



An Experimental Investigation on the Properties of Concrete containing Natural Sand by Manufactured Sand

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ABSTRACT

In this paper, conventional mix 1:2.32:2.82 with water to binder ratio is maintained as 0.55 was used in this present study. Here the River Sand is partially and fully replaced with M Sand with different percentages like 0%, 45%, 50%, 55% and 100%. Fresh and hard concrete properties were studied with natural sand substitute by M-Sand. In this study some investigation on the compressive, tensile, flexural and impact strength by partial and fully replacement of Msand by River sand and Result should be compared.

Keywords: River Sand, M sand, Impact, Flexural, Compressive and Split tensile strength

1. Introduction

Concrete is a mixture of cement, fine aggregate (sand), coarse aggregate and water. Sand is the one of main constituents of concrete making which is about 35% of volume of concrete used in construction industry. Nowa days good sand is not readily available; it is transported from a long distance. Those resources are also exhausting very rapidly [2].

Recently India has facing a great demand to natural river sand due to its excessive cost and depletion of these natural sources causes major environmental problems. So it is a need of the time to find some substitute to natural river sand. In order to fulfill the requirement of fine aggregate, some alternative material must be found. The cheapest and the easiest way of getting substitute for natural sand manufactured sand.

2. Objects

- To investigate the properties of M-sand and River Sand.
 - To provide background information on manufactured sand, river Sand, cements, and aggregates and mix design processes [3].
 - To assess existing concrete produced using manufactured sand by compressive, tensile, and flexural and impact strength.
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3. Experimental Investigation

3.1. Material Used

Cement

Cement Ordinary Portland Cement (OPC) 53 grade Bharathi cement corresponding to IS 12269-1987 is used

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Table 1 –Properties of Cement.

Properties		Results
Specific Gravity		3.15
Standard consistency		32%
Setting Time	Initial(Minutes)	32 min
	Final (Minutes)	400 min
Compression strength	7 Days	32
	28 Days	45

Natural River Sand

Natural river sand is mainly excavated from river beds and river sand used in this study was collected from the Innoli, Boliyar local area.

Table 2–Properties of Natural Sand.

Properties	Value
Specific gravity	2.5
Water absorption (%)	2.6%
Fineness modulus	3

Manufactured Sand

The Manufactured sand obtained from a quarry at Mudipu, Mangalore confirming to IS: 383- 1970 Properties Value

Table 3–Properties of Manufactured Sand.

Properties	Value
Specific gravity	2.6
Water absorption (%)	2.7%
Fineness modulus	3.6

Coarse Aggregate

Crushed stone coarse aggregate typically cubical in shape, well graded of size 20mm down and confirming to IS 2386-1963.

Properties Value Specific gravity 2.6 Water absorption (%) 2.7%

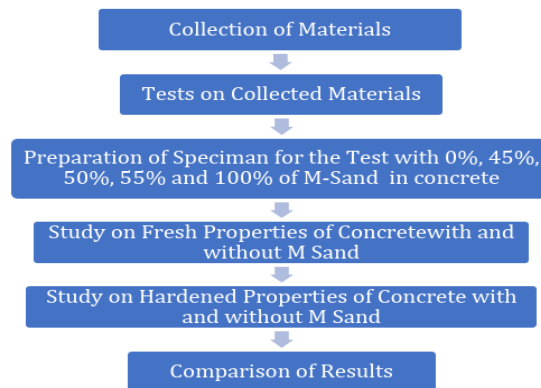
Table 4–Properties of Coarse Aggregate.

Properties	Value
Specific gravity	2.4
Water absorption (%)	0.50%
Aggregate crushing value	27
Aggregate impact value	26
Abrasion value Los Angle	26
Elongation and Flakiness Index	25

Details of specimen**Table 5–Details of Specimen**

Property of the specimen	7, 14 and 28 days Compression Test of the Specimen	Dimension of the Specimen (mm)
7, 14 and 28 days Compression Test	Cube	150*150*150
28 days Split Tensile Test	Cylinder	150*300
28 days Flexural Test	Beam	150*150*700
28 days Impact Test	Cylinder	150*6
		4

4. Methodology



5. Mix Design

In the present study a mix 1:2.32:2.82 approximately represent M20 was considered

Table 5–Details of Specimen

Mix design	Cement (kg/m ³)	Aggregate (kg/m)		W/C Ratio	Water
		Fine	Coarse		
1:2.32:2.82	358	829.67	1009.96	0.55	197

6. Result and Discussion

Comparison Between the properties of River sand and M sand

Table 5–Comparison Between the Aggregate

Properties	Natural Sand	Manufactured Sand
Specific Gravity	2.5	2.6
Fineness	3	3.4

6.1. Slump Test

Due to the superior gradation of M sand gave good plasticity to concrete providing excellent workability [4].

