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Manufacturing of Plastone using Plastic and Quarry Dust

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Abstract:
Plastic waste is increasing day by day becomes eyesore and in turn pollutes the environment, especially in high mountains, villages where no garbage collection system exists. A large amount of plastics is being brought into the region are discarded or burned air. Hence these plastic waste are to be effectively utilized. The aim of the project is to replace cement with plastic waste and quarry dust in the plastone and to reduce the cost; when compared to that of the conventional concrete blocks. Hence the project will be helpful in reducing plastic waste in a useful way.

Keywords: Plastic, Quarry dust, Plastone. Compressive Strength, Flexural Strength.

I. INTRODUCTION

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. Paver block paving is versatile, aesthetically attractive, functional, and cost effective and requires little or no maintenance if correctly manufactured and laid. Plastics are rapidly growing segment of the municipal solid waste. Disposal of waste materials including waste plastic bags has become a serious problem. Amount of waste plastic bags being accumulated in 21st century has created big challenges for their disposal. The waste plastics in house hold is large and increases with time. In each country waste consumption is different, since it is unaffected by socioeconomic characteristics and waste management programs, but the level of plastics in waste consumption is high. In order to overcome this issue, we have to use it in effective way. This project is about recycling waste plastics into pavement blocks and study their characteristics. 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. A large amount of plastic is being brought into the tourist trekking regions are discarded or burned which leads to the contamination of environment and air. Pavement blocks are perfect materials on the pathways and streets for simple laying and finishing. Here the strength properties of pavement blocks comprising of waste plastics and the design considerations for pavement block incorporating waste plastic bags is presented. Most concrete block paving constructed in India also has performed satisfactorily but two main areas of concern are occasional failure due to excessive surface wear, and variability in the strength of block. Plastic waste is carried to melt and mixed with a varying proportion of solid waste fly ash and quarry dust. In order to prevent the environment pollution caused by plastic waste, We decided to utilize it effectively in the manufacturing of paver blocks. Large amount of plastic wastes have been collected from several places such as tourist and public places etc., High density polyethylene bags are collected, cleaned and used as a replacement for cement in the manufacturing of Paver Blocks. The molten state of plastic is added with Fine aggregate (sand) at different percentages to obtain high strength Paver Blocks that possess good thermal properties and compressive strength.

II. DEFINITION OF PROBLEM:

- Plastic waste is increasing due to increase in population, utilization and development.
- The disposal of waste plastic has become a serious problem globally due to their non-biodegradability.

III.OBJECTIVES:

- Cement is replaced with plastic.
- Decrease the cost of paving block.
- Decrease setting time of paving block.
- Strength comparision between plastic used paving block vs normal paving blocks.
- To safety guard to the environment by utilizing waste property.
- To provide an economical construction material.

IV. EXPERIMENTAL PROCEDURE:

Properties of Materials:

Low density polyