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International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Review on Suitability of Industrial Byproducts in the Production of Interlocking Concrete Paver Blocks [ICPB]

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ABSTRACT

Interlocking concrete paver blocks (ICPB) are brick-like piece of concrete commonly used as exterior flooring which can be used as an alternative pavement to asphalt and concrete pavements. ICPB is formed from individual concrete paver blocks that fit next to one another on a suitable sub base leaving a specific joint space among them to be filled with jointing sand. The main aim of this study is to understand the suitability of interlocking paver block manufacutured using industrial byproduct as raw material. The main reason for the use of the industrial wastes is to reduce the landfill problem and also to control the depletion of the natural resources. For this purpose various industrial wastes such as copper slag, fly ash, phosphogypsum, and sludge were selected and their physical and chemical properties were studied. Various mixes with different proportions of these industrial wastes were casted and tested as per the standards given in the Indian standards for precast concrete blocks for paving (is.15658:2006). These test results are then compared with the results of the conventional paver blocks.

KEY WORDS:- Paver blocks , Marble powder , Copper slag, ICPB , Industrial wastes

1.INTRODUCTION

Interlocking Concrete Paver Blocks are the most widely used in various countries to a certain Extent of time as a standard practice for providing pavements. It is used because of its firmness in regions such as walkways, parking lots, parks where normal type of pavement is not suitable or less resistance due to many operative and environmental restrains. Concrete paver blocks are the readymade solid cementblocks available in various size and shapes.Concrete paver blocks are the good idea with advancement of waste materials like fly ash, marble powder, copper slag , and other building debris. form these waste materials from industries can be used as one of the raw materials or replaced of the concrete ingredients so that these will be certain advantage of strength enhancement. Interlocking concrete blocks paving is a system of individual shaped blocks arranged to form a continuous hardwearing surface overlay. Over the past two decades paving composed of concrete blocks has became a feature of towns and cities. It is to be found In commercial industries and residential areas, in paving of malls, plazas, parking area and bus stops. Paving blocks are fully engineered products, manufactured in factory conditions, ensuring consistency and accuracy. Laid with an edge restraint over a granular bedding course, individual blocks interlock to act compositely which can distribute large point loads evenly. With the infrastructure development in India, demand of paving blocks is increasing day by day. At the same time the amount of different types of waste generation is also increased. Therefore control of waste disposal shall be given top priority while on the other hand recycling of waste efficiently as raw materials has become more important. Products which use recycled materials could contribute significantly to conservation of the environment in terms of reducing waste and protection of nature.

MATERIALS

Cement

Cement is the basic ingredient of concrete, normaly portland cement is uded for pavar blocks, concret is formed when portland cement creates a paste with water that binds with fineaggreates and course agrregates and it helps to make concrete hard when it is binds with others materials. Cement is manufactured through a closely controlled chemical combination of calcium, silica, aluminum, iron, and other ingredients. Cement playes a major role within a concrete mixture and affects the most important aspects of the mix, such as : workability, compressive strength, drying shrinkage, and durability. Through the process of hydration, cement particals react with water, binding the aggregates, and the strength matrix develops. The ordinary portland cement of 53 grade conforming IS 12269 was used for experimentation, the replacement of cement is with the flyash about 30% and marbal powder about 25% , the replacement of granite powder increases the water abosrbtion sightly, 25% of replacement of cement with granite powder was found that to be optimum doasge. The properties of cement used for experimentation were the standarad consistency of cement is 33%, and initial setting time is 30 minities and final setting time of cement is 1.30 hours, and the specific gravity of cement is 2.85 and strength of cement is 38.32 n/mm^2.

Coarse aggregates

Coarse aggregates refer to irregular and granular materials such as sand, gravel, or crushesd stone, are are used for making concrete. In most cases, coarse is naturaly occuring and can be obtained by blasting quarring or crushing them by hand or crushers. Aggreates of size passing between 4mm – 8mm are used as per the requriments of IS-383. As possible semicrushed agrreagtes are used. The avarage specific gravity of coarse aggreagtes used is 2.66, water absorbtion is not more than 30% and finenes modulus is about 7.25.

Fine agrregates

For fine aggreagte the average sepcific gravity that we used is 2.70 , water obsorbtion of about 1.0% and finenes modulus of fine aggregates is 3.18. the bulk density is noted as 1577 kg/m^3

Copper Slag

Copper slag used in the form of fine aggregate,The addition of the copper slag considerably improves, it's density so the weight of the block also increases The compressive strength of Paver block at 28 days is 45.46N/mm^2. Therefore optimum percentage of fine aggregate by copper slag is 30%, Paver block with copper slag with gains 10% strength more than to that of Paver block with conventional concrete. After 30% increase in copper slag fine aggregate strength of concrete mainly based on the combined effect of specific gravity of material that is reflected in the interfacial zone of concrete hence after the 30% replacement the strength decreases of Paver block

Granite powder

Granite powder used in the form of fine aggregate in concrete, The specific gravity of granite powder is 2.72.The replacement of cement by granite powder about 25% The compressive strength achieved is 44N/mm^2 which is 7% more than the compressive strength of conventional concrete Paver block. The flexural strength achieved is 5.51N/mm^2 which 12% more than the flexural strength of conventional concrete Paver block.

Fly ash

Cement is replaced by fly ash about 30%, At 30% replacement, the compressive strength of Paver block is 38.6N/mm^2 which is greater than the conventional Paver block. Flexural strength is 7N/mm^2 which is greater than the conventional Paver block. Split tensile strength is 3.42N/mm^2 which is greater than the conventional Paver block. Water absorption is reduced from 5.89%(14^{th} day) to 5.75% (28^{th} day).

Induction Furnace slag (IFS)

The material was crushed and sieved and IFS Passing through 10mm sieve and retaining on 4.75mm. The specific gravity of Induction Furnace slag is 2.48. Induction furnace slag used in the form of coarse aggregate. At 20% the compressive strength 26.76MPA which is more than 20MPA (M20 Grade of concrete). 40% material replacement are also more than 20MPA .40% coarse aggregate replaced by induction furnace slag so 40% material replacement results are good and also the 40% utilization of induction furnace slag is done in concrete.

3.0 MIX DESIGN

Mix Design means, determination of the proportion of the concrete ingredients i.e. Cement, Water, Fine Aggregate, Coarse Aggregate which wouldproduce concrete possessing specified properties such as workability, strength and durability with maximum overall economy. done according to IS 10262:2009

4.0 CONCLUSION

By adding different dosages of copper slag and sea shell powder in pavement block it was observed that compressive strength at 5 days gain early strength for lower percentage dosages of copper slag and seashell. This was attributed high percent ofsilica, high toughness of copper slag and better heat of hydration. But at 10 days gain later compressive strength for higher percentage of dosages of copper slag i.e 30% It was almost equal to conventional pavement block. This was attributed that copper slag has high density than sand, so self weight of pavement block is increases. Keeping in view of

savings in natural resources sustainability,environment, production cost, maintenance cost and all other Concrete Strength properties, it can be recommended as an innovative construction material for the use of constructions.

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