

# Manufacturing of pavement block by using waste plastic and sea sand

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**Abstract** - Plastic is used in day today life at present nearly 56 lakhs ton of plastic waste produced in India per year. Plastic are generally non-degradable hence, they may be take centuries to decay. This is due to the intermolecular bonds that constitutes plastic, whose structure insure that the plastic neither corrode nor decompose. Plastic dispose of indecently get washed away to water reservoirs. They clog waterways and float on reservoir, polluting and making them unsightly. The use of waste plastics in concrete pavement block is a partial solution to the environmental and ecological challenges associated with the use of plastics. The aim of this project is to reduce environmental pollution by using waste plastic to produce pavement blocks. The plastic material is first shredded and melted in an container at a temperature range of 250 °C - 260 °C and the sea sand were added in their respective ratios (1:1,1:2,1:3) From the above findings, plastic pavement blocks have a good strength and can therefore be used for specific requirement namely footpaths, parking areas etc. Hence the project is helpful in reducing plastic waste in a useful way. The best ratio of sea sand and plastic which leads to higher strength to pavement block. The paver block were prepared and tested and results were compared with cement concrete paver block.

**Key Words:** plastic, blocks, paver, sand, waste

## 1. INTRODUCTION

Plastics are used in day today life. At present nearly 56 lakhs tons of plastic wastes are produced in India per year. Plastics are generally non-degradable hence, they take centuries to decay. Economic growth and changing consumption patterns are resulting in the rapid increase in the use of plastics in the world. The consumption of plastic materials has increased from 5 million tons in the 1950s to 100 million tons in the 2000s

The amount of plastic waste is ever increasing due to increase in human population, developmental activities, and changes in lifestyle and socio-economic conditions. Plastic waste is a significant portion of the total municipal solid waste. Therefore there should be the need for proper waste management system. Plastics are being littered and misused all over the country and now causing threat to the nation. Some of these problems associated with plastic waste in India

1. Plastic block drains and gutters and causes floods.
2. Plastics release toxic gas into the atmosphere when burnt.
3. Plastics bottles and containers act as breeding ground for mosquitoes when filled with rainwater.

Fortunately, there are various ways in which waste plastics could be reuse or converted to other products

High density polyethylene (HDPE) waste is used in making bags and dustbins. These materials serve as an alternative for the metallic dust bins and leather bags.

Plastic is one major component of Municipal Solid Waste (MSW) which is becoming a major research issue for its possible use in pavement blocks. Polymer modified pavement blocks has applications in road construction and buildings.

Hence waste plastic can therefore, be mixed in concrete mass in some form, without significant effect on its other properties or slight compromise in strength (Polymer Modified Concrete).

In this study waste voltaic bottles and polyethylene bags were shredded into flakes and was used in the production of pavement blocks.

### 1.1 Scope of project work

According to our research the major source of pollution in India is waste plastic. Growth of population, increasing urbanization, rising standards of living due to technological innovations have contributed to an increase both in the quantity and variety of solid wastes generated by industrial, mining, domestic and agricultural activities. Globally The estimated quantity of wastes generation was 56 million tones in the year.

To find the possibilities of reducing the amount of waste plastic as it will create an eco-friendly environment as well as it used in construction of pavement block.

### 1.2 OBJECTIVE

The main objective of this review is to determine the suitability of waste voltaic bottles and polyethylene bags in the development of pavement blocks for construction.

To reduce the plastic waste.

To use plastic waste material in construction methodology.

To reduce the environmental and ecological challenge associated with plastic.

To find alternatives of basic materials which are used in construction of pavement blocks.

## 2. LITERATURE REVIEW

R.Mahadevi1 et.al, "An experimental investigation on concrete paver block by using PVC plastic material", International Research Journal of Engineering and Technology (IRJET), Volume: 5, Issue: 03, [March- 2018] ISSN (Online):2349-9745; ISSN (Print):2393-8161 [1]

Use of concrete paver block in road pavements is more common nowadays. Concrete paver block is a better option in road construction when compared to the conventional road which is made by bitumen and gravel. As India is a developing country, construction of roadways and buildings plays a vital role. The use of waste plastic in concrete pavement block is a partial solution to the environment and ecological challenges associated with the use of plastics. The aim of this research is to reduce the unit weight, cost of block and also to reduce the environmental pollution. Disposal of plastic in an environment is considered to be a big problem due to its low biodegradability and presence in large quantities. The PVC plastic is used in the form of powder as partial replacement in M-Sand as fine aggregate in percentage of 0, 10 and 30. Using 197x167x61mm bone shaped paver block molds and M30 grade of concrete mix are used. The compression and water absorption tests are carried out.

