



REPLACEMENT OF NATURAL SAND WITH MANUFACTURED SAND IN CONCRETE

¹Harsh Solanki, ²Rutvi Patel

¹PG Student M.E. Structural Engineering, Gokul Global University, Siddhpur, Gujarat, India

²Assistant Professor, M.E. Structural Engineering, Gokul Global University, Siddhpur, Gujarat, India

ABSTRACT

Scarcity of good quality Natural River sand due to depletion of resources and restriction due to environmental consideration has made concrete manufactures to look for suitable alternative fine aggregate. One such alternative is “Manufactured sand”. Though manufactured sand has been in use in concrete manufacturing in India, the percentage of its contribution is still very negligible in many parts of the country. Except in Kerala and in some pockets in Southern and Western India, real processed manufacture sand is not available and this makes manufacturing of good quality of concrete very difficult. A well processed manufactured sand as partial or full replacement to river sand is the need of the hour as a long term solution in Indian concrete industry until other suitable alternative fine aggregate are developed.

DOI Number: 10.48047/NQ.2022.20.3.NQ22968

NeuroQuantology2022;20(3): 1071-1076

I. Introduction

The river beds are the main sources for the natural sand. These natural resources are being depleted very fast, due to over exploitation and contamination by chemicals and waste from nearby industries. This causes scarcity of natural sand. The natural sand is transported from available places to the construction sites. Transporting river sand to the construction sites increases its sale price significantly.

Specifications which are generally guided by Australian and International Standards require sand to have particular physical and chemical characteristics such as particle size distribution limits, hardness, inertness, water absorption limits, density, mineral type, durability and to be free of deleterious matter.

1.1 Manufactured Sand

The Manufactured Sand (MS) is a by-

product of the crushing and screening process in the quarries. Quarry generates considerable volumes of quarry fines while crushing the rock into aggregates. It is also referred to as crushed rock sand, stone sand, crusher sand and crushed fine aggregate. Quarry fines consist of a graded mix of coarse sand, medium sand and fine sand sized particles, plus clay/silt fraction known as the ‘filler’ grade. Filler grade material is defined by the industry as the material having less than 0.075mm (75 microns) in size.

II. SURVEY OF LITERATURE:

1. Jeevan Kumawat, Er. R.S. Shekhawat: The fine aggregate replacement of M-Sand with river Sand is more cost economical.

With 100% replacement of natural sand with manufacture sand, the strength criteria can be fully established. The compressive strength of 28 days for M25 and M30 concrete mix with 100%



River sand replacement by Msand yield compressive strength of 33.23 and 38.96 N/mm². The most extreme increment in compressive strength is 5.44% (M25) and 1.72% (M30), flexural strength is 1.29% and 9.95% and Split tensile strength is 6.16% and 6.68% respectively

2. S. Pranavan , G. Srinivasan: The work on this study evaluates the different comparisons of mechanical properties of complete M-sand (MS), complete sea sand (SS) and 50% of M-sand with 50% of sea sand . compressive strength percentage increases on Fully Sea sand based and 50% M-Sand + 50% Sea sand respectively for 28 days is 8.10% & 1.52% compared to Fully MSand based concrete. split tensile strength percentage decreases on Fully M-Sand and 50% M-Sand + 50% Sea sand respectively at 28 days is 13.33% & 9.47% compared to Fully Sea sand based concrete. Flexural strength test results percentage observed increasing on Fully Sea sand based and 50% M-Sand+ 50% sea sand is respectively at 28 days is 2.76% & 11.05%

3. Dessalegn Mamaru: This experimental study was conducted by preparing three concrete cubes for each percentage replacement. The replacement was done at 0%, 10%, 20%, 40%, 60%, and 100%. The maximum compressive and flexural strengths at 40% replacement were 31.25 MPa and 4.37 MPa respectively for the target concrete grade C-25. The workability of fresh concrete was decreased by 33.43% when manufactured sand increases from 10% to 60%.

4..K. Srinivas Reddy: The main objective of this experimentation is to find out the effect of replacement of natural sand by manufactured sand with 20%, 40% and 60% on hardened properties of cement concrete. Results are compared with reference mix of 0% replacement of Natural sand by Robo sand.After 28 days, Compressive strength increase with increase of

manufactured sand percentage. With 20% replacement:
+1.84 N/mm².With 40% replacement: + 2N/mm².
& With 60% replacement : +3.77N/mm²

III. RESEARCH METHODOLOGY

Replace the natural sand with Manufactured sand in various levels (25%,50%,75%,100%) and find perfect replacement of M-sand in concrete grade M-25 & find out the Optimum Percentage replacement level in concrete (M-25)

IV. EXPERIMENTAL SETUP

As the title of the investigation program shows, the work is based on the mechanical and durability of concrete with manufactured sand replaced with natural sand. the aim is to perform replacement of natural sand with m-sand in various levels (25%,50%,75%,100%) in concrete grade m-25. The concrete mix of M25 grade was prepared as per IS10262:2009. To carry out the experimental investigation total 30 cubes of size 150mm x 150mm x 150mm were casted to determine Compressive strength. 6 cubes were casted to determine the compressive strength of normal concrete without Manufactured sand. Similarly, each set of 6 cubes were casted to determine the compressive strength for 25%, 50%, 75% and 100% replacement of M sand with Natural sand in concrete respectively. From these 6 cubes, each set of 3 cubes were utilized to determine the compressive strength of concrete after 7 days and 28 days of curing. Also 6 cubes were casted to determine the Flexural strength of normal concrete without Manufactured sand. Similarly, each set of 6 cubes were casted to determine the Flexural strength for 25%, 50%, 75% and 100% replacement of M sand with Natural sand in concrete respectively.

