Effectual Use of Waste Plastic As Manufacturing of Paver Block

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Abstract- *The aim of this project is to replace cement with plastic waste in paver block and to reduce the cost of paver block when compared to that of convention concrete paver blocks. 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. At present nearly 56 lakhs tones of plastic waste is produced in India per year. In order to prevent the environment pollution caused by plastic waste, We decided to utilize it effectively in the manufacturing of paver blocks. High density polyethylene bags are collected, 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 way as are placement for cement in the manufacturing of Paver Blocks. In this project we have used plastic waste in different proportions with quarry dust, coarse aggregate and ceramic waste. The paver blocks were prepared and tested and the results were discussed.*

Keywords- Paver block, Plastic waste, Ceramic waste, Plastic waste, high density polyethylene, polyethylene.

I. INTRODUCTION

Generally the level of plastic in the waste composition is high.one of the largest component of plastic waste is polyethylene which is followed by polypropylene. There are several methods available to recycle and reuse the waste effectively. Since plastic has long service life, they can be recycled effectively. The biggest problem with plastic bags is that they don't readily breakdown inThe large volume of materials required for construction is potentially a major area for the reuse of waste materials. 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 environment. It takes 20 – 1000 years based on their composition. The average plastic waste produced in India per year is 15432 tonnes among which 6000 tonnes.The replacement of plastic waste for cement provides potential environmental as well as economic benefits. With the view to investigate the behaviour of quarry rock dust, recycled plastic, production of plastic paver block from the solid waste a critical review of literature was taken up.

II. MATERIALS USED

2.1. Plastic Wastes

By definition the plastics can be made to different shapes when they are heated.in closest environment it exists in the different forms such as cups, furniture's, basins, plastic bags, food and drinking containers, and they are become waste material. The consumption of plastics have increased from 4000 tons/annum (1990) to 4 million tons/annum (2001) and it is expected to rise 8 million tons/annum during the year 2009. Nearly 50 to 60% of the total plastics are consumed for packing. Once used plastic materials are thrown out. They do not undergo bio-decomposition. Hence, they are either land filled or incinerated. Both are not eco-friendly processes as they pollute the land and the air. Plastic waste used in making paver block was collected from the surrounding locality LDPE is indicated by resin number 4. It includes plastic bags. The plastic bag used is of about 50 microns. The basic properties are provided below.

TABLE 1

S.NO.	EXPERIMENT	RESULTS
1	Density	530.35kg/m^3
2	Specific gravity	0.655
3	Flash point (°c)	24
4	Fire point(°c)	28
5	Tensile strength	.2 to .5 N/mm^2
6	viscosity	0.652

2.2. Quarry dust

Quarry dust is a byproduct of the crushing process which is a concentrated material to use as aggregates for concreting purpose, especially as fine aggregates. In quarrying activities, the rock has been crushed into various sizes; during

the process the dust generated is called quarry dust and it is formed as waste. So it becomes as a useless material and also results in air pollution. Therefore, quarry dust should be used in construction works, which will reduce the cost of construction and the construction material would be saved and the natural resources can be used properly.

2.3. Coarse Aggregate

Those particles that are predominantly retained on the 4.75 mm (No. 4) sieve and will pass through 3-inch screen, are called **coarse aggregate.** Thecoarser the aggregate, the more economical the mix. Larger pieces offer less surface area of the particles than an equivalent volume of small pieces. Use of the largest permissible maximum size of coarse aggregate permits a reduction in cement and water requirements. Using aggregates larger than the maximum size of coarse aggregates permitted can result in interlock and form arches or obstructions within a concrete form. That allows the area below to become a void, or at best, to become filled with finer particles of sand and cement only and results in a weakened area. Locally available coarse aggregates were used in this work. Aggregates passing through 12mm sieve and retained on 10mm sieve were sieved and tested as per Indian standard specification IS:383-1970.

2.4. Ceramic waste

Ceramic products are part of the essential construction materials used in most buildings. Some common manufactured ceramics include wall tiles, floor tiles, sanitary ware, household ceramics and technical ceramics.

Table 2. Chemical Composition Of Ceramic Waste

Oxides	%
Si O2	16.20
AI2 O3	18.23
Fe_2O_3	4.32
Ca O	4.46
Mg O	0.72
P2 O5	0.16

III. MIX RATIO

Block type1- Three paver blocks were casted using mix ratio provided below
Plastic waste = 1
Quarry dust = 2
Aggregate= 2
Block type 2 - Three paver blocks were casted using mix ratio provided below
Plastic waste = 1
Quarry dust= 1.5
Aggregate = 2
Ceramic waste = 0.75
Block type 3 - Three paver blocks were casted using mix ratio provided below
Plastic waste=1
Quarry dust= 1.5
Gravel = 3
Ceramic waste = 1

IV. PREPARATION OF TEST SPECIMENS

Plastic wastes are heated in a metal bucket at a temp of above 150˚. As a result of heating the plastic waste melt.

