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Use of Waste Plastic in Paver Block

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Abstract: The usage of waste plastic in concrete paver block is partial solution to the environmental and ecological problems associated with it. The aim of this research is to study the uses of plastic waste as a binding material in paver block casting. In this project, the difference mix proportion of milk packet waste was used to replace cement in paver block to obtain desired result. In 21st century over 300 million tons of plastic produced worldwide each year. Hence this type of study is required to reduce the plastic waste in useful way. Another aim is achieved by this research to reduce the cost of paver block when compare that of concrete paver block. For the test, paver block is prepared and their compressive strength is tested.

Index Terms - compressive strength, waste plastic, LPDE (Low density poly ethylene), paver block, ecological problems

1. INTRODUCTION

Now-a- days, plastics are the most essential part of society due to their low cost and versatility. But as we know only 9% of plastic waste has been recycled and about 12% has been incinerated. Plastics are durable and slow degradable because of that most of the landfills are completely filled. Due to excessive surface wear and variability most of the concrete block loses their strength. CO₂ gas is evolved while producing cement. By replacing cement with waste plastic environment can be protected. When paver block is correctly casted it is adoptable, attractive, cost effective and requires zero maintenance.

Plastic waste used in this casting is collected from local area. The presence of plastic in surrounding adversely affects human beings and wild life directly and indirectly. So, we need to reuse the plastic in maximum amount. By this project we won't address only one use, we can use this block for floors, wall masonry, parking, roads.

With the view to examine the behavior of waste plastic in the formation of block some review of literature taken up.

B. Shamugauli et.al² made an attempt to replace cement with plastic waste and ceramic waste to reduce the cost of the Paver block when compare to that of conventional paver block. For that block size of 215×115×6 was casted and checked their compressive strength. Mohan D.M.S. et.al³ used waste plastic in different proportion with fine aggregate and checked their compressive strength. Nivetha C. et.al⁴ studied the possibilities of using waste plastic as a binding material instead of cement in the manufacture of paver block. In this plastic waste is carried to mix with varying proportion of solid waste fly ash. Anzar Hamid Mir¹ discovered an example of creative waste managed by using plastic waste in pavement construction.

2. METHODOLOGY AND EXPERIMENTAL PROCEDURE

A. Properties of Materials

1) Waste Plastic (LPDE)

Plastic waste used in the casting of paver block was collected from the college canteen. LDPE is indicated by resin no.4. The plastic milk bags used for this casting is of about 50µ. The thermal and mechanical properties of plastic are provided below.

TABLE I
PROPERTIES OF PLASTIC

SR NO.	PARTICULARS	VALUE
1	Melting	150 ⁰ C
2	Thermal co efficient of expansion	100-200×10 ⁻⁶
3	Density	0.910-0.940kg/m ³
4	Tensile Strength	0.20-0.40(N/mm ²)

2) Sand

The sand use as fine aggregate first sieve through 4.75 mm IS sieve to remove any particle greater than 4.75mm then washed to remove the dust. The sand used for this study taken from college lab. The properties of fine aggregates are provided below

TABLE III
PROPERTIES OF SAND

SR NO.	PARTICULARS	VALUE
1	Specific gravity	2.52
2	Water content	0.968
3	Grading zone	Zone II
4	Fineness modulus	2.92

3) Cement

OPC 53 grade was used for casting

TABLE IIIII
PROPERTIES OF CEMENT

SR NO.	PARTICULARS	VALUE
1	Specific gravity	3.15
2	Initial setting time	60 min
3	Final setting time	600 min

B. Preparation of Test Specimen

With the help of metal furnace, we heated the plastic waste at temperature 150⁰ C with opening for collection of gas. As a result, solid plastic waste gets converted into molten liquid state. We added the described materials at molten state of plastic and properly mixed. To reduce the pores in it we need to store it in hot condition and compact. They are allowed to dry for 24hr to gain the desired strength, then the paver block is removed from mould and ready to use.



Fig I Heating and Casting

C. Design Mix Proportion

As per design, we casted 3 cubes of each ratio. First we kept the cement block in mould for 24 hr and after we that curing is been done for 24 hr. In case of plastic mould, curing is not required.

