

# Replacement of Sand with M-Sand in Concrete

Manish Singh Rajput<sup>1</sup> Abhishek Mangal<sup>2</sup> Ankit Trivedi<sup>3</sup> Danveer Singh Bhadauriya<sup>4</sup>

<sup>1,2</sup>B.E Scholar <sup>3,4</sup>Assistant Professor

<sup>1,2,3,4</sup>Department of Civil Engineering

<sup>1,2,3,4</sup>Sakshi Institute of Technology & Management, Guna (M.P.), India

**Abstract**— In today’s world of urbanization, construction companies play an important role for any country development. Infrastructure is the way to judge the growth and development of any country. Most of developing country is focused on their infrastructure to prove ourselves in the world. Concrete is the main material used in construction mostly. The versatility of concrete has made it an important part of construction. Sand is the major component of concrete. Manufactured Sand (M-Sand) different 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. We test the sand for grade of concrete M-20 on different percentages and take out the compressive strength of concrete after curing the cube of concrete in 7, 14 and 28 days respectively.

**Key words:** M-Sand, Concrete

## I. INTRODUCTION

The most widely used construction material in the world is concrete and is the second most utilized substance on the earth next to water. The word concrete is derived from the Latin word “concretus” which means compact or condensed.

Concrete is a composite product obtained artificially or a man-made mixture of cement, sand, coarse aggregate and water in pre-determined proportions and sometimes we used admixtures as per requirements. When these ingredients are mixed, they form a plastic mass, which can be moulded in desired shape. It gets hardened into hard solid mass. Water is one of the most important ingredient of concrete.

In concrete sand is used as a fine aggregate, gravels and crushed stone are used as a coarse aggregate. The cement acts as a binding material which forms a paste with water and on hardening this cement paste holds coarse and fine aggregates together to forms a solid mass.

## II. INTRODUCTION OF MANUFACTURED SAND

Natural or river sand are weathered and worn out particles of rocks and are of various grades or sizes depending upon the amount of wearing. Now a day’s good sand is not readily available, it is transported from a long distance. Those resources are also exhausting very rapidly. So it is a need of time to find some substitute to natural river sand.

The artificial sand produced by proper machines can be a better substitute to river sand. The sand must be of proper gradation (it should have particles from 150 microns to 4.75 mm in proper proportion).

When fine particles are in proper proportion, the sand will have fewer voids. The cement quality required will be less. Such sand will be more economical. Demand for manufactured fine aggregates for making concrete is increasing day by day as river sand cannot meet the rising

demand of construction sector. Natural river sand takes millions of years to form and is not replenishable.

Because of its limited supply, the cost of natural river sand has sky rockets and its consistent supply cannot be guaranteed. Under this circumstances use of manufactured sand becomes inevitable.

River sand in many parts of the country is not graded properly and has excessive silt and organize impurities and these can be detrimental to durability of steel in concrete whereas manufactured sand has no silt or organic impurities.

However, many people in India have doubts about quality of concrete/mortars when manufactured or artificial sand are used. Manufactured sand have been regularly used to make quality concrete for decades in India and abroad.

Parameters	M-Sand	River Sand
Process	Manufactured in factory.	Naturally available on river banks
Shape	Angular and has rougher texture. Angular aggregates demands more water. Water demand can be compensated with cement content	Smoother texture with better shape. Demands less water.
Moisture Content	Moisture is available only in water washed M- Sand.	Moisture is trapped in between the particles which is good for concrete purposes.
Compressive Strength	Higher	Lesser
Eco Friendly	Though M-Sand uses natural coarse aggregates to form, it causes less damage to environment as compared to river sand.	Harmful to environment. Eco imbalances, reduce ground water level and rivers water gets dried up.
Price	M-Sand price ranges from Rs.35 - Rs.45 per cubic feet in Bangalore ( India)	River sand price ranges from Rs 60 - 80 per cubic feet in Bangalore (India).
Applications	Highly recommended for RCC purposes and brick/ block works.	Recommended for RCC, plastering and brick/ block work.
Quality	Better quality control since manufactured in a controlled environment.	No control over quality since it is naturally occurring.
Particle passing 75 micron	Up to 15% (IS: 383 - 1970)	Up to 3% (IS:383 - 1970)

Table 1: Comparison between M-Sand & River Sand

### III. COMPRESSIVE STRENGTH

In this research we test the manufactured sand on different percentage of mixes in the grade of concrete M20 and make cube of standard size 150mm×150mm×150mm on curing of 7 days, 14 days and 28 days.