1072



Fig. 1 Compressive strength test



Fig. 2 Flexural strength of concrete beam

TABLE 1 Compressive Strength Result of M25 grade concrete

% Replacement of Natural sand with Manufactured sand	Average Compressive strength of the concrete at different ages(N/mm ²)		
	% REPLACEMENT OF M- SAND	7 DAYS	28 DAYS
0% M-Sand		21.93 N/mm ²	31.59 N/mm ²
25% M-Sand		20.97 N/mm ²	28.08 N/mm ²
50% M-Sand		23.37 N/mm ²	30.15 N/mm ²

75%M-Sand	26.66N/mm2	34.15 N/mm2
100% M-Sand	22.63N/mm2	32.67 N/mm2

Fig. Graphical Comparison of Compressive strength of Concrete grade M25

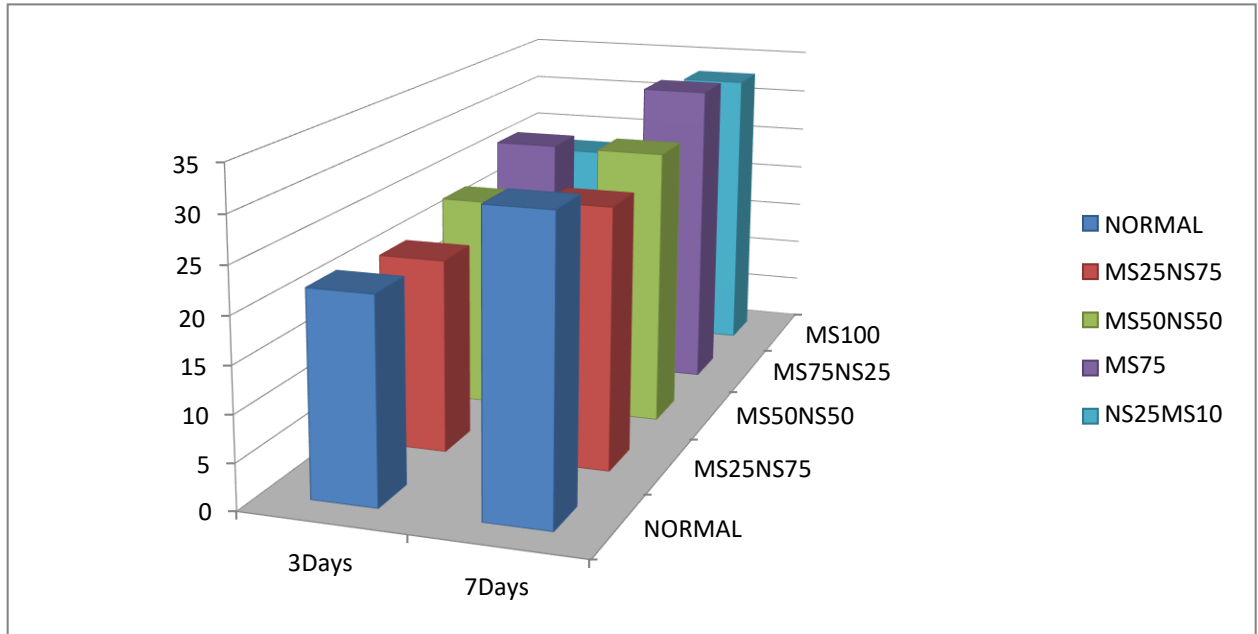
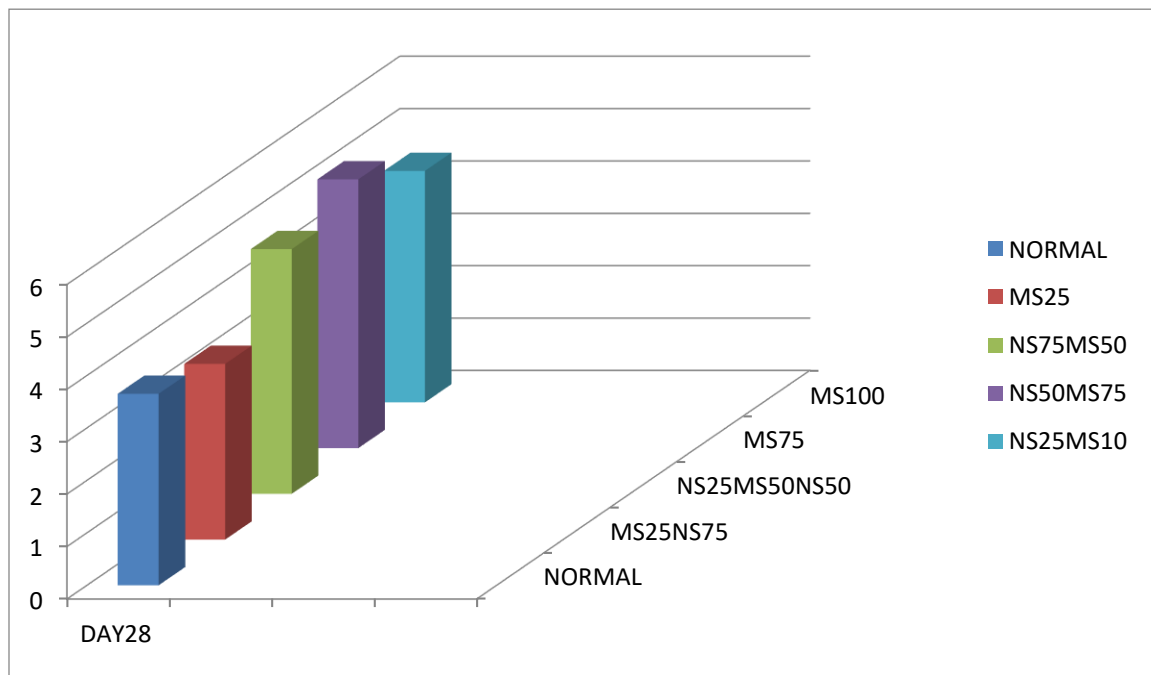


