UTILIZATION OF WASTE PLASTIC IN MANUFACTURING OF INTERLOCKING PAVERS.

Mr. Sadashivappa, Lecturer, Department of Civil Engineering, Government Polytechnic Aurad (B), Bidar Dist. Karnataka State, India. 585326,

Dr.Vijayakumar H., Assistant Professor, Department of Studies in Civil Engineering, University B.D.T.College of Engineering Davangere, Davangere. Dist., Karnataka State, India. 577004

Abstract : Plastic is such a non-bridgeable material material by which our earth is getting pollute so we have such a project by which this material can be used for our paving blocks which will be an good alternate material for the construction industry. You can hardly do away with it. Every day we use plastic in daily lifestyle that is Garbage, coffee cup, electronic material, plastic bags Etc. Road surfaces are infrequently marked to guide. Today, Paving methods are beginning to be used for low impact roadways and walkways. Concrete paving blocks are ideal materials on the footpaths for easy laying, better look and finish. Whereas the tiles find extensive use outside the large Building and houses, lots of these materials are also used in flooring in the open areas of public offices and commercial buildings and residential apartments.

Keywords: Interlocking,Plastic,Pavers..etc

I. INTRODUCTION

Plastic is considered as non-inexhaustible asset since it is non-biodegradable. It takes 1000 years for deterioration. Almost 56 lakhs huge amounts of plastic waste are created in India every year. Plastic waste needs legitimate finish of life the board. Plastic is inventive material for utilizing it in development purposes. Plastic application is connected with their uncommon properties, low thickness, simple preparing, great mechanical properties, great concoction opposition, astounding warm and electrical offending properties and ease. Strong waste administration is one of the major ecological worries in India. Landfills are getting scant and the expense in building landfill destinations are expanding. During transportation of squanders from homes and ventures by these exchange station to the dumping destinations some aftermath from the trucks into canals. In any case, by and large the degree of plastics in squander organization is high. The biggest segment of the plastic waste is polyethylene, trailed by polypropylene, polyethylene Terephthalate and polystyrene luckily, there are different manners by which squander plastics could be reuse or changed over to different items. High thickness polyethylene (HDPE) squander is utilized in making packs and dustbins. Polymer adjusted asphalt squares has applications in street development and buildings. Consequently squander plastic sacks can subsequently, be blended in concrete mass in some form, without noteworthy impact on its different properties or slight trade off in quality. In this task squander plastic sacks gathered from city strong waste and utilized in the creation of asphalt squares which by and large utilized in the park, side of the road trails and in the yard of building (1).

Plastic is evil. You can hardly do away with it. Every day we use plastic in daily lifestyle that is Garbage, coffee cup, electronic material, plastic bags Etc. so plastic is very harmful to humans, animals, marine and as well as to environment. But where is all the plastic going? It would be startling to note that billions of tons of plastic are ending up in the world's oceans. Pollution caused by plastic is not only harmful to marine life but is also affecting the health of humans. The harmful chemicals like PCBs, DDT, and PAH, which get absorbed in the plastic debris that floats in the seawater, have a varied and harmful range of chronic effects like endocrine disorders. The toxins are transferred in the food chain as they get absorbed in the animals' bodies after they eat the plastic pieces. Human beings consume these contaminated fish and mammals. Plastic pollution is affecting the global economy. It is destroying the fishing and aquaculture industries. Plastic is mostly produced by household, tourism and trekking etc. In many countries, the composition of Waste is different, that it is affected by the socioeconomic characters, waste management programs, and consumption patterns, but generally, the level of plastic in the waste composition is high. One of the largest components of plastic waste is polyethylene which is followed by polypropylene (2).

By using plastic, the product is made in various sizes and shapes viz. Rectangular, square and round blocks of different dimensions with designs for interlocking of adjacent tiles blocks. The raw materials required for manufacture of the product are Portland cement and aggregates which are available locally in every part of the country. This pavement are less susceptible to rutting, minimum fatigue or thermal cracking, low stripping due to moisture and offers great durability, little or no impact on processing and also produces eco- friendly construction and costs less. Road surface or pavement is the durable surface material laid down on an area intended to sustain vehicular or foot traffic, such as road or walk way. In the past, gravel road surfaces, cobblestone and granite sets were extensively used, but these surfaces have mostly been replaced by asphalt or concrete laid on a compacted base course. Road surfaces are infrequently marked to guide. Today, Paving methods are beginning to be used for low impact roadways and walkways. Block tiles and paving blocks find applications in pavements, footpaths, gardens, passenger waiting sheds, bus- stops, industry and other public places. The product is commonly used in urban areas for the above applications. Hence, the unit may be setup in urban and semi-urban areas, near the market .A lot of face-lift is being given to roads, footpaths along the roadside. Concrete paving blocks are ideal materials on the footpaths for easy laying, better look and finish. Whereas the tiles find extensive use outside the large Building and houses, lots of these materials are also used in flooring in the open areas of public offices and commercial buildings and residential apartments (5).

