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Mechanical Behavior of Solid Cement Concrete Blocks With Partial Replacement of Fine Aggregate by Road Dust

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Abstract: **- Cement Blocks are widely used construction and building material around the world. Many researchers are actively working to find new and improved methods of compacting the waste disposal concern, particularly by establishing useful and economic utilization of waste material. Efforts to improve the environment, through conversion of waste materials into useful construction products and this has created a large scope for sustainable development among building material suppliers and high-end contractors. A block is a single unit of a kneaded concrete material cured and it is used in masonry construction. In this project, cement blocks are prepared from waste (dust) materials which comprises in road ways with the replacement of (0%,25%,50%,75%,100%). The comparison of conventional block and cement block is investigated. The main objective of this project is to reduce the air pollution and accident. Cement blocks are satisfied by introducing an alternative strength, cost effective, accurate shape, and eco-friendly innovative building blocks. The various proportions is carried out, investigated and tested.**

Keywords**: Road dust, waste materials, sustainable development, Air pollution control.**

I. INTRODUCTION

Cement concrete blocks are one of the prominent building materials, having its origin around 18th century. It is cheap, durable and commonly available building material. These are rectangular in shape, with interlocking behaviour stacked with mortar between them. Typically blocks are stacked together or laid as masonry work using various kind of mortar to hold the blocks together and make a permanent structure. Cement blocks refer to those blocks which use cement as main raw materials, adding m-sand and aggregates, after mixture preparation, pressed in moulding, then through high temperature or normal pressure curing or natural curing methods into beings. Cement blocks can be defined as three kinds, one named solid block, another one called hollow block and interlocking. Cement concrete blocks are mainly used for load bearing structure and framed structures, where compression forces are predominant. It is the future alternative for red bricks and fly ash bricks. In cement block, it possesses lower water absorption when compared to the conventional blocks, also with a elevated thermal insulation, superior compressive strength, accurate shape. In this thesis work, a comparison was made between the conventional cement concrete blocks with the cement blocks by using road dust.

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1.1. Objective of The Thesis

The aim of this thesis is to study about the mechanical properties of cement concrete blocks with incorporating road dust at varying percentages, and hence to provide a comparative study with the conventionally used cement blocks.

1.2. Road Dust

Road Dust on roads may make up 33% of air pollution. Road dust consists of deposits of vehicle exhausts, industrial exhausts, particles from tires, brake wear, dust from paved roads or potholes, and dust from construction sites.

II. MATERIAL PROPERTIES

2.1. Cement

Ordinary Portland cement (OPC) of Bharath brand confirming to IS-12269 (53 Grade) having specific gravity of 3.14 and the Consistency of the cement was 32% was used in the present study. The Initial Setting time and Final Setting time was found to be 29 min and 7 hours 30min respectively, determined from the standard Vicat test apparatus.

2.2. Fine Aggregate (M- sand)

M-Sand with Fineness Modulus of 2.78, confirming to Zone II, with a Specific Gravity of 2.6 was used as fine aggregate in the present work.

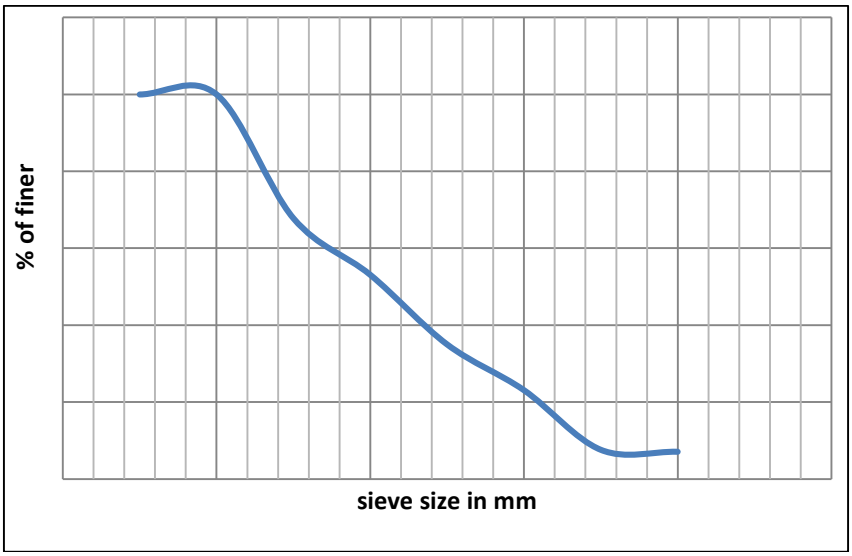

Fig.1 Sieve Analysis of M-sand

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2.3. Road Dust

Road dust with the Fineness Modulus of 1.75, conforming to Zone IV, with a specific Gravity of 2.14 and it is used as a replacement material in the present work.
Physical properties

1. Size
2. Water absorption
3. Bonding properties

Chemical properties

1. The effect of dust depends on its chemical composition .It may consist of many inorganic and organic compounds which may have the chemical such as (O, Si, Ca, Al, Mg, Fe, S, K and Na) detrimental effects