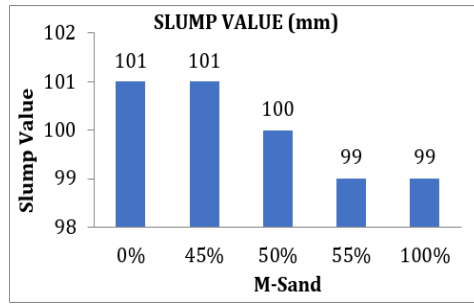


Fig. 1 –Slump Value

6.2. Compression Strength

Compressive strength of concrete for 7 and 14 days with river sand is higher when compared with compressive strength of concrete with M-Sand. 28 days strength of concrete with M-Sand is higher than that of with river sand. 100% replacement of M-sand with respect to River Sand is decreases with 7, 14 and 28 strength [5]. Replacement of 100% River Sand with M sand is not satisfied the strength compare to conventional concrete.

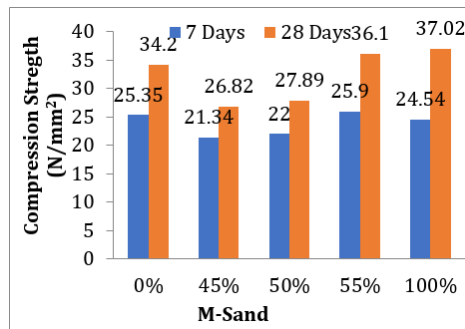


Fig. 2–Compression Strength

6.3. Tension Strength

It is clear that Tensile strength goes on increases with the increase in the M sand percentage and for 55% tensile strength will be optimum.

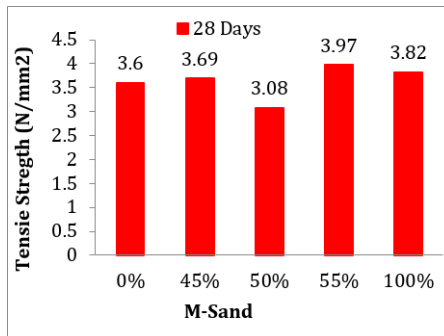
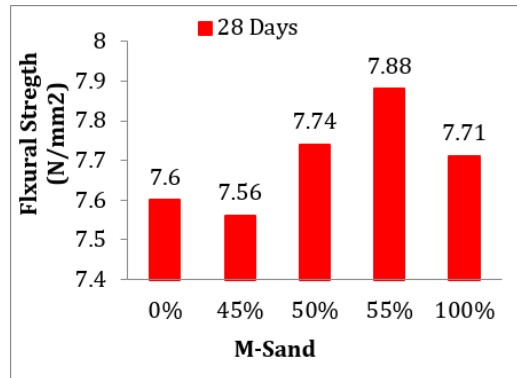


Fig. 3 – Tension Strength

6.4. Flexural Strength

It is clear that Flexural strength goes on increases with the increase in the M sand percentage and for 55% Flexural strength will be optimum.

Fig. 4 – Flexural Strength



6.5. Impact Test Results

The total energy absorbed by the concrete cylinders when struck by the hard impact or depends on the lower energy absorbed by both in contact zone and by the impact [6].