Applications

1. The use of waste plastic underway of paver square has gainful method of removal of plastic waste.
2. It can be utilized in gardens, on foot way and cycle way and so on.
3. It can be used in non-traffic and light traffic road.
4. By using the plastics in pavers, reduces the weight by 15%.
5. It requires less an ideal opportunity to make.

Advantages

1) The cost of the plastic sand paver is low compared to concrete paver.
2) Water absorption is too less compared to concrete paver.
3) Plastic waste is totally replacement of cement in plastic sand paver.
4) Compare to fly ash pavers, plastic pavers strength is more.
5) Light in weight.

Disadvantages

1) The fume emitted during burning of plastic waste is very dangerous both human health and environment.
2) Compressive strength is low compare to concrete pavers.

Scope of the Topic

For the landscaping purpose of bungalow and apartments you need spectacular entrance with lavish look of outdoor flooring, you can have various options but to increase the visible features I strongly think and recommend that interlocking pavers plays the best, economic and easiest way to fulfil the purpose. Interlocking pavers being industrial products are comparatively hard and stiff for pedestrians and vehicular traffic. These solid precast pavers are versatile, aesthetically attractive and require less or no maintenance if correctly manufactured and installed. Pavers are very common and have popular method of hard landscaping which is worthy for applications like, driveways, paths, municipal gardens, garages, roads, etc. After the useful life, pavers can be demolished and can be used as recycled aggregates also. The main advantage of using pavers over other materials is that individual pavers can be removed and replaced.

The interlocking paver is increasing day by day. The interlocking plastic paver has a lot of scope for Development of the pavers. The strength of the interlocking pavers can be increased. The application of Interlocking plastic pavers can extend its applications to areas where huge load is applied.

Plastic Waste

Plastic is the general common term for wide range of synthetic or semi synthetic organic amorphous solid material derived from oil and natural gas. The word Plastic is derived from the Greek word **plastikos** meaning fit for moulding and **plastos** meaning moulded. A marvel of polymer chemistry, plastics has become an indispensable part of our daily life. The first human made plastic, parkesine, later called cellulose, was invented by Alexander parkes in 1855. The development of plastic has come from the use of natural plastic material to the use of chemically modified natural material, e.g., rubber, nitrocellulose, collagen, galalite and finally to completely synthetic molecules, e.g., Bakelite, epoxy, polyvinylchloride and polyethylene.

More especially the majority of plastic waste comes from packaging and containers. Once we've consumed whatever was contained in that plastic, it becomes "waste". As we continue to utilize plastic products, we continue to generate more plastic waste (fig 1.1). Our increasing dependence on petroleum products creates a vicious cycle of waste creation to container; more plastic waste is generated from durable products, such as furniture, and nondurable products, Such as plastic bags. Obviously, the goal is to lower the overall amount of generated plastic waste. In a perfect world, 100% of the plastic generated would simply be reused, degraded, or reincarnated into another product. We must find a way to reduce the amount of plastic waste generated by initially using less, or finding more efficient ways of recycling and reusing plastic products.

Fig1.1. Plastic waste

Objective

1) To evaluate compressive strength of ordinary concrete paver blocks and plastic pavers.
2) To evaluate the durability of the plastic pavers.

MATERIALS AND METHODOLOGY

(i) Plastic Waste: Plastic waste used in pavers was collected from the surrounding locality than with help shedding machine crushed plastic is used. Low density polythein plastic is used.

a) Firstly plastic should be collected from different sources like dumping yards, dustbins near street Corners and collected from the municipal town panchayath.

b) The collected plastic should be cleaned and dried such that the particles sticked to it removed

Fig: 3.1.1. Waste plastic

(ii) Sand

Sand is a granular material composed of finely divided rock and mineral particles. The properties of sand were determined by conducting as per IS 2386 results indicate that the sand confirms to zone 2 of IS (9383-1970).

Sand is defined as particles with a diameter of between 0.074 and 4.75 millimetres. In this procedure of paving pavers we have used sand which is passed from the 600micron.

Fig: 3.1.2. River Sand

Technical method of preparing interlocking paver blocks by using Plastic:

1) Firstly plastic should be collected from different sources like dumping yards, dustbins near street corners and municipal town panchayath.
2) The collected plastic should be cleaned and dried such that the particles sticked to it removed
3) The river sand collected should be oven dried under a temperature range of 105°C to 110°C.
4) Then the sand is sieved for desired size (our project requires sand passed over 300 microns is sieve).
5) The plastic that is cleaned is now weighed and batched accordingly to the requirement along with Sand.
6) The plastic is placed in the heating bowl and heated with huge amount of heat (as we are using all Kinds of plastic no particular temperature couldn't be mentioned).
7) After some time plastic turns to molten state (not completely liquid but as semi liquid).
8) Now the sand is added with require amount of sand according to the proportion required.
9) As it is heated generally it is black colour so it is advisable to add pigment to the required quantity and Mix it well.
10) Then place the material in the required mould to get attractive shapes.
11) Allow it to settle for 15 minutes to compact well and remove it.