Fig 2.2 Road Dust

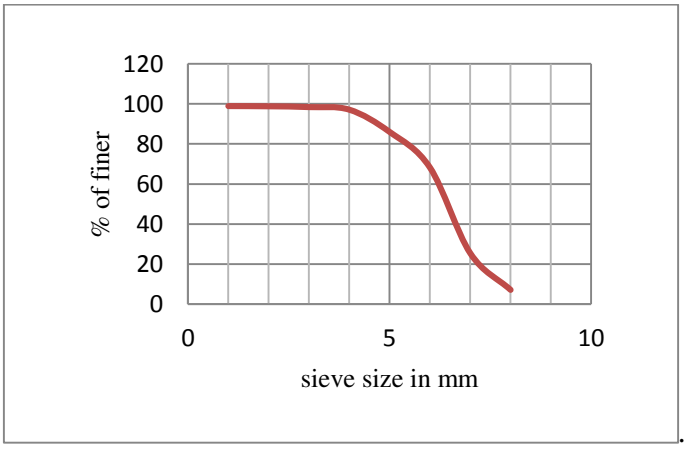

Fig.3 Sieve Analysis of Road Dust

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TABLE I. SPECIFIC GRAVITY

Test	M-sand	Road Dust
Specific gravity	2.6	2.14

2.4. Coarse Aggregate

Coarse aggregate in the size of less than 12mm with Specific Gravity of 2.8, was adopted in the present work. The size of aggregate <12mm

III. MIX DESIGN

A Mix design of M15 was computed with material properties as a base, relevant to IS 10262-2009.The class of the brick is class C

TABLE II. MIX DESIGN

Water	Cement	Coarse Aggregate	Fine Aggregate
0.60	1	3.07	1.64

TABLE III. REPLACEMENT TABLE OF ROAD DUST

Replacement %	Fine Aggregate	Road Dust
0%	1.3	0
25%	0.975	0.325
50%	0.65	0.65
75%	0.325	0.975
100%	0	1.3

IV. RESULTS AND DISCUSSIONS

By varying the percentage of fine sand by road and the Indirect Tensile Strength was performed.

4.1. Indirect Tensile strength

A rectangular specimen is loaded across the rectangular cross section. The loading causes a tensile deformation perpendicular to the loading direction, which yields a tensile failure. By registering the ultimate load and by knowing the dimension of the specimen, the indirect tensile

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strength of the material can be computed. Below is a figure showing the load fixture and a principal picture of the loading

Tensile strength is typically used as SMA performance measure for pavement because it better simulate the tensile stresses at the bottom of SMA surface course when it is subjected to loading. This stresses typically the controlling structural design stresses. Tensile strength is difficult to measure directly because of secondary stresses induced by gripping a specimen so that it may be pulled apart. Therefore tensile stresses are typically measured indirectly by a splitting tensile test.

Objectives

1. To know about the behaviour of cement block under tensile loading conditions.
2. According to the test, the possibilities of using in the various region along with the compression region

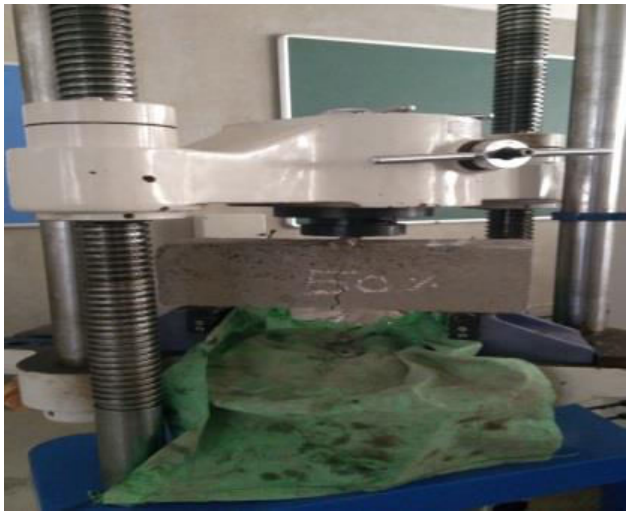

Fig.5 Indirect Tensile Strength setup

TABLE IV. INDIRECT TENSILE STRENGTH OF A ROAD DUST INCORPORATED BLOCKS

Replacement %	Load (KN)	Flexure Strength (N/mm^2)
0%	3.2	0.0905
25%	2.7	0.0763
50%	2.08	0.0588

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Replacement %	Load (KN)	Flexure Strength (N/mm^2)
75%	1.28	0.0362
100%	0.96	0.0271

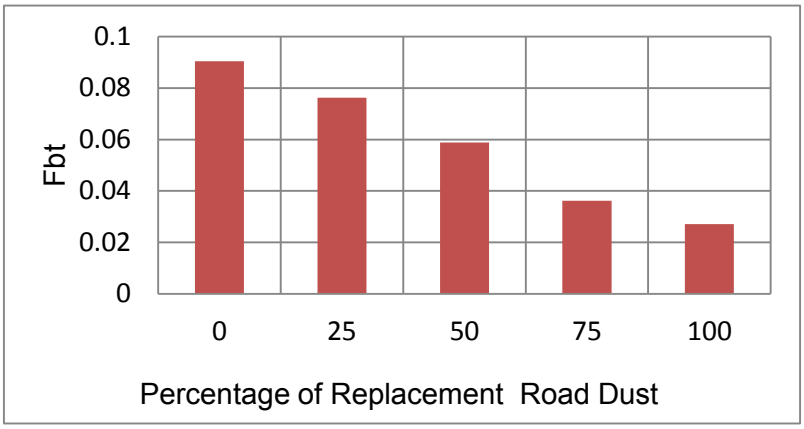

Fig. 4 Indirect tensile strength of a road dust incorporated blocks

V. CONCLUSIONS

The investigation identified the effect of Road Dust in cement block masonry. Further it was established various test such as density, water absorption, compression strength and indirect tensile strength. Based on the test results, the following conclusions are made

1. The density, water absorption, compression strength and indirect tensile strength decreases with increase in replacement of road dust.

2. Even though a gradual reduction in value of experimental testes is determined up to 25% road dust replacement of fine aggregate the compression strength of solid blocks satisfies the Codal provision**.**

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