Table Flexural Strength Result of M25 grade concrete

% Replacement of Natural sand with M sand	Average Flexural strength of the concrete at different ages(N/mm ²) 28 days
0% M-Sand	3.65 N/mm ²
25% M-Sand	3.35 N/mm ²
50% M-Sand	4.67 N/mm ²
75% M-Sand	5.13 N/mm ²
100% M-Sand	4.42 N/mm ²

1075

Fig. Graphical Comparison of Flexural strength of concrete grade M25



VII CONCLUSION

1. Characteristics of concrete were examined using M-Sand as a fine aggregate and the results were compared with those of river sand as fine aggregate.
2. Concrete of grade M25 were considered in these investigation.
3. The fine aggregate replacement of M-Sand with river Sand is more cost economical
4. Replacement of M sand by 25% with natural sand decrease compressive strength up to 4.37% & 11.10% for 7 & 28 days
5. Replacement of M sand by 50% with natural sand increase the strength up to 6.54% for 7 days & decrease up to 4.55% for 28 days.
6. Replacement of M sand by 75% with natural sand increase the strength up to 21.56% & 8.10% for 7 & 28 days.
7. Replacement of M sand by 100% (Fully replaced) with natural sand decrease the strength up to 3.19% & 3.41% for 7 & 28 days.
8. The most extreme increment in compressive strength is found out with 75% replacement of M sand in concrete (M25)
9. Replacement of M sand by 25% with natural sand decrease Flexural strength up to 8.22% for 28 days
10. Replacement of M sand by 50% with natural sand increase Flexural strength up to 27.94% for 28 days
11. Replacement of M sand by 75% with natural sand increase Flexural strength up to 40% for 28 days
12. Replacement of M sand by 100% (Fully replaced) with natural sand increase Flexural strength up to 21% for 28 days
13. The most extreme increment in Flexural strength is found out with 75% replacement of M sand in concrete (M25)

of strength can be plotted as well as optimum amount can also be determined.

3. Conducting chloride penetration test and water absorption tests on concrete ensure adequate durability
4. Suitability of manufactured sand must be ascertained for plastering

REFERENCE

- Dessalegn Mamaru "Suitability of Crushed Manufactured Sand for Replacement of Natural River Sand to Produce C-25 Concrete", 2016
- Halesh Kumar B T, Anusha H S , Bhargavi S P ,Syed Zabiulla "Replacement of Fine Aggregate by M-Sand" 2017
- Jeevan Kumawat, Er. R.S. Shekhawat "Effect on Rheological Properties of Concrete Using Manufactured Sand", 2020
- K. Srinivas Reddy " Replacement of Natural Sand with Robo/Artificial Sand in Specified Concrete Mix", 2016
- Kiran. M. Mane, Dr. Dilip. K. Kulkarni, Abhishek. A. Joshi "STRENGTH AND WORKABILITY OF CONCRETE WITH MANUFACTURED SAND" 2017
- S. Pranavan , G. Srinivasan "Investigation on behaviour of M-sand and sea sand based concrete", 2021

1076

VII SCOPE FOR FUTURE WORKS

1. This research was intended to examine the influence of Manufactured sand additions in concrete with replace to Natural sand for M25 mix. The same work can be extended for other grades of concrete mixes with varying water/cement ratio
2. Replacing natural sand with different % of manufactured sand so that clear variation

