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A Review on Utilization of Plastic and Ceramic Waste In Paver Block

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ABSTRACT : Plastic waste is now a worldwide problem. According to the study, India generates 9.46 million tonnes of plastic waste each year. It is dangerous not only to humans, but also to animals and the environment. This paper discusses the use of plastic waste as a substitute for cement. On the other hand, because the demand for river sand in the construction industry is increasing and its availability is decreasing, there is an urgent need to find suitable alternatives that can replace sand partially or in a high proportion. One of the active research areas that encompasses the effectiveness of replacement in all aspects of construction materials is the utilization of ceramic waste.

Paver block paving is customizable, aesthetically pleasing, functional, and cost-effective, and if manufactured and installed correctly, requires little or no maintenance. Although the majority of concrete block paving installed in India has performed well, there are two major areas of concern: occasional failure due to excessive surface wear and block strength variability. Making environmentally friendly concrete from both plastic and ceramic waste is critical.

The goal of this paper is to discuss how waste plastic and ceramic waste can be used to partially replace cement and sand. In order to analyse changes in properties, paver samples were cast with 5%, 10%, 15%, and 20% replacement of cement using plastic waste and with a constant 10% replacement of sand using ceramic waste and tested after 7, 14, and 28 days of curing.

KEYWORDS: Plastic waste, Ceramic Waste, Eco-friendly Construction.

I. INTRODUCTION

Paver block paving is customizable, aesthetically pleasing, functional, and cost-effective, and if manufactured and installed correctly, requires little or no maintenance. Although the majority of concrete block paving installed in India has performed well, there are two major areas of concern: occasional failure due to excessive surface wear and block strength variability. Making environmentally friendly concrete from both plastic and ceramic waste is critical.

Natural resources are depleting around the world, while waste generated by industry and residential areas is increasing dramatically. To compensate for the lack of natural resources and to find alternative ways to conserve the environment, sustainable construction involves the use of non-traditional and innovative materials, as well as the recycling of waste materials.

The plastic waste used in this project was collected locally. In India, about 56 lakh tonnes of plastic waste are dumped each year. The dumping of waste pollutes the environment. As a result, it has direct and indirect effects on both humans and animals. As a result, it is necessary to properly dispose of plastic waste in accordance with our government's regulations.

II. TYPES OF PAVING BLOCKS

a) Concrete Paving Block

Concrete blocks are mass manufactured to standard sizes. This makes them interchangeable. Typical concrete paving blocks have one smooth face and one rough, although some paving blocks so come with reversible surfaces (can be used both sides). The performance characteristics of concrete paving blocks make it suitable for the heaviest duty applications, able to support substantial loads and resist shearing and braking forces. These blocks come in different colours. The colours typically come from metallic oxides. However, these

colours tend to fade over a period of time, so it is helpful to exercise caution while selecting them Concrete paving blocks are the most preferred choice for laying of pavements, driveways, etc.

b) Clay Paving Block

Clay paving blocks (also called as bricks or cobbles) are generally available as typical, rectangular bricks, although custom shapes can be made for specific projects. Unlike the concrete paving blocks, both the surfaces of most clay blocks are fully useable or interchangeable. Clay bricks do not use any dyes to impart colour; they come in natural colour. Consequently, the colour of these blocks does not usually fade with time. Clay paving blocks are more difficult to cut than their concrete counterpart. The paving blocks are most suitable for walls or pillars.

Plastic Waste

A material which contains one or more number of polymers having large molecular weight.” Solid in its finished state same state will manufacturing or processing into finished articles is known as Plastic. Looking to the global issue environmental pollution by post-consumer plastic waste, research efforts have been focused on consuming this waste on massive scale in efficient and environmental friendly manner. Researchers planned to use plastic waste in form concrete ingredient as the concrete is second most sought material by human beings after water. The use of post-consumer plastic waste in concrete will not only be its safe disposal method but may also improve the concrete properties like tensile strength, chemical resistance, drying shrinkage and creep on short and long term basis. Why The Plastics:- Polymers have a number of vital properties, which exploited alone or together, make a significant and expanding contribution to constructional needs.

Ceramic Waste

Environmental issues associated with ceramic tile and sanitary ware manufacturing primarily includes the following:

- 1) Air Emissions, Greenhouse Gases, and Energy Efficiency
- 2) Wastewater
- 3) Solid waste Each year thousands of tones of wastes are disposed of in landfills which effects occupation and degradation of valuable land. Depletion of natural resources is a common phenomenon in developing countries like India due to rapid urbanization & industrialization, involving construction of infrastructures and other amenities. Indian ceramic production is 100 Million ton per year. In the ceramic industry, about 15%-30% waste material generated from the total production. This waste is not recycled in any form at present. However, the ceramic waste is durable, hard and highly resistant to biological, chemical, and physical degradation forces.

The Ceramic industries are dumping the powder in any nearby pit or vacant spaces, near their unit although notified areas have been marked for dumping. This leads to serious environmental and dust pollution and occupation of a vast area of land, especially after the powder dries up so it is necessary to dispose the Ceramic waste quickly and use in the construction industry. As the ceramic waste is piling up every day, there is a pressure on ceramic industries to find a solution for its disposal. The advancement of concrete technology can reduce the consumption of natural resources.

They have forced to focus on recovery, reuse of natural resources and find other alternatives. The use of the replacement materials offer cost reduction, energy savings, arguably superior products, and fewer hazards in the environment.

III. PROBLEM STATEMENT

- Burning of plastic in the open air, leads to environmental pollution due to the release of poisonous chemicals.
- The polluted air inhaled by humans and animals affect their health and cause respiratory problems.
- Plastic pollution in water contaminates and poisons to aquatic life.
- Plastic causes serious to damage to the environment both during its manufacture and disposal.
- Plastics on land spoil the soil fertility and environmental aesthetics.
- Industrial waste management constitutes one of the major global problems of our times.
- Due to the fact that biodegradation period of ceramic waste is very long and recycling of ceramic is big problem.

IV. LITERATURE REVIEW

I. GENERAL

Following are some literature reviews on various national and international papers on the use of plastic waste in paver block. This all reviews are on Paver Block and improvement on the paver block characteristic by various waste material into paver block.

II. RESEARCH PAPERS

1. **Name of article** – Production of Plastic Paver Block from the solid waste.

Author name - Nivetha, C. Rubiya, M. Shobana, S. Vaijayanathi, G.

Abstract or conclusion - To reuse the solid waste quarry dust fly-ash and PET with an aim not to lose the strength far from original Paver blocks. From the observations of test results, PET can be reused with 50% of quarry dust and 25 % of fly-ash in Plastic Paver block. The physical and mechanical properties of materials used in Plastic Paver block were investigated. For the test 6 cubes were cast for measuring Compressive strength. Satish Parihar et.al² used recycled plastic aggregate in various proportions in concrete mix and check there stability. Amount of waste plastic being accumulated in 21st centuries has created big challenges for their disposal, thus obliging the authorities to invest in facilitating the use of waste plastic coarse aggregate in a concrete is fundamental to the booming construction industry. Three replacement levels of 10 %, 20%, 30 by weight of aggregates were used for the preparation of the concrete. Poonam Sharma³ et. al. discussed about cement concrete paver blocks for rural roads. The study of Joel Santhosh and Ravikant Talluri⁴ indicated that fly ash and waste glass powder can effectively be used as cement replacement without substantial change in strength.

2. **Name of article**–Recycled Plastic used Concrete Paver Block.

Author name - Ganesh Tapkire , Satish Parihar , Pramod Patil , Hemra R. Kumavat.

Abstract or conclusion- In this paper Recycled plastic aggregate used in various proportion in concrete mix and check there suitability. It was investigated Recycled plastic is used in concrete paver block amount of plastic waste more and problem for disposal , so waste is utilized in construction industry , plastic waste like plastic bottles , pallets , carry bags ; polypropylene (PP) and polyethylene terephthalate (PET) were as alternatives replacement of a part of conventional aggregates of concrete. 20% recycled plastics are used in place of aggregates in concrete ,which does not affect properties of concrete.

3. **Name of article**-Cement Concrete Paver Blocks for Rural Roads.

Author name - Poonam Sharma, Ramesh kumar Batra.

Abstract or conclusion-Segmented concrete paving is a system of individual shaped blocks arranged to form a continuous hardwearing surface overlay. Over the past two decades, paving composed of segmental blocks has become a feature of our towns and cities. It is to be found in commercial industrial and residential areas, in the paving malls, plazas, parking areas and bus stops. It has been successfully used for embankment walls, slope protection and erosion control. During this period, extensive research has been carried out on the engineering characteristics and structural performance of segmental block paving. Existing pavements subjected to heavy bus traffic and industrial loads have been monitored and their service life shown to be satisfactory. The Engineering and specification aspects has been satisfactorily solved, and this type of paving has a proven performance and service record. But the aesthetic use of segmental paving and the contribution it can make to improve our landscape is only been appreciated.

4. **Name of article** –Manufacture Of Interlocking Concrete Paving Blocks with Fly Ash and Glass Powder.

Author name – Joel Santosh, Ravikanth Talluri.

Abstract or conclusion – Problems associated with construction site have been known for many years. Construction industry has to support a world of continuing population growth and economic development. Interlocking concrete paving blocks are ideal materials on the footpaths, parking areas, gardens, etc. for easy laying, better look and finish. But now being adopted extensively in different uses where the conventional construction of pavement using hot bituminous mix or cement concrete technology is not feasible or desirable. The rising costs of construction materials and the need to adhere to sustainability, alternative construction techniques and materials are being sought. To increase the applications of concrete paving blocks, greater understanding of products produced with locally available materials and indigenously produced mineral admixtures is essential. In the present investigation, concrete paving blocks may be produced with locally available cement, aggregates, fly ash and waste glass powder as the mineral admixture. Different mix proportions are prepared using cement replaced by equal quantity of fly ash and waste glass powder. The study indicated that fly ash and waste glass powder can effectively be used as cement replacement without substantial change in strength.