M-sand replacement	CTM reading (KN)	Average load	Compressive Strength (N/mm <sup>2</sup> )
0%	380 400 410	396.66	17.66
50%	460 490 480	476.66	21.18
75%	450 440 430	440	19.55
100%	400 420 430	416.66	18.51

Table 2: Compressive Strength Test Result At 7 Days

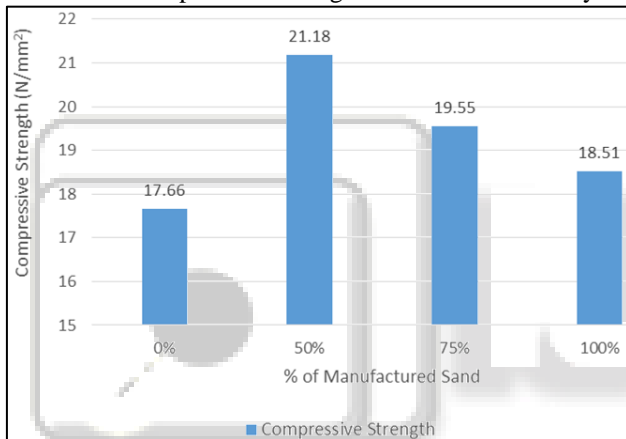


Fig. 1: Compressive Strength in 7 Days

M-sand replacement	CTM reading (KN)	Average load	Compressive Strength (N/mm <sup>2</sup> )
0%	400 440 420	420	18.66
50%	490 520 510	506.66	22.51
75%	460 490 470	473.33	21.04
100%	510 540 520	523.33	23.25

Table 3: Compressive Strength Test Result In 14 Days

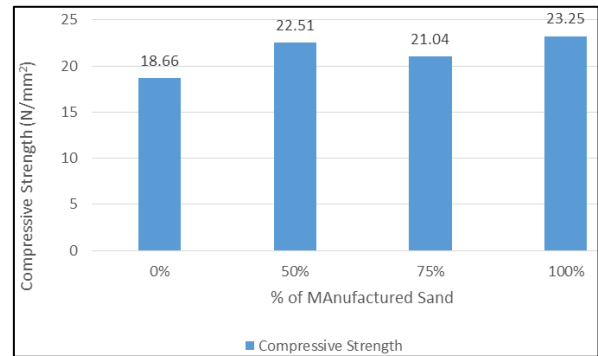


Fig. 2: Compressive Strength in 14 Days

M-sand replacement	CTM reading (KN)	Average load	Compressive Strength (N/mm <sup>2</sup> )
0%	440 450 420	436.66	19.40
50%	500 480 490	490	21.77
75%	520 540 500	520	23.11
100%	540 580 590	570.00	25.33

Table 4: Compressive Strength Test Result at 28 Days

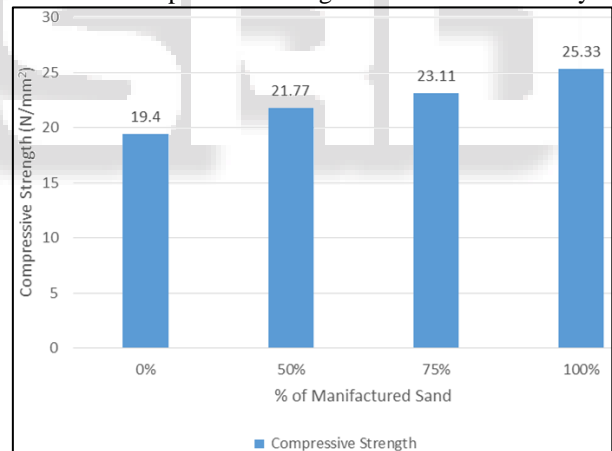


Fig. 3 Compressive Strength in 28 Days

### IV. EXTRA INFORMATION ABOUT M-SAND

- According to "TheHindu" newspaper on 11/09/2015, Manufactured sand is a 100% substitute for river sand says: - Kuncheria P. Isaac, VC (Kerala Technical University).
- Pune – Mumbai expressway was completely built using manufactured sand.
- Runway of Thiruvananthapuram International Airport.
- New Flyover at Thakarapambv and Palayam Underpass at Thiruvananthapuram are also learnt to have constructed using M-Sand.

## V. CONCLUSION

In this research we observed that the replacement of sand with M-sand in concrete is successively gives the result in 14 days of curing when 100% sand replaced with M-sand. So we can say that 14 days curing is enough.

% of M-Sand	CTM reading (KN)	Compressive Strength (N/mm <sup>2</sup> )
0%	420	18.66
50%	506.66	22.51
75%	473.33	21.037
100%	523.33	23.25

Table 5: Best Result Acquired After Replacement of River Sand by M-Sand

## REFERENCES

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