The materials quarry dust, aggregate and other materials as described in previous chapter are added to it in right proportion at molten state of plastic and well mixed. The metal mould is cleaned through at using waste cloth. Now this mixture is transferred to the mould. It will be in hot condition and compact it well to reduce internal pores present in it. Then the blocks are allowed to dry for 24 hours so that they harden. After drying the paver block is removed from the moulds and ready for the use.

Fig 1 Heating and Adding

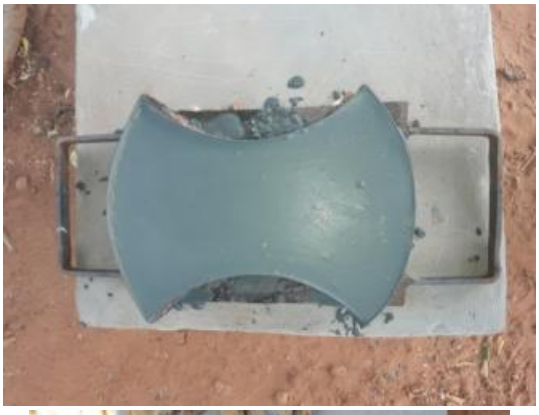

Fig 2 Casting and Drying

V. TESTS

To know the quality of plastic sand paver blocks following tests can be performed. In these tests some are performed in laboratory and the rest are on field.

5.1. Compressive test

Compression testing is a very common testing method that is used to establish the compressive force or crush resistance of a material. Generally five specimens of blocks are taken to laboratory for testing and tested one by one. In this test a paver block specimen is put on crushing machine and applied pressure till it breaks. The ultimate pressure at which block is crushed is taken into account. All five paver block specimens are tested one by one and average result is taken as paver block's compressive strength. The plastic sand paver blocks of different ratios are tested one by one and in this the high compression.

Fig 3: Compressive strength for plastic sand bricks

TABLE 3: Compressive strength of Plastic sand paver

SI NO	TYPE OF PAVER BLOCK	VALUE
1	Plastic Sand blocks(without hydraulic press)	1 N/mm^2
2	Plastic Sand blocks(with hydraulic press)	5 N/mm^2

5.2. Water absorption test

In this test, paver blocks are weighed in dry condition and let them immersed in fresh water for 24 hours. After 24 hours of immersion, those are taken out from water and wipe out with cloth. Then paver block is weighed in wet condition. the difference between weights is the water absorbed by the paver block. The percentage of water absorption is then calculated. The less water absorbed by the paver block the greater its quality. Good quality paver block doesn't absorb more than 5% of its own weight.

Water absorption of test specimen = 3.2 %
As per IS 15658:2006 water absorption percentage within 5%, the result of specimen is 3.2% hence it is satisfied.

Fig 4: Dry brick weight

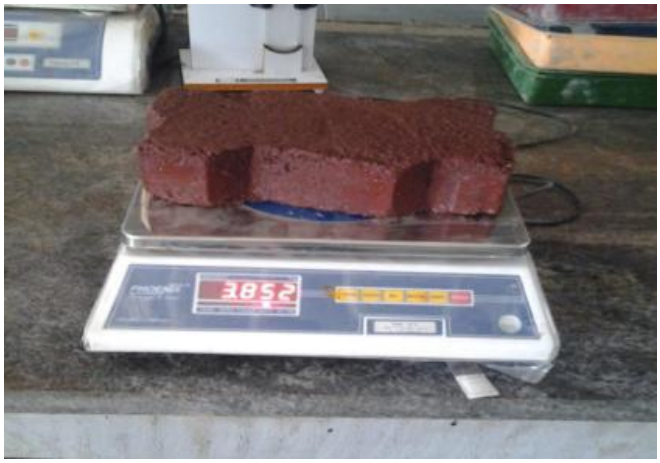

Fig 5: Wet brick weight

5.3. Efflorescence test

The presence of alkalis in bricks is harmful and they form a grey or white layer on brick surface by absorbing moisture. To find out the presence of alkalis in bricks this test is performed. In this test a brick is immersed in fresh water for 24 hours and then it's taken out from water and allowed to dry in shade. The plastic sand brick has low alkali content and so a little white patch is formed over the surface.

Fig 6: Efflorescence test on plastic sand brick

5.4. Fire resistance test

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

5.5. Hardness test

In this test a scratch is made on block surface with steel rod (any hard material can be used) which was difficult to imply the blocks were hard. This shows the brick possess high quality.

VI. CONCLUSION

The following conclusions were drawn from the experimental investigation

- The utilization of waste plastic in production of paver block has productive way of disposal of plastic waste.
- The cost of paver block is reduced when compared to that of concrete paver block.
- Paver block made using plastic waste, quarry dust, coarse aggregate and ceramic waste have shown better result.
- It also shows good heat resistance.
- Though the compressive strength is low when compared to the concrete paver block it can be used in gardens, pedestrian path and cycle way etc.
- It can be used in Non-traffic and light traffic road.

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