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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.

KEYWORDS: plastic, blocks, paver, sand, waste.

I. 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.

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properties or slight compromise in strength (Polymer Modified Concrete). In this study waste voltaic bottles and polyethylene bags were shredded into Hence waste plastic can therefore, be mixed in concrete mass in some form, without significant effect on its other flakes and was used in the production of pavement blocks.

i. 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 tonnes 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.

II. COLLECTION OF MATERIALS AND PROPERTY OF MATERIAL

i. Waste Plastic

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. Accumulation of such wastes can result into hazardous effects to both human and plant life. Therefore, need for proper disposal, and, if possible, use of these wastes in their recycled forms, occurs. This can be done through process of plastic management. Waste management in respect to plastic can be done by recycling. If they are not recycled then they will become big pollutant to the environment as they not decompose easily and also not allow the water to percolate in to the soil and they are also poisonous.

Properties Of Plastics Polyethylene

S.NO	EXPERIMENTS	RESULTS
1	Density at 23°C	.958
2	Elasticity modulus	9
3	Tensile creep strength	8
4	Bending creep modulus	1
5	Tensile strength at 23oC	2
6	Elongation at break (%)	>600
7	Thermal conductivity	0
8	Ignition temperature	3

ii. Sea Sand

Sea sand can become a potential resource capable of supplying fine aggregate material for domestic civil engineering and construction usage. In addition, using sea sand is economic than using riversand because river sand is more expensive. Sea sand mainly contains much salinity as sodium chloride. If the salt is not treated and sea sand is directly utilized for civil engineering and construction concrete project, the durability of the structural may be affected and as the result the concrete might be swelling, precipitating, sulphating and other adverse consequences. Therefore, the salt content of the sea sand must be eliminated before it is utilized to avoid the potential hazards. The sand dunes are formed by sand particles blown by wind from sea shore. The top most layers of sand dunes contain higher chloride content due to continuous exposure to sea breeze. However, when sea sand is actually utilized, the first problem encountered is the salt contained in the sea sand. A distinction must also be made between sea sand and sand deposits

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in dry coastal areas. The latter would tend to have very high chloride contents resulting from salt spray and evaporation over long periods of time.

Properties Of Sea Sand

Properties	Sea sand
Fineness modulus	3.1
Specific Gravity	2.767
Water absorption (%)	1.2
Bulk Density (gm./cc)	1.78

III.MIX DESIGN

In order to find the plastic soil bricks that they possess high compressive strength with various mix proportions are made and they are tested using compressive testing machine. The mix proportion were in the ratio of (1:1, 1:2, 1:3) These are the ratio which represent the plastic, sea sand respectively.

IV. MATERIAL REQUIRED FOR CONSTRUCTION OF PAVEMENT BLOCK

- Overalls, gloves, masks, covered shoes or boots
- 1 melting barrel (an oil drum cut in half, 80cm wide and 50cm high). If possible use a shield to keep the fire concentrated under the barrel
- Stirring equipment (a spade with a metal shaft, or metal reinforcing rods with a metal paddle welded to the end)
- Firewood or other solid fuel
- Clean, dry, sieved sharp sand
- Trowel
- Tile mould

V. PROCEDURE FOR MAKING PAVEMENT BLOCK BY SEA SAND AND WASTE PLASTIC

i.Preparation Of Melting Barrel

To make the melting barrel, cut a simple oil drum in half and attach three legs made of rebar. With the legs attached, the ideal height of the barrel is 50cm, and 80cm wide. Try to make the burner big enough that you can hold a good amount of liquid plastic but not so tall that it is tricky to mix. If you can sink the legs into the ground it will make the barrel more stable for mixing.

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fig : Melting Barrel

ii. Preparation Of Mould

The moulds can be whatever shape you wish – they are constructed in the same way as moulds for concrete floor tiles. If the walls of the mould however, the material will stick to the sides and not come out properly.