Manish kumar sahu, Lokesh singh, "Critical review on types of bricks type 14: plastic sand bricks", International Journal of Mechanical and Production Engineering, Volume- 5, Issue-11, Nov.-2017, ISSN: 2320-2092 [2]

Brick is one of the most common masonry units used as building material. Due to the demand, different types of waste have been investigated to be incorporated into the bricks. There has been a considerable imbalance between the availability of conventional building materials and their demand in the recent past. On the other hand the laterite quarry waste is abundantly available and the disposal of waste plastics (PET, PP, etc.) is a biggest challenge, as repeated recycling of PET bottles poses a potential danger of being transformed to a carcinogenic material and only a small proportion of PET bottles are being recycled.

Because of costly conventional recycling techniques, there has been an increased demand for more scientific and innovative technologies to effectively recycle these materials. This paper deals with manufacturing process, materials used as well as the testing method of plastic sand bricks.

Lairenlakpam Billygraham Singh, Suresh Thokchom, et.al, "Manufacturing Bricks from Sand and Waste Plastics", International Journal of Engineering Technology, Management and Applied Sciences, Volume 5 Issue 3, March 2017, ISSN 2349-4476 [3]

The present work is performed to manufacture bricks or building blocks from sand and waste plastics. The bricks are produced by mixing waste plastic and sand after heating at 200°C. Two specimens of bricks, one with sand and waste CDs; another with sand and waste water bottles are produced and tested for some physical and mechanical properties. The sand-plastic bricks are lightweight and present a waxy surface. The results of sand plastic bricks are compared with those of traditional local bricks. It is observed that sand plastic bricks have low water absorption, low apparent porosity and high compressive strength.

B.Shanmugavalli, K.Gowtham, et.al, "Reuse of plastic waste in paver block, International journal of engineering research and technology", Vol. 6 ISSUE 02, FEB 2017, ISSN: 2278-0181 [4]

The aim of this project is to replace cement with plastic in paver block and to reduce the cost of paver block when compared to that of convention concrete paver block. At present nearly 56 lakhs ton of plastic waste is produced in India per year. The degradation rate of plastic waste is also a very slow process. Hence the project is helpful in reducing plastic waste in useful way. In this project we have use plastic waste in a different proportions with quarry dust, coarse aggregate and ceramic waste. The paver blocks were prepared and tested and the result were discussed.

A.Panimayam, P.Chinnadurai et.al, "Utilization of Waste Plastics as a Replacement of Coarse Aggregate in Paver Blocks", International Journal of Chem Tech Research, Vol.10 No.8, pp. 211-218, 2017, ISSN: 0974-4290, ISSN (Online):2455-9555[5]

The rapid industrialization and urbanization in the country leads lot of infrastructure development. This process leads to several problems like shortage of construction materials, increased productivity of wastes and other products. This paper deals with the reuse of waste plastics as partial replacement of coarse aggregate in M20 concrete. Usually M20 concrete is used for most constructional works. Waste Plastics were incrementally added in 0%, 2%, 4%, 6%, 8% and 10% to replace the same amount of Aggregate. Tests were conducted on coarse aggregates, fine aggregates, cement and waste plastics to determine their physical properties. Paver Blocks of I section of casted and tested for 7, 14 and 28 days strength. The result shows that the compressive strength of M20 concrete with waste plastics is 4% for Paver Blocks

Koli Nishikant, Aiwale Nachiket, et.al, June 2016, "Manufacturing of pavement block by using waste glass material", International Journal of Scientific and Research Publications, Volume 6, Issue 6, June 2016 61 ISSN 2250-3153[6]

There is now a significant world-wide interest to solve the environmental problems caused by industrial waste and other materials by including such materials in the manufacture of concrete. This technology has been introduced in India in construction, a decade ago, for specific requirement namely footpaths, parking areas etc. but now being adopted extensively in different uses where the conventional construction of pavement using bituminous mix or cement concrete technology is not feasible or desirable. The characteristics of concrete containing fine crushed glass during its process, the best ratio of fine crushed glass which leads to higher strength of concrete in order to produce concrete blocks, and the effect of waste glass

replacement on the expansion caused by Alkali-silica reaction (ASR). This study looked at the feasibility of waste glass inclusion as partial FA replacement systems. Properties of concrete incorporating waste glass as partial substitution for FA amounts of 15%, 30% and 45% were investigated. The waste glass material used was obtained waste collectors. The results obtained show clearly that glass enhances the compressive strength properties of the final concrete product. The study indicated that waste glass can effectively be used as fine aggregate replacement (up to 45%) without substantial change in strength.

Dinesh.A , Kirubakaran.K et.al, (2016), "Utilization of waste plastic in manufacturing of bricks and paver blocks", International Journal of Applied Engineering Research Vol. 11 No3 , ISSN 0973-4562<sup>[7]</sup>

Plastic waste which is increasing day by day becomes eyesore and in turn pollutes the environment, especially in high mountain villages where no garbage collection system exists. A large amount of plastic is being brought into the tourist trekking regions are discarded or burned which leads to the contamination of environment and air. Hence, these waste plastics are to be effectively utilized. High-density polyethylene (HDPE) and polyethylene (PE) bags are cleaned and added with sand and aggregate at various percentages to obtain high strength bricks that possess thermal and sound insulation properties to control pollution and to reduce the overall cost of construction, this is one of the best ways to avoid the accumulation of plastic waste which is an on-degradable pollutant. This alternatively saves the quanta of sand/clay that has to be taken away from the precious river beds/mines. The plastic waste is naturally available in surplus quantity and hence the cost factor comes down. Also Coloring agents can be added to the mixture to attain desired shades. Hence in this thesis, an attempt is made to study regard the properties of the brick which is manufactured using plastic wastes.

Manhal A Jibrael, Farah Peter, "Strength and Behavior of Concrete Contains Waste Plastic", Journal of Ecosystem & Echography, Volume 6 • Issue 2 • 1000186, May 31, 2016, ISSN: 2157-7625<sup>[8]</sup>

This paper presents a method of strengthen concrete by the addition of percentages recycled waste plastic (polyethylene). Almost 126 samples of concrete are prepared, the concrete Strength (compressive, splitting tensile and flexural strength) are investigated along a time interval of 7 to 28 days using 1%, 3% and 5% from fine aggregate recycled waste plastic (polyethylene). It is found that when waste plastic bottles increased from zero to 5% of the sand in the mix, the compressive, tensile and flexural strength of concrete decreased by the ratios of 12.81, 10.71, and increase by 4.1% respectively at 7 days age and also these concrete strength decrease by the 7.93, 28.6, and 23.6% at 28 days age

S.Revathi<sup>1</sup>, Dr.R.Kumutha<sup>2</sup>, Dr.K.Vijai<sup>3</sup>, 02 May-2015, "Properties of Paver Blocks with Groundnut Husk Ash as Fine Aggregates", International Research Journal of Engineering and Technology (IRJET), Volume: 02 Issue: 02 May-2015, e-ISSN: 2395 -0056, p-ISSN: 2395-0072<sup>[9]</sup>

Use of concrete Paver Blocks in road pavements is more common nowadays. Concrete Paver Block is a better option in road construction when compared to the conventional road which is made by bitumen and gravel from the point of view of cost and better suitability. As India is a developing country, construction of roadways and buildings plays an important role. In the present investigation paver blocks were prepared using M40 mix using 10 mm Coarse aggregates, Portland Pozzolona Cement and Fine Aggregates. The dimension of the paver block is 215 x 170 x 55 mm. The fine aggregates were partially replaced using Groundnut husk ash in percentage of 0, 10, 20, 30, 40, 50, and 60. Tests were carried out to find out the Compressive Strength,

Water Absorption and Density. The main objective of this paper is to use waste products like groundnut husk ash for the production of Paver Blocks which will be useful in construction.

Ganesh Tapkire, Satish parihar et.al, "Recycled plastic used in concrete paver block", IJRET: International Journal of Research in Engineering and Technology, Volume: 03 Special Issue: 09 | NCETCE-2014 | June-2014, ISSN: 2319-1163 | ISSN: 2321-7308 [10]

In this paper Recycled plastic aggregate used in various proportion in concrete mix and check their suitability. 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. Disposal of plastic waste in an environment is considered to be a big problem due to its very low biodegradability and presence in large quantities. In recent time use of such, Industrial wastes from plastic bottles, pallets, carry bags; polypropylene (PP) and polyethylene Terephthalate (PET) were studied as alternative replacements of a part of the conventional aggregates of concrete. If plastic wastes can be mixed with the concrete mass in some quantity or in some form, without affecting the fundamental and other properties or slight negotiation in strength the strength of concrete. Industrial wastes from polypropylene (PP) and polyethylene Terephthalate (PET) were studied as alternative replacements of a part of the conventional aggregates of concrete. Three replacement levels. 10 %, 20 %, 30 by Weight of aggregates were used for the preparation of the concrete.

### 3. CONCLUSIONS

From the above observation it is possible to use plastic in concrete, and it is having the bonding property. In general plastic is used in manufacturing and construction of bricks, roads, etc. It is the best way of disposal of plastic waste and it is a partial solution to the environmental and ecological challenges associated with the use of plastics.

### ACKNOWLEDGEMENT

I would wish to acknowledge the group members and teachers at Dr. D Y Patil School of Engineering and Technology, Charholi, Pune. Who have contributed to the development of this paper.

### REFERENCES

- [1] R.Mahadevi, S.Abirami, et.al, "An experimental investigation on concrete paver block by using PVC plastic material", International Research Journal of Engineering and Technology (IRJET), Volume: 5, Issue: 03, [March- 2018] ISSN (Online):2349-9745; ISSN (Print):2393-8161D. Karnack and P. Rakia, "Cell Proliferation without Neurogenesis in Adult Primate Neocortex," Science, vol. 294, Dec. 2001, pp. 2127-2130, doi:10.1126/science.1065467
- [2] Manish Kumar sahu, Lokesh Singh, "Critical review on types of bricks type 14: plastic sand bricks", International Journal of Mechanical and Production Engineering, Volume- 5, Issue-11, Nov.-2017, ISSN: 2320-2092
- [3] Lairenlakpam Billygraham Singh, Suresh Thokchom ,et.al, "Manufacturing bricks from sand and waste plastics", International Journal of Engineering Technology, Management and Applied Sciences , Volume 5 Issue 3, March 2017 , ISSN 2349-4476

- [4] B.Shanmugavalli, K.Gowtham, et.al, "Reuse of plastic waste in paver block", International journal of engineering research and technology, Vol.6 ISSUE 02, Feb 2017, ISSN: 2278-0181.
- [5] A.Panimayam1, P.Chinnadurai et.al, "Utilisation of waste plastics as a replacement of coarse aggregate in paver blocks", International Journal of Chem Tech Research, Vol.10 No.8, pp. 211-218, 2017, ISSN: 0974-4290, ISSN(Online):2455-9555
- [6] Koli Nishikant, Aiwale Nachiket, et.al, June 2016, "Manufacturing of pavement block by using waste glass material", International Journal of Scientific and Research Publications, Volume 6, Issue 6, June 2016 61 ISSN 2250-3153
- [7] Dinesh.A ,Kirubakaran.K et.al, (2016), "Utilization of waste plastic in manufacturing of bricks and paver blocks", International Journal of Applied Engineering Research Vol. 11 No.3 , ISSN 0973-4562
- [8] Manhal A Jibrael, Farah Peter, "Strength and behavior of concrete contains waste plastic", Journal of Ecosystem & Echography, Volume 6 • Issue 2 • 1000186, May 31, 2016, ISSN: 2157-7625
- [9] S.Revathi1, Dr.R.Kumutha2, Dr.K.Vijai3, 02 May-2015, "Properties of paver blocks with groundnut husk ash as fine aggregates", International Research Journal of Engineering and Technology (IRJET) , Volume: 02 Issue: 02 May-2015 , e-ISSN: 2395 -0056 , p-ISSN: 2395-00723
- [10] Ganesh Tapkire, Satish parihar et.al, "Recycled plastic used in concrete paver block", IJRET: International Journal of Research in Engineering and Technology, Volume: 03 Special Issue: 09 | NCETCE-2014 | June-2014, ISSN: 2319-1163 | ISSN: 2321-7308