RESULTS AND DISCISSION
COLLECTION OF MATERIALS

Fig: 4.1.1.River Sand

Fig: 4.1.2.Waste LDPE Plastic

PROPERTIES OF MATERIALS

Waste LDPE Plastic
LDPE (low density polyethylene) is a soft, flexible, lightweight plastic material. LDPE is noted for its low temperature flexibility, toughness, and corrosion resistance. It is not suited for applications where stiffness, high temperature resistance and structural strength are required. It is often used for orthotics and prosthetics. LDPE has good chemical and impact resistance and is easy to fabricate and form.

River Sand

Table 4.2.Properties of River Sand

Sl No	Tests	Result
1.	Specific Gravity	2.65
2.	Water Absorption	0.81
3.	Fineness Modulus of river sand which passes through 600 micron sieve	

MIX DESIGN

Mix Design of 1:3 and 1:4 is taken

1:3 Mix Ratio, for 1kg of Plastic 3kg of river sand which passes through 600micron is taken. 1:4 Mix Ratio, for lkg of Plastic 4kg of River sand which passes through 600micron is taken.

MIXING, MOULDING AND DEMOULDING

Burning of Plastic

Fig: 4.4.1 Burning of waste LDPE plastic

After batching the plastic bags were taken for burning in which the plastic is dropped one by one into the container and allowed to melt. These would be done in closed vessel because to prevent the toxic gases released into atmosphere. These will be at the temperature of 120-150 degrees centigrade.

Mixing

Fig: 4.4.2.Mixing

Mixing of materials is essential for the production of uniform and strength for pavers the mixing has to be ensuring that the mass becomes homogeneous, uniform in colour and

consistency. Generally, there are two types of mixing, Hand mixing and mechanical mixing. The plastic liquids thoroughly mixed by using trowel before it hardens. The mixture has very short setting bags are turned to molten state; the river sand is added to it. The sand added is mixed time. Hence mixing process should not consume more time.

Moulding

Fig: 4.4.3.Moulding of plastic sand mix

The mixture is then poured into the paver mould of size 50mm thick and is compacted by using tamping rod or steel rod. The surface is finished by using trowel. Before placing the mixture into the mould, the sides of the mould are oiled to easy removal of pavers. Mould removed after it gets harden.

Demoulding

Fig: 4.4.4.Demoulding of Paver blocks from Mould

TESTS CONDUCTED ON INTERLOCKING PAVERS

List of Tests on Plastic Sand Pavers

1) Compressive strength
2) Oven test

Compressive strength Test

Fig: 4.5.1.Compressive strength Test

Plastic pavers 1:3, 1:4 were taken and tested one by one. In this test, a specimen is put on compression testing machine and applied load till it breaks. The load at failure shall be the maximum load at which the specimen fails to produce any further increase in the indicator reading on the testing machine.

Compressive strength for plastic paver blocks of size 200x160x50 mm was obtained. The highest load at failure is taken and mean compressive strength was calculated using following equation,

Compression Strength (N/mm2) = [Ultimate load in N / cross sectional area (mm2)]

Oven Test

Fig: 4.5.2.Oven Test for Mould

As the paver blocks have been made from plastic, to understand its melting factor through oven test method. The paver blocks have been stored in oven for 5hr 30minutes.

RESULTS

Compressive strength Result

Plastic pavers 1:3, 1:4 were taken and tested one by one. In this test, a specimen is put on compression testing machine and applied load till it breaks. The load at failure shall be the maximum load at which the specimen fails to produce any further increase in the indicator reading on the testing machine and the test result were mentioned in the below Table 4.6.1.1.

Table 4.6.1: compressive strength of cement concrete pavers

S1 no	Grade designation of pavers	Compressive strength of pavers at 28days in N/mm2	Traffic category	Recommended minimum paver block thickness in mm
1	M30	30	Non traffic	50
2	M35	35	Light traffic	60

3	M40	40	Medium	80
4	M50	50	Heavy	100
5	M55	55	Very heavy	120

able 4.6.1.1: Compressive strength of plastic pavers for various ratios

Sample no.	Mix ratio	Maximum load (KN)	Compression strength (N/mIR2)
1.	1:3	170KN	6.07
2.	1:4	130KN	4.64

As compare to the cement concrete paver blocks, compressive strength of Plastic pavers are less.
For 1:3 mix ratio 6.07N/mm2 And for 1:4 mix ratio 4.64N/mm2.

Oven Test Results
As the paver blocks have been made from plastic, to understand its melting factor through oven test method.
The paver blocks have been stored in oven for 5hrs 30minutes and after their conditions were noted as mentioned below.
PAVERS START TO MELT AT 108'C — 5HR 30MINUTES.

CONCLUSIONS

The Plastic sand pavers possess more advantages which include cost efficiency, removal of waste products.
The following conclusions were drawn from the experimental investigation

- Utilization of waste plastic in production of paver blocks has a productive way of disposal of plastic waste.
- The cost of plastic pavers is reduced when compared to that of concrete pavers.
- It can be used in park, footpath, yards of residential building and commercial building Non- traffic roads.
- From the obtained results it can be concluded that this plastic pavers are not suitable in areas of heavy traffic.
- From the obtained results it can be concluded that plastic pavers have less compressive strength compare to concrete pavers.

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