

# COMPARISON OF NATURAL AND MANUFACTURED FINE AGGREGATES IN CEMENT MORTAR

<sup>1</sup>Nethravathi S.M, <sup>2</sup>Gagan Krishna R.R

<sup>1</sup>Assistant Professor, <sup>2</sup>Assistant professor

<sup>1</sup>Department of Civil Engineering

<sup>1</sup>Sahyadri College of Engineering and Management, Mangalore, India

**Abstract:** *The Natural River sand available in the river bed is depleting and also at present the presence of excess silt and clay in sand affects the strength of concrete. Scarcity of river sand has forced the construction industry to find the suitable substitute. The manufactured fine aggregate such as Blast furnace slag, manufactured sand, quarry dust, foundry sand and demolition waste can be used as substitute for natural sand. An attempt has been made for compressive strength studies on mortar by 100% replacement of natural sand by artificial sand.*

**Key words:** *Manufactured fine aggregate, Mortar, Compressive strength.*

## I. INTRODUCTION

The most commonly used fine aggregate is natural river sand. Selection of good quality aggregate at site is important, because the aggregate forms the main matrix of concrete or mortar. Nowadays sand is becoming a very scarce material, in this situation research began for inexpensive and easily available alternative material to natural sand. Some alternative materials have already been used as a part of natural sand e.g. fly-ash, slag limestone, and siliceous stone powder are used in concrete mixtures as a replacement of natural sand. Required quality is the major limitation in some of the above materials. Infrastructural growth demands the alternative material for natural sand that should satisfy technical requisites of fine aggregates as well as it should be available abundantly.

## II. MATERIALS

**Cement:** In this work, ordinary Portland cement of Birla (43 grade) brand obtained from a single batches through out the investigation was used. The ordinary cement content mainly has two basic ingredients namely, argillaceous and calcareous. The cement satisfies the requirement of IS: 8112-1989.

**Blast Furnace Slag:** The iron industries produce a huge quantity of blast furnace slag as by product which is non biodegradable waste material. It is glassy black in color. It is consisting essentially of silicates and alumina silicates of calcium and of other bases that is developed in a molten condition simultaneously with iron in a blast furnace.

**Manufactured Sand (M-Sand):** M-Sand produced from hard granite stone by crushing. The crushed sand is of cubical shape with rounded edges, washed and graded to as a construction material. The size of manufactured sand is less than 4.75mm.

**Quarry dust:** It is obtained by crushing the stone boulders of size 100 to 150 mm in the stone crusher, then it is sieved and the particles passing through 4.75mm sieve is used in this project.

**Demolition waste:** It is waste debris from destruction of a building. The debris varies from insulation, electrical wiring, rebar, wood, concrete, and bricks. Demolished waste was collected from Bykampady, industrial area, Mangalore, India.

**Foundry sand:** Foundry sand is a byproduct of the ferrous and nonferrous metal casting industry. It consists primarily of clean, uniformly sized, high-quality silica sand or lake sand that is bonded to form molds for ferrous (iron and steel) and nonferrous (copper, aluminum, brass) metal castings. Although these sands are clean prior to use, after casting they may contain Ferrous (iron and steel) industries account for approximately 95 percent of foundry sand used for castings. The automotive industry and its parts suppliers are the major generators of foundry sand.

## III. OBJECTIVE

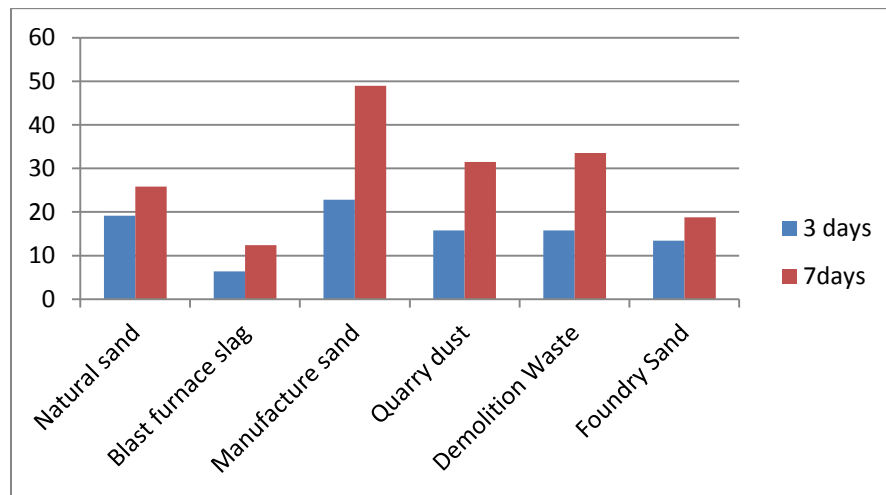
1. To study the effect of 100% replacement of natural fine aggregates with manufactured fine aggregate and finds its effect on the strength Characteristics of mortar.
2. Study of compressive strength properties of mortar at the ages of 3 and 7 days.

## IV. COMPRESSIVE STRENGTH OF MORTAR

For determining the Compressive strength, standard cubes of mortar (7.07 cm) size were casted and tested using Compression Testing Machine (CTM). Table 1 shows the 3 and 7 days strength of mortar cubes of 1:4 proportions casted with 0.4 W/C ratios.

**Table 1 Comparison of mortar strength at 3 and 7 days**

SL. No	Type of Sand	C/S Proportions	Compressive strength of mortar at 3 days, Mpa	Compressive strength of mortar at 7 days, Mpa
1	Natural sand	1:4	19.11	25.81
2	Blast furnace slag	1:4	6.36	12.40
3	Manufacture sand	1:4	22.80	48.95
4	Quarry dust	1:4	15.75	31.51
5	Demolition Waste	1:4	15.75	33.53
6	Foundry Sand	1:4	13.40	18.77



**Fig. 1 Comparison of mortar compressive strength at 3 and 7 days**

## V. CONCLUSIONS

1. Using of manufactured sand as a replacement of fine aggregate will might prove an economical and environmentally friendly solution.
2. Chemical Composition with respect to Silica, Aluminium, Oxygen, Calcium and magnesium are nearest to normal sand in manufactured Sand.
3. From the comparison of compressive strength of cubes casted using alternative sand and natural sand prove that, Compressive strength of Manufactured sand is 30% stronger than the natural sand.

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