Energy=N*w*h in Joules

Where,

N = No. of blows

w = Weight of steel ball (N)

h = Height of fall (m)

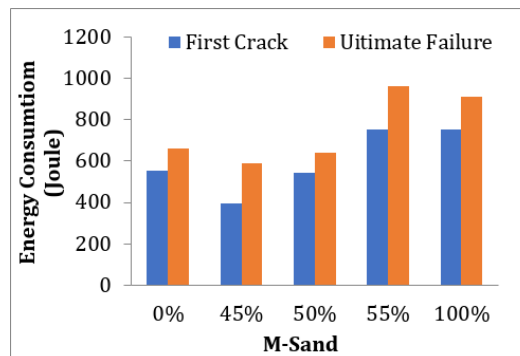


Fig. 5 – Impact Test

6.6. Ductility Index

Variation in impact test results of the concrete specimen prepared by replacing river sand by M sand at the percentages of 0%, 45%, 50%, 55% and 100%. It can be concluded that 55% and 100% replacement of river sand by M sand has a threshold values for an optimal performance in energy adsorption and crack resistance [7].

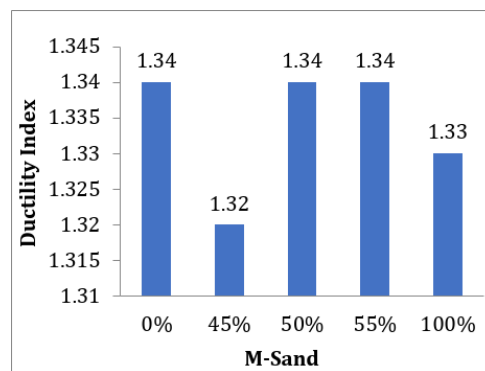


Fig. 6 – Ductility Index

7. Conclusion

The physical properties of M sand and River Sand almost same, the specific gravity of M sand and River sand 2.6 and 2.5 respectively confirming to IS 2386 (PART III): 1963. M-Sand is slightly coarser than the river sand and both sand falls under zone-2 [8]. Due to the superior gradation of M sand gave good plasticity to concrete providing excellent workability. 100% replacement of M sand with respect to River Sand is decreases with 7 and 28 strength. Replacement of 100% River Sand with M sand is not satisfied the strength compare to conventional concrete [9]. Compressive strength of concrete for 7 and 14 days with river sand is higher when compared with compressive strength of concrete with M-Sand. 28 days strength of concrete with M-Sand is higher than that of with river sand [10]. Tensile strength and Flexural Strength at 55% replacement of M sand by River sand is optimum after 28 days strength of concrete. Increased in Impact resistance of the concrete was derived from an increased ability of material to absorb energy and insulate sound during impact [11]. To achieve target mean strength and minimum grade strength requirement, a replacement of 55% or 100% of M sand with river sand can be recommended [12].

REFERENCES

- Amnon K., Hadassa B. (2006), "Effect of high levels of fines content on concrete properties" - ACI Material Journal, Vol.103 (6), pp. 474-481.
- Bhanja S, Sengupta B. Influence of silicafume on the tensile strength of concrete, Cement and Concrete Research Journal. 2005; 35:743-747.
- Dr. Elavenil S, Vijaya B. Manufactured sand, a solution and an alternative to river sand and in concrete manufacturing journal of Engineering, computers and applied sciences. 2013; 2(2):20-23.
- Gambhir M. L., "Concrete technology," Tata McGraw Hill Publishing Co. Ltd, India (2006).
- Goncalves J.P., Tavares L.M., Toledo F.R.D., Fairbairn E.M.R., Cunha E.R. (2007) "Comparision of natural and manufactured fine aggregates in cement mortars" - Cement and Concrete Research, Vol. 37, pp. 924-932.
- Hudson, B. P., "Manufactured Sand for concrete," The Indian concrete Journal, May 1997, pp. 237240.
- Ilangovan, R.; Nagamani, K., and Kumarasamy, K., "Studies on strength and behaviour of concrete by using crushed rock dust as fine aggregate," Civil Engineering and Construction Review, October 2006, pp. 924-932.
- Jane, S.; Justin, N.; Juenger, M., and David, W. F., "Characterizing minus no. 200 fine aggregate for performance in concrete," The University of Texas at Austin, March 2006, Research Report ICAR 107-1.
- Malhotra VM. Properties of fresh and hardened concrete incorporating GGBS, in Supplementary cementing for concrete, 1987.
- Misra VN. Use of Stone dust from crushers in cement sand mortars the Indian concrete journal. 1984, 219223