TABLE IVV
PLASTIC PAVER BLOCK

Sr no.	RATIO (P : FA)	STRESS N/mm ²
1	1:1	7
2	1:2	9
3	1:3	11
4	2:3	8.5

TABLE V
CEMENT MORTAR CUBE

Sr no.	RATIO (C : FA)	STRESS N/mm ²
1	1:1	25.02
2	1:2	23.23
3	1:3	37
4	2:3	24.10

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3. TESTING AND ANALYSIS

A. Compressive Strength for Paver Blocks

Plastic paver block of size 70.6mm×70.6mm×70.6mm. The maximum load at failure reading was taken and average compressive strength is calculated using the following formula

Compressive strength= load/area of specimen

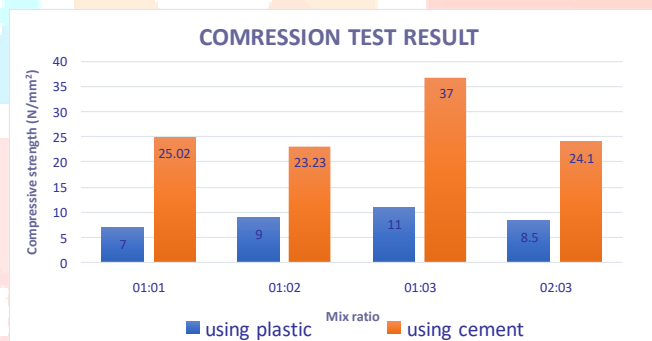


Fig II Compression Strength Comparison

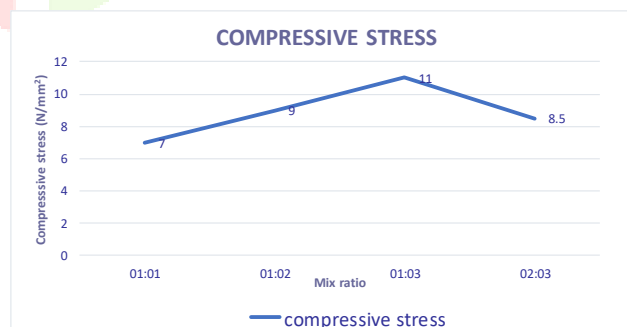


Fig III Compressive Strength

B.Oven Test

To know the melting point of plastic paver block we have performed oven test. We kept paver block in oven for 120 minutes and after that we verify its condition

TABLE VI
THERMAL TEST

BLOCK NO.	TEMPERATURE	RESULT
1	50	No Change
	100	No Change
	150	Melt
2	50	No Change
	100	No Change
	150	Melt
3	50	No Change
	100	No Change
	150	Melt
4	50	No Change
	100	No Change
	150	Melt

C. Water Absorption test

In this test, block are weighted in dry condition and let them immersed in fresh water for 24 hrs. After 24 hrs of immersion, this are taken out from water and wiped out with damp cloth. The difference between weight is water absorbed by block. The percentage of water is calculated

TABLE V
ABSORPTION TEST

Block No.	DRY WEIGHT(gm)	WET WEIGHT(gm)	% OF WATER ABSORPTION
1	520	526	1.15
2	514	519	0.972
3	508	512	0.787
4	501	508	1.39

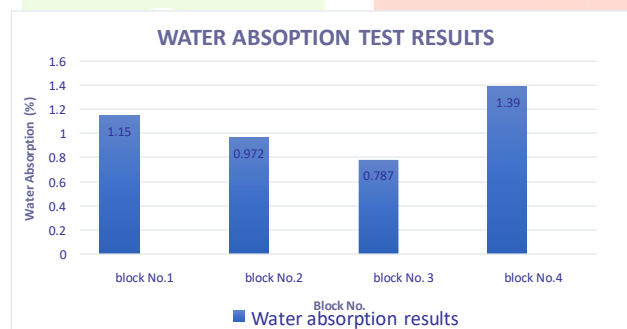


Fig III Water Absorption Test

4. CONCLUSIONS

1. Based on the experimental study we found that plastic is as useful as concrete block.
2. As we can see the utilization of waste plastic in production of paver block is productive way of disposal of plastic waste.
3. Cost of plastic paver block is less than concrete paver block.
4. The compressive strength is low when compared to concrete paver block but it can be used in garden, pedestrian path, cycle way.
5. It can be used in non-traffic and light traffic.

5. REFERENCES

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