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ABSTRACT:

The use of plastic waste as additive in the production of the pavement blocks has both engineering and environmental implications. The use of paver blocks produced from plastic wastes becoming more popular, finding application in parking areas, compounds, open spaces, streets and in minor and major roads. The need for the construction sector to be sustained by innovative technology targeted at conserving natural resources and protecting the environment cannot be overemphasized. This research is aimed using plastic waste as binding groundmass in place of cement in the production of pavement blocks. This will go a long way to solve our environmental and ecological resulting from indiscriminate dumping of plastic waste. These blocks were subjected to flexural, compressive strength, water absorption, oven and acid test.

INTRODUCTION:

The use of plastic wastes as additives in the production of pavement blocks has both engineering and environmental implications and use of paver blocks produced from plastic wastes is becoming more popular, finding applications in parking areas, compounds, open spaces, streets, and in minor and major roads. The way and manner plastic wastes generated are managed in developing countries is worrisome and disturbing, due to their non-biodegradable nature. The application of plastic waste in the production of paver block is an innovative way of disposing plastic waste littered all over the place, thereby cleaning the environment where the cost of plastic waste paver block when compared with concrete paver block is stronger, tougher, economical and more resistant to heat and corrosion. The study has clearly established that plastic paver blocks are better alternative to normal cement paver blocks and research is aimed at using plastic wastes as binding groundmass in place of cement in the production of pavement blocks. This will go a long way in solving part of our environmental and ecological problems resulting from indiscriminate dumping of plastic wastes. These blocks were subjected to flexural, compressive-strength, water-absorption, oven and acid tests. The results of these tests revealed that paver blocks produced from plastic additives show more tensile strength, better water absorption, more resistant to corrosion and good heat absorber compared to the blocks produced from cement. At present nearly 56 lakh tons of plastic waste are produced in India per year. Economic growth and changing consumption patterns are resulting the in the rapid increase in the use of plastic in the world. The consumption of plastic material has increased from 5million tons in the 1950s to 100million tons in the 2000s. Therefore there should need for proper waste management system. Plastic are being littered and misused waste all over the country and now causing threat to nation.

Some of these problems associated with plastic waste in India likely (A) Plastic blocks drain and gutters and causes floods, (B) Plastic leads toxic gas into atmosphere when burnt. (C) Plastic bottles and containers act as breeding ground for mosquitoes when filled with rainwater.

MATERIALS AND PROPERTY OF MATERIAL:

A. Plastic Waste

Studies have revealed that waste plastics have great potential for use in bituminous construction as its addition in small doses, about 5-10%, by weight of bitumen helps in substantially improving the Marshall stability, strength, fatigue life and other desirable properties of bituminous mix, leading to improved longevity and pavement performance.

Advantages and limitation of using waste plastic as modifier and binder:

Laboratory as well as field performance studies/investigations carried out in India identifies following advantages in using waste plastic in bituminous mixes.

- Higher resistance to deformation.
- Higher resistance to water induced damages.
- Increased durability and improved fatigue life.
- Improved stability and strength.
- Disposal of waste plastic and thereby environment friendly.

B. River Sand

With the continuous improvement of our country's development process, the standard of living has tremendous improved. The rapid development in urbanization and industrialization causes a heavy demand for new cement-based materials infrastructures such as buildings, bridges, pavements.

MATERIAL REQUIRED FOR 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

PROCEDURE FOR MAKING PAVEMENT BLOCK BY SEA SAND AND WASTE PLASTIC

Material used in paving block:

The largest component of plastic waste is polythene followed by polypropylene, polythene terephthalate , polystyrene. Looking towards the global issue of environmental pollution by post

consumer plastic waste, the use of post consumer plastic waste will not only be its safe disposal method but my also improve concrete properties like tensile strength, chemical resistance, drying shrinkage, and keep on a short long term basis. To make the melting barrel, cut a simple oil drum in half and attach three legs made of rebar. 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.

Collection of Plastic Waste:

The manufacturing of plastic paving block requires a huge plastic and the quantity of sand depend on the plastic used for blocks. 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 bottles (weighing around 4 kg) makes one paving slab.

Select The Type Of Plastic:

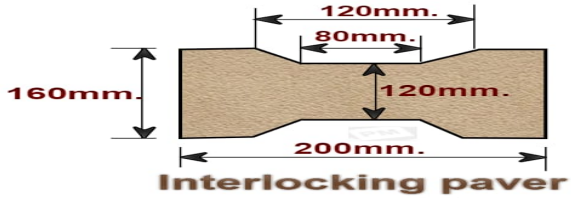
This is because different types of plastic melt and burn at different temperatures and have different physical qualities. The process described here works well with LDPE1. Water bags, non-woven plastic shopping bags and plastic film are usually made of LDPE. It is important that you do not use other 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.

Mixing Process:

The mixture is progressively heated in a recycled half barrel with continuous and strong mixing. Taking a barrel and heat at constant temperature and placed the plastic at a proper weight. 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.

Moulding:

The plastic paste is hot so 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. 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 1hours. It requires a gentle pulling of the mould. Paving block on their metallic support is immerged in a tank with cold water.



