

# Reuse of waste material in paving blocks and complete replacement of concrete

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**Abstract** - The aim of this project is to replace cement with waste materials such as plastic waste, coconut shells , thermocol in paver block and to reduce the cost of paver block and is light weight when compared to that of convention concrete paver blocks. At present nearly 56 lakhs tones of plastic waste is produced in India per year. The degradation rate of plastic waste is also a very slow process. Plastic waste which is increasing day by day becomes eyesore and in turn pollutes the environment, especially in such a populated and A-1 classified cities such as Indore where tons of plastic is produced on a daily basis. Hence the waste plastic has to be effectively utilized. Hence the project is helpful in reducing plastic waste in a useful way. In this project we have used plastic waste, thermocol balls , coconut cover that is available in abundance and sand.

**keywords** - Plastic waste, Thermocol, Coconnut shells, high density polyethylene, polyethylene, paver block, melted Low Density Polyethylene (LDPE).

## I. INTRODUCTION

Concrete block paving has been widely used nowadays because of its diverse advantages.They are versatile, aesthetically attractive, functional, and cost effective and requires little or no maintenance if correctly manufactured and laid. These blocks are a type of concrete with good quality and durability.They have a very high strength.

The material that are used here does not have concrete or cement. What if we have a alternate ecofriendly way of constructing blocks? Natural resources are depleting worldwide at the same time the generated wastes from the industry and residential area are increasing substantially. The sustainable development for construction involves the use of Non-conventional and innovative materials, and recycling of waste materials in order to compensate the lack of natural resources and to find alternative ways conserving the environment and at the same time improves the strength and mechanical properties of blocks.From the literature study , we came to know that there are researches where some waste materials are used to replace the conventional concrete and cement to create paving blocks. The materials used are plastic, fly ash, bottom ash, tin, limestone dust, tiles, rubber,coconut fibre, glass and so on which are available at cheaper price or free of cost.

Now there are some weakness in conventional paver blocks.They requires high cost for its creation and in addition they are heavy. Therefore the objectiveof this study was to justify that waste materials such as waste plastic, thermocol , coconut shells and sand can be reused as additives and replacement materials in paving blocks. In addition, it also intended to protect the environment from the accumulation of waste materials that can affect the ecosystem and environment especially to wildlife and humans. Plastic waste used in this work was brought from the surrounding areas. Currently about 56 lakh tonnes of plastic waste dumped in India in a year. The dumped waste pollutes the surrounding environment. As the result it affects both human beings and animals in direct and indirect ways. Hence it necessary to dispose the plastic waste properly as per the regulations provided by our government. The replacement of plastic waste for cement provides potential environmental as well as economic benefits.

## II. OBJECTIVES

The objective is complete replacement of concrete with waste plastic with additives like sand , thermocol balls and coconut shell or coconut fibres to make a low cost and light weighted paving block which have high strength, which is versatile , asthetic and durable and hence environment friendly. By replacing cement with melted plastic we substitute the binding material. Some more basic objectives are as follows

- To reduce the setting time of paving block.
- To make the block water resistive.
- To do cost comparison between plastic used paving blocks Vs normal paving blocks.
- To utilize the waste plastic which is non-degredeable and very harmful for Environment as plastics can take hundreds of years to degrade.
- Encourage waste to energy options.
- Ensure an efficient and effective solid waste management
- Plastic blocks drains and gutters and causes floods so instead utilize that plastic.
- Plastics bottles and containers act as breeding ground for mosquitoes when filled with rainwater.

### III. ADVANTAGES

- They are light in weight.
- They are fire resistive.
- They do not absorb water.
- They are cheap than conventional method of making pavers.
- They do not breakdown in pieces in case of failure they just deform.
- They look versatile and can fit to any condition.
- They can be prepared very fast.
- They save lot of waste plastic.
- They give a great strength as per there load they bear.

### IV. MATERIALS USED

The materials used in study were -

- Waste Plastic or tin
- Sand
- Thermocol
- Coconut shells
- Mould

For concrete wor ordinary Portland cement is used which has two important properties that are adhesion and cohesion. Ecofriendly paving blocks uses 60% of aggregates such as sand , thermocol and crushed coconut shell and 40% of waste material such as plastic and tin. The ordinary paving block has cement , sand , coarse gravel in ratio 1:2:4 and here the ratio of waste plastic to sand is 1:3. This ratio gives the best results as suggested by researchers.

The moulds are rectangular boxes which are open at top and bottom. They may be of wood or steel. We are using hand moulding. In hand moulding, the bricks are moulded by hand i.e.; manually. It is adopted where manpower is cheap and is readily available for the manufacturing process of **bricks** one small scale. In this we have used a hexagonal mould for making of paver block. We have used the hexagonal system because it will create a interlocking system which will look attractive and will also give more strength

### V. METHODOLOGY

We are using melted plastic to make paving blocks by mixing sand , therrmocol balls and coconut shells in it. We are mixing fifty percentage sand with thirty percentage of plastic and ten percentage each of thermocol balls and crushed coconut shell by weight. Further after making blocks we will be doing different tests on it. The step by step procedure is as follows –

- 1) Collection of waste materials all included.
- 2) Weight batching according to the required ratio.
- 3) Melting of plastic after weighting and after melting again weight batching.
- 4) Mixing of additives according to the weight ratio.
- 5) After proper mixing in melting container slowly filling it in to mould.
- 6) Then vibrate the mould properly such that there is no air in voids and there is proper settlement.
- 7) After keeping it for sometime to cool we have to un mould it.

### VI. RESULTS AND DISCUSSION

#### 1) Compressive Strength

- Compressive strength is the capacity of material or structure to resist or withstand under compression.
- The Compressive strength of a material is determined by the ability of the material to resist failure in the form cracks and fissure.
- In this test, the push force applied on the both faces of concrete specimen and the maximum compression that concrete bears without failure is noted.
- The practical is carried out using Universal testing machine or compressive testing machine.

#### 2) Compressive Test

- This is done to know the compressive strength of the bricks and paver blocks.
- This is also called crushing strength of bricks and paver blocks.
- Generally five specimens of bricks are taken to laboratory for testing and tested one by one.
- In this test a brick and paver block specimen is put on crushing machine and applied pressure till it breaks.
- The ultimate pressure at which brick is crushed is taken into account.
- All five brick specimens are tested one by one and average result is taken as brick's compressive /crushing strength.

- The plastic sand bricks and paver blocks of different ratios are tested one by one and in this the high compression is found and comparison made between the fly ash and normal brick. Three specimens of bricks were taken to laboratory for testing and tested one by one.
- In this test, a brick specimen is put on crushing machine and applied pressure till it breaks.
- The ultimate pressure at which brick is crushed is taken into account. All 3 brick specimens are tested one by one and the load at crushing was noted.

Here by different manufacturing ratios we tested different blocks after 7 days. The results are as shown in table below ie table 1.

Mix design	Plastic Sand Ratio	Compressive Strength(N/MM <sup>2</sup> )
M1	1:2	38.26
M2	1:3	44.72
M3	1:4	37.12

TABLE 1  
Compressive strength of waste material paver block

### 3) Water Absorbtion Test

- In this the bricks first weighted in dry condition and they are immersed in water for 24 hours.
- After that they are taken out from water and they are wipe out with cloth. Then the difference between the dry and wet bricks percentage are calculated.
- The result of this test was 'the water absorbed by the block was 1.10.
- This is very less and we can almost say this block as water resisitive.

### 4) Efflorescence Test

- The presence of alkali's is harmful for paving blocks as they form grey or white layer on the brick surface by absorbing moisture.
- To find out the presence of alkalis in blocks this test is performed.
- In this test a brick is emmersed in water for 24 hrs and then kept to dry in a shade.
- The plastic bricks are low alkali contained so a little white patch is formed over it.

### 5) Fire Resistance Test

- The Plastic is highly susceptible to fire but in case of Plastic sand bricks/Paver blocks the presence of sand imparts insulation.
- There is no change in the structural properties of block of bricks up to 180C above which visible cracks are seen and the blocks/bricks deteriorate with increase in temperature.

## VII. Summary and Conclusion

In this project replacement of cement by waste plastic was used. The following conclusions are made :-

- It is concluded that plastic paving blocks can bear the normal weight of walking humans and other things.
- The plastic paving block doesn't shows sudden failure, it starts deforming after 60 kn/mm load which is quite high with comparison to human weight.
- This is an eco-friendly paving block as it subsides harmful effects of waste plastic as they cant be decomposed, burned etc.
- Plastic is very hard polluted ingredient in the nature so used in the paving block to reused the pollution in the area.
- The finishing , shape, interlocking and appearance of the plastic paving block are good as conventional concrete paving block.
- Cost of plastic used paving blocks is less as compare to normal paving blocks.
- These blocks can be used in the park, walking area in the house and footpath of the road.
- The Plastic sand bricks possess more advantages which include Cost efficiency, Removal of waste products thus abolishing the land requirement problem for dumping plastic, Reduction in the emission of greenhouse gases by the conversion of flue gases into synthetic oil etc.
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- This method is suitable for the countries which has the difficult to dispose /recycle the plastic waste. The natural resources consumed for the manufacturing of Plastic sand bricks and Paver blocks are very much less when compared to its counterparts.

- The manufacturing cost could be reduced further by replacing the river sand with fly ash/quarry dust or other waste products.
- Owing to the numerous advantages further research would improve the quality and durability of plastic sand bricks and paver blocks.

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