



UTILISATION OF M-SAND AND GGBS AS A PARTIAL REPLACEMENT OF FINE AGGREGATE AND CEMENT

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Abstract: Traditionally, naturally available river sand has been the choice and there are no issues with this practice. With ever increasing construction activities, this resource is dwindling globally. Restrictions put in place by various governmental agencies has brought in severe strains on the construction industry to look for alternate materials. M-sand and GGBS are two such alternatives that are used to replace natural sand in cement concrete. The purpose of this project is to investigate the feasibility of these materials as a replacement to natural sand by conducting experiments.

I. INTRODUCTION

Natural sand has been widely used as fine aggregate in cement concrete. Due to immense depletion of sand from river beds, it affects environment in various ways. Alternatives are being explored to replace natural sand. Two of the alternatives are M-sand and GGBS. Experimental analysis is done on M-sand and GGBS to examine their qualities and characteristics and their ability to replace Natural sand in Cement concrete. These materials are tested for their specific gravity, workability and compressive strength.

II. METHODOLOGY

MANUFACTURED SAND (M-SAND). Artificially manufactured sand acquired by processing quarry dust. Grey in colour, cubical in shape, manufactured as per IS, BS, ASTM standards. There are no over sized particles, no marine products, or clay and silt particles in M-sand unlike natural sand. It has similar chemical composition as natural sand.

III. MANUFACTURING PROCESS

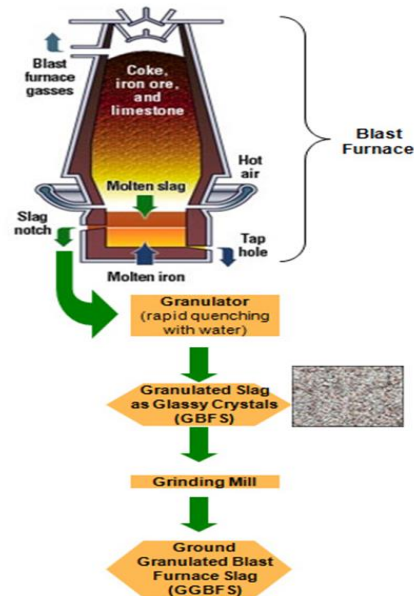
Extracting

Crushing

Sorting

IV. GROUND GRANULATED BLAST FURNACE SLAG Production of GBFS and GGBFS (GGBS)

By-product from the blast furnaces used to make iron.
 Off white in colour, very fine.
 Chemical composition is CaO, Silica, Alumina, Magnesia.



V. MANUFACTURING PROCESS

- Collection of slag
- Quenching
- Grinding

VI. TESTS CONDUCTED

TEST ON FINE AGGREGATE;

SPECIFIC GRAVITY

WORKABILITY TEST ON FRESH CONCRETE;

VEE BEE CONSISTOMETER

SLUMP CONE TEST

TEST ON HARDENED CONCRETE;

COMPRESSION TEST

VII. SPECIFIC GRAVITY TEST

MATERIAL	AVG.SPECIFIC GRAVITY VALUE
NATURAL SAND	2.61
MANUFACTURED SAND	2.62
GGBS	2.9

VIII. SLUMP CONE TEST

FINE AGGREGATE	W/C RATIO	SLUMP VALUE (mm)
100% NATURAL SAND	0.5	75
100% M SAND	0.5	60
100% GGBS	0.5	40



IX. VEE-BEE CONSISTOMETER

FINE AGGREGATE	W/C RATIO	CONSISTENCY IN SECONDS
100% NATURAL SAND	0.5	18
100% M SAND	0.5	22
100% GGBS	0.5	27



X. COMPRESSIVE STRENGTH OF NATURAL SAND

CUBE COMPOSITION	WEIGHT OF CUBE (kg)	7-DAY STRENGTH (N/mm ²)	14-DAY STRENGTH (N/mm ²)
Reference Mix (0% replacement)	8.487	21.50	25.90

**XI. COMPRESSIVE STRENGTH OF M-SAND**

CUBE COMPOSITION	WEIGHT OF CUBE (g)	7-DAY STRENGTH (N/mm ²)	14-DAY STRENGTH (N/mm ²)
25% M-SAND	8.23	23.12	25.60
50% M-SAND	8.352	24.10	27.50

XII. COMPRESSIVE STRENGTH OF GGBS

CUBE COMPOSITION	WEIGHT OF CUBE (kg)	7-DAY STRENGTH (N/mm ²)	14-DAY STRENGTH (N/mm ²)
25% GGBS	7.29	23.86	27.75
50% GGBS	7.866	25.10	28.70

CONCLUSION

M-sand and GGBS are analysed for different characteristics such as specific gravity, workability and compressive strength. Workability for M-sand is quite similar to natural sand. Compressive strength of concrete with M-sand is also identical. Workability of GGBS is lower than both M-sand and natural sand and addition of plasticizers is necessary for use in concrete. Compressive strength of concrete with GGBS is marginally higher than that of M-sand and natural sand. Hence, M-sand and GGBS proves to be a suitable replacement for natural sand as fine aggregate in cement concrete

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