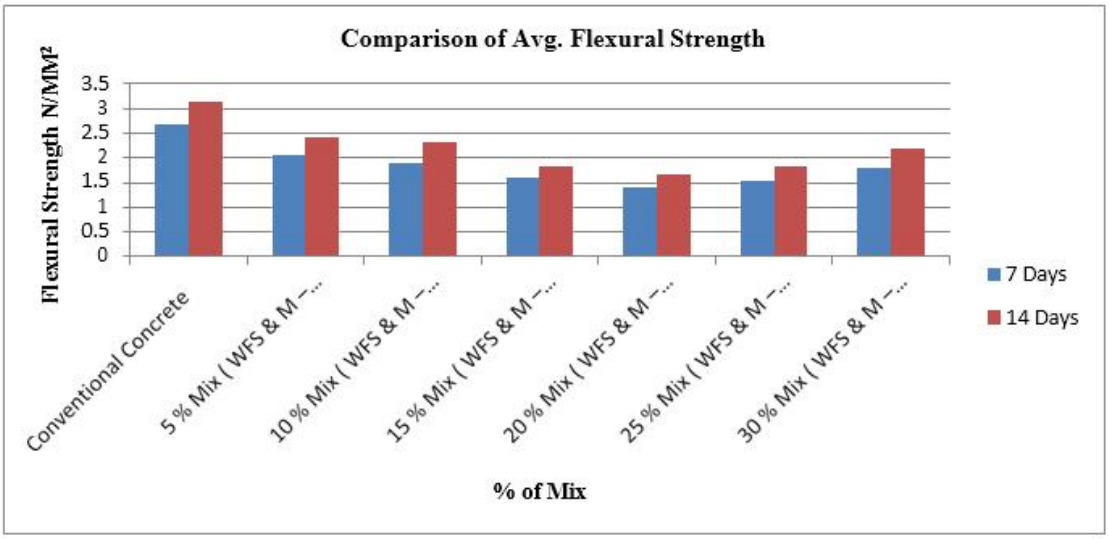
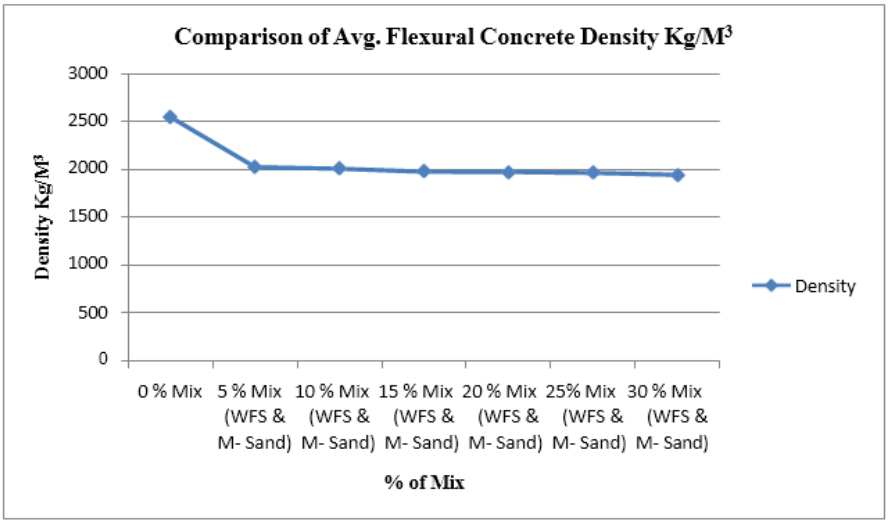
Flexural Concrete

% of Mix.	Avg. Compressive Strength (N/MM^2)		Avg. Density (KG/M^3)
	7 Days	14 Days	
Conventional Concrete	2.67	3.14	2545
5 % Mix (WFS & M – Sand)	2.07	2.43	2024
10 % Mix (WFS & M – Sand)	1.9	2.31	2006
15 % Mix (WFS & M – Sand)	1.6	1.84	1976
20 % Mix (WFS & M – Sand)	1.42	1.66	1973
25 % Mix (WFS & M – Sand)	1.54	1.84	1963
30 % Mix (WFS & M – Sand)	1.78	2.19	1943



Comparison of Avg. Flexural Strength N/MM

Observation: From this graph we can conclude that, the Flexural strength of M25 Grade concrete is decrease for 5 to 30 % of Mix proportion at 7, 14 & 28 days.



Comparison of Concrete Density Kg/M^3

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Observation: From this graph we can conclude that, the density of M25 Grade concrete for 30 % mix proportion found minimum Concrete Density at 7 & 14 days. The Density decrease near about 25 % as compare to normal/ Convectional concrete.

VIII. CONCLUSION

- Foundry sand and m-sand can be used in Light Weight Concrete to achieve equal strength partial replacement of fine aggregate with waste foundry sand and m-sand is used to improve the strength.
- The above studies help to meet the construction Industry strategic goal of environmental study such that Manufactured sand (MS) & Waste Foundry sand can replace natural sand in concrete mix. Using less natural sand leads to a decrease in river dredging and the disruption of river environments.
- Use 30% replacement of fine aggregate with manufactured sand & Waste foundry sand in which compressive strength is slightly increased.
- For the above results is noted that concrete made with manufactured sand & Waste foundry sand can be suitably used in making structural grade concrete.
- The compressive & Flexural strength is decrease in 7 & 14 day curing respectively for 5 % Mix & 30 % of Mix than conventional concrete & also decrease the density of concrete as per the conventional concrete.

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