Figure: Example tile moulds

Tile moulds can be many different shapes, provided the tiles fit together with no gaps. This mould (left, above) produces 3 tiles with the shape illustrated on the right. It is made by cutting and welding three rings.

iii. Required Proportion Of Sea-Sand And Plastic

The strength of the floor tile depends on the mix with sand. Laboratory tests indicate that the optimum mixture is 3 parts sand to 1 part LDPE (2:1 sand:plastic), however it is strongly recommended that you try different mixes for yourself.. A mix of 2:1 works well for floor paving tiles to be used in a home compound. Usually, the tiles contain more sand than plastic, because the plastic serves as a bonding agent to hold the sand together.

As a rough guide, one standard rice sack of plastic with around 200 plastic bags (weighing around 2.5 kg) makes one paving slab.

iv. Select The Type Of Plastic

- It is important to only select the correct type of plastic. This is because different types of plastic melt and burn at different temperatures and have different physical qualities. The process described here works well with LDPE1.
- 1 Process design from the Living Earth Waste to Wealth programme, entrepreneur, teacher and Waste Aid Associate.

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- Water bags, non-woven plastic shopping bags and plastic film are usually made of LDPE. It is important that you do not use other types of plastic – it could be harmful to your health.
- Make sure your plastic waste is mainly clean. Remove all materials that are not LDPE (including other plastics). If you're not sure if something is LDPE, leave it out.

v. Heating The Material

Light a small fire under the metal drum and **gently** heat it. Add the plastic waste. As it warms up it will reduce in size. Light the plastic at the top using a small flame to help it melt down. Make sure the fire does not get too hot. Keep adding plastic gently at the side of the melted plastic until it melts down to a black liquid. Keep adding plastic until you have around a 20cm depth of melted plastic.



Figure : Keep mixing the melting plastic

vi. MIXING PROCESS

Keep mixing thoroughly until all the plastic has melted and there is a consistent black liquid. Sometimes LDPE lumps can remain even at very high temperatures. Stirring and heating must continue until all lumps are removed and a homogenous paste is obtained, since they affect the strength of the material. This can take up to 20 minutes. Do not let the liquid get so hot that it burns strongly – it will not work as a building material if this happens. A few flames from the liquid is acceptable. Add sand until you have the required mixture and keep mixing so that the plastic, which acts as a binder, is very well mixed in and looks like grey cement.

vii. Mould

Prepare the mould by making sure it is very clean, with no pieces of plastic on it from previous mouldings, and well oiled.



Figure : Check The Tile Moulds Are Clean And Oiled Before You Start Work.

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viii. Filling Material In Mould

Quickly remove the mixture using the spade with the metal shaft and put it into the mould with the trowel. The mixture is very hot so be careful and wear gloves.



Fig: Press the mix tightly into the moulds.
Air gaps will reduce the quality of your finished tile.

ix. Setting Of Pavement Block

Allow the hot mixture in the mould to set for a few minutes, repeatedly shaking the mould to loosen the edges (a rocking motion works well). Keep trying to lift the mould. When the mixture has hardened enough that the slab will not collapse, remove the mould and leave. It should harden in around 1 hours.



Fig : Ready Pavement Blocks

VI.RESULTS

TEST CONDUCTED	PLASTIC PAVEMENT BLOCK 7 DAYS STRENGTH (N/mm ²)		NORMAL PAVEMENT BLOCK 7 DAYS STRENGTH (N/mm ²)	
COMPRESSIVE STRENGTH	Specimen 1	9.55	Specimen 1	9.52
	Specimen 2	7.88	Specimen 2	9.01
	Specimen 3	10.12	Specimen 3	9.33

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TEST CONDUCTED	PLASTIC PAVEMENT BLOCK 28 DAYS STRENGTH (N/mm ²)		NORMAL PAVEMENT BLOCK(M20GRADE 28 DAYS STRENGTH (N/mm ²)	
	Specimen 1	14.38	Specimen 1	19.25
COMPRESSIVE STRENGTH	Specimen 2	14.05	Specimen 2	19.76
	Specimen 3	14.89	Specimen 3	20.12

VII. CONCLUSION

From the above observation it is possible to use plastic in concrete, and in pavement block, 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. The results obtained from the test are all near to the traditional pavement blocks.

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