5. Name of article—Effective Replacement of Cement For Establishing Sustainable Concrete.

Author name - Raval A. D., Patel I., Pitroda J.

Abstract or conclusion - Raval et al. (2013) Noticed that ceramic industries waste 15% to 30% of total production, there is a pressure on ceramic industries to find a solution for its disposal, so ceramic waste use in construction so The Compressive Strength of M20 grade Concrete increases when the replacement of Cement with Ceramic Powder up to 30% replaces by weight of Cement.

6. Name of article—Properties of Paver Blocks with Groundnut Husk Ash as Fine Aggregates.

Author name – Revathi S., Kumutha R., Vijai K.

Abstract or conclusion – Revathi et al. (2015) Noticed that used of concrete paver block in road pavement is common. concrete paver block is better option when light weight traffic for that road, concrete paver block is cheap and low maintained compared to content bituminous road. pre-cast concrete block made with m40 concrete mix proportions. Rice husk ash is waste material use in as alternative in a space of fine aggregate with different percentage range 0% to 60%. Density of paver blocks is within the range of 1888-2202 kg/m³ and Density values decreases with increase in Groundnut husk ash. With the use of Groundnut husk ash is suitable making the water absorption is less than 7%

7. Name of article—Properties of Concrete Paving Blocks made with Waste Marble.

Author name -Gencela Osman, Ozelb Cengiz, Koksalc Fuat, Erdomusd Ertugrul

Abstract or conclusion - Gencel et al. (2012) Found that Marble industry produces large amounts of waste marble they causes environmental problems. There are two types one have cementaceous property and others have no cementaceous property, we have partly replaced aggregate with waste marble. Physical and mechanical tests were performed on blocks so produced. The cement type turns out to be an important factor. Paver block with marble waste give economical value in Turkey 1 m³ concrete to produce paving block costs approximately 34 US \$. However, when waste marble is used in the ratio of 40%, the cost goes down to approximately 30 US\$.

8. Name of article – Reducing Cement Contents of Paving Blocks By using Mineral Waste and By-products Materials.

Author name - Ganjian E., Jalull G., Sadeghi-Pouya H.,

Abstract or conclusion - Ganjian et al. (2015) Found that use of cement in production of conventional paver block is approximate 210kg/m³. Portland cement is production is it impacts negatively on the environment due to carbon dioxide emissions. So alternative waste product used in space of cement, alternative material like such as run-of-station ash (ROSA), basic oxygen slag (BOS), ground granulated blast-furnace slag (GGBS), plasterboard gypsum (PG), and cement bypass dust (BPD) to reduce the amount of cement in paving blocks. So used of ROSA up to 60%, GGBS up to 55%, BPD up to 25%, and plasterboard gypsum PG up to 5% by weight can replace Portland cement without having any substantial impact on the strength or durability of the blocks. So used on different alternative material can reduce cement content by up to 30% in comparison to the percent of cement used in factories

9. Name of article – Study of the properties of paver block using fly ash

Author Name –Mall R., Sharma S., Patel R.D

Abstract or conclusion – Mall et al. (2014) Analyzed that Paver Block is a better option for road construction as compared road made of bitumen and gravel in a cost view of the point and better stability. Paver block by using Cement Concrete mixture of Design Mix M35 made with use material 10mm Coarse Aggregate, OPC 43 Grade Cement and Fine Aggregate and paver block are of dimension 200 x 160 x 80 mm. To study this process uses the partial replacement of Cement with Fly Ash in percentage of 0% to 30% respectively, and added Gypsum constantly 2% by weight of cement and Superplasticizer is used as an admixture which is added 2% by weight of cement so find that 25% of fly ash give higher strength and economic value compare to conventional mix.

V. CONCLUSION

Based on the results of experimental investigation, following conclusions are drawn:

1. Plastic and ceramic Paver Block achieved very early high compressive strength of 60.60 MPa.
2. The compressive strength of Plastic and Ceramic paver block was found to be increasing with replacement up to 15% Plastic and Ceramic 10% replacement gives slightly high compressive strength.
3. Complete replacement by 20% Plastic and 10% Ceramic decreasing slight compressive strength is 43.635 MPa.
4. Maximum strength of Paver block was found at 60.60 MPa at Plastic 15% and 10% Ceramic replacement which is very high, can be used for light weight traffic.
5. Water absorption of Plastic and Ceramic paver block is less than 6% which is satisfying permissible limit of IS :15658- 2006.
6. The cost of paver block is reduced compare to that of concrete paver block.



7. The utilization of waste plastic and ceramic in production of paver block has productive way of disposal of plastic and ceramic waste.
8. Paver block made using plastic waste, quarry dust, coarse aggregate and ceramic waste have shown better result.

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