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Use Of Waste Foundry Sand In Place Of Conventional Sand For Paver Blocks

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ABSTRACT: A huge amount of sand is being used by the metal foundries within the metal casting process and the sand is successfully recycled and used by the foundries. After some time, foundries are not able to use the same sand again. Then the sand is taken off away from the foundries and is known as Waste Foundry Sand. There is almost 6 to 10 million tons of production of foundry sand annually. Some of the foundry sand dumped near the industries while some are dumped in the landfills. This causes pollution and increases the burden on landfills. Waste Foundry Sand consists mainly of silica sand about 96 to 99% and less than 1% carbon and mud. To enhance the strength and durability aspects, Waste Foundry Sand can be utilized in concrete for paver blocks which is a non-structural component. So, it can be used as a partial alternative of natural aggregates such as fine aggregates for accomplishing different properties of concrete. In this study, the effect of Waste foundry Sand as a substitution of fine aggregate on the compressive strength of paver block of M25 grade was investigated. There were five percentages of replacement to which Waste Foundry Sand was replaced by weight of fine aggregates i.e., 0, 10, 20, 30 and 40% by weight of the fine aggregate. Tests will be conducted for determining the compressive strength of paver block.

Keywords – Waste Foundry Sand, Paver Block, Compressive Strength, aggregates

INTRODUCTION

Paver block or Paving block is one of the most popular flexible surface treatment options for exterior pavement applications. These blocks are aesthetically pleasing, comfortable to walk on, extremely durable, and easy to maintain. Generally, concrete paver block has one smooth face and one rough, although some paving blocks also come with reversible surfaces (can be used both sides). The long-lasting performance of paving blocks make it suitable for the heaviest duty applications, able to support substantial loads and resist shearing and braking forces. It is also recognized as Interlocking paver blocks have been extensively used in a number of countries for quite some time as a specialized problem-solving technique for providing pavement in areas where traditional pavingsystems are less durable due to many operational and environmental constraints.

Paver blocks are rectangular in shape and had more or less the same size as the bricks. The last five decades are extremely noticeable the paver block and the block shape has steadily evolved from non- interlocking to partially interlocking to fully interlocking to multiply interlocking shapes. Concrete paving includes connecting small piece, solid un-reinforcedpre-cast concrete paver blocks lay on a thin,compacted bedding material which is constructed over a properly designed base course and is fixed by edge restraints/curbsstones. The gap left between the paver block is then filled using suitable fine material. A properly designed and constructed interlocking paver block gives excellent performance when applied at locations where conventional systems havelower service life due to a number of geological, traffic, environmental and operational constraints. There are different uses for light, medium, heavy and very heavy traffic conditions currently in practice around the world.

II MATERIALS

CEMENT

53 grade Ordinary Portland Cement (OPC) confirming to IS 12269-2013 is used. Cement is used as the binding material for the concrete. It is mixed fine aggregates, coarse aggregates and water.

AGGREGATES

River or M-sand is used as the fine aggregate. 10mm stone chips is used as the coarse aggregate for paver block. These areused to fill up the gap and increase the strength.

WASTE FOUNDRY SAND

Waste Foundry Sand (WFS) obtained from metal casting industries is used as certain percent replacement of fine aggregate in theconcrete for paver block.

WATER

The Water used for mixing and curing should be free from undesirable quantities of alkalis, acids, oils, salts and sugars. The pH value of water should not be less than 6.

PAVER BLOCK MOULD

A paver block mould made of rubber is taken for casting the paver block. The Thickness of the mould is 60mm and its area is 0.032m^2.

III SPECIMEN PREPARATION

1. The mix design for M25 concrete for paver block is calculated.
2. After the completion of design mix, the concrete mix must be prepared with conventional sand as the fine aggregate i.e.,with no replacement of Waste Foundry Sand.
3. Then the concrete mix must be poured in the paver block mould and compacted well.

4. In the same way, prepare the concrete mix with 10%, 20%, 30% and 40% replacement of fine aggregate with the Waste Foundry Sand (WFS) and pour the concrete mix in the respective paver block moulds.

5. The mould should be left undisturbed for12 hours for setting of the concrete.

6. Two specimens are made for each percentage of Waste Foundry Sand.

7. Then the paver blocks are taken out of themoulds and one set of blocks is cured for 7days and set of blocks is cured for 28 days.

8. Then the blocks are taken for testing.

IV TESTING OF SPECIMENS

After curing for 7 and 28 days respectively, the specimen is taken out and wiped out thoroughly to get a dried surface specimen.

COMPRESSIVE STRENGTH

The compressive strength of paver block is measured using the universal testing machine. The specimen is kept between thetwo bearing plates for uniform distribution of loads. The load shall be applied without shock and increased continuously at a rate of 15 ± 3 N/mm^2/min until no greater load can be sustained by the specimen or delamination occurs. The maximum load applied to the specimen shall be noted in N.The apparent compressive strength of individual specimen shall be calculated by dividing the maximum load applied(N) by the plan area(mm^2). The corrected compressive strength shall be calculated by multiplying the apparent compressive strength by the appropriate correction factor in Table 5 of IS 15658-2006. The strength shall be corrected to the nearest 0.1N/mm^2.

V TEST RESULT

7-day compressive strength

Paver block with 0% WFS = 18.7N/mm^2 Paver block with 10% WFS = 19.8N/mm^2 Paver block with 20%WFS = 22.1N/mm^2 Paver block with 30% WFS = 25N/mm^2 Paver block with 40% WFS = 23N/mm^2 **28-day compressive strength**

Paver block with 0% WFS = 26.23N/mm^2 Paver block with 10% WFS = 28.67N/mm^2 Paver block with 20%WFS = 30.01N/mm^2 Paver block with 30% WFS = 31.12N/mm^2 Paver block with 40% WFS = 28.72N/mm^2

VI CONCLUSION

- Based on the above study, it is observed that Waste Foundry Sand (WFS) can be effectively used as a fine aggregate.
- The strength of paver block increases from 10% replacement upto 30% replacement of Waste Foundry Sand (WFS).
- It attains the optimum strength at 30% replacement and then decreases.

- So, 30% foundry sand can be replaced with fine aggregate during the manufacturing of paver blocks.

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