Result and Discussion

Specimen -Dumble interlocking Plastic Paver Block 3 Days strength

SL NO	Wt in Kg	Load in Newton	Area in mm2	Compressive Strength in 3 Days	Mean
Sample 1	3.96	126700	28000	4.525	
Sample 2	4.00	127530	28000	4.554	4.793
Sample 3	3.97	148400	28000	5.3	

Specimen - Dumble interlocking Plastic Paver Block 7 Days strength

SL NO	Wt in Kg	Load in Newton	Area in mm2	Compressive Strength in 7 Days	Mean
Sample 1	3.92	229600	28000	8.2	
Sample 2	3.91	218400	28000	7.8	8.01
Sample 3	3.95	225680	28000	8.04	

Specimen - Dumble interlocking Normal Paver Block 3 Days strength (M20)

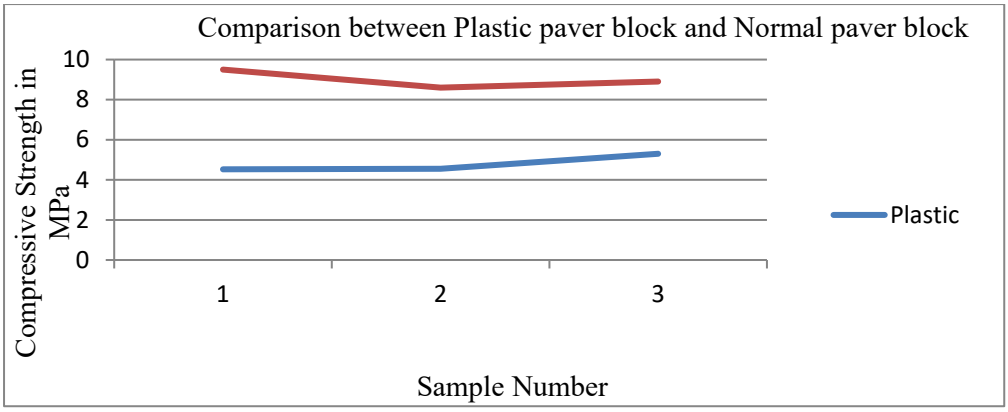
SL NO	Wt in Kg	Load in Newton	Area in mm2	Compressive Strength in 3 Days	Mean
Sample 1	5.231	266000	28000	9.5	
Sample 2	4.563	240000	28000	8.6	9.0
Sample 3	4.869	249200	28000	8.9	

Specimen - Dumble interlocking Normal Paver Block 7 Days strength (M20)

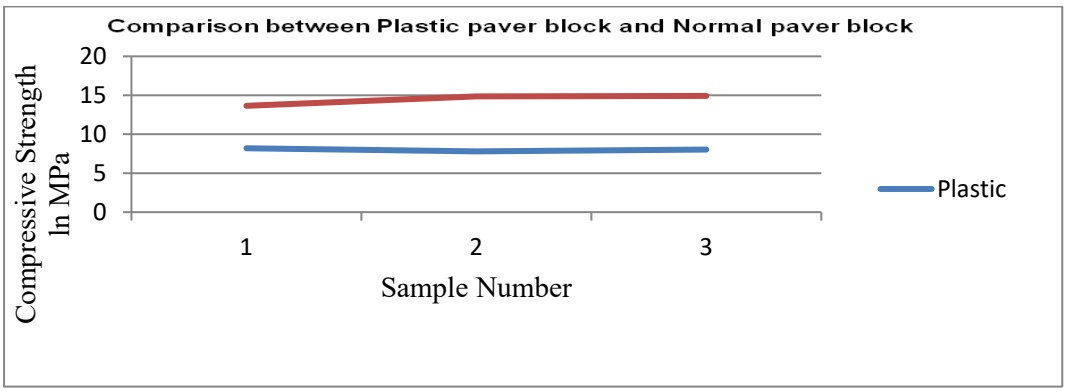
Sl No	Wt in Kg	Load in Newton	Area in mm2	Compressive Strength in 7 Days	Mean
Sample 1	6.00	382200	28000	13.65	
Sample 2	4.976	415800	28000	14.85	14.47
Sample 3	5.95	417760	28000	14.92	

Analysis through Graph:

Comparison between Plastic Paver Block and Normal Paver Block (M20) 3 Days Strength.



Comparison between Plastic Paver Block and Normal Paver Block (M20) 3 Days Strength.



CONCLUSION:

Based on the outcome of results of various tests carried out, the study has clearly established that the plastic derived paver blocks are more rugged, tougher, durable , heat and corrosion resistant compared to paver block produced from conventional cement. 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. This study has efficiently and effectively demonstrated the application of waste plastic into useful construction material as well as reducing its menace in our surrounding. The plastic waste littered all over environment can convert into useful construction materials more economical than cement.

REFERENCES:

Allaheverdi, A. and S. Frantisek. 2000. “Acid Corrosion of Hydrated Cement-based Material”. Ceramic-Silikaty. 44(3): 114-120.

Dinesh, S., A. Dinesh, and K. Kirubakaran. 2016. Bricks and Paver Blocks”. International Journal of Applied Engineering Research. 11(3): 364 – 368.

Youcef, A.S. and M.N. Ganesh. 2015. “Use of Recycled Plastic bag Waste in the Production of Concrete”. Journal of International Scientific Publications, Materials, Methods and Technologies. 8(3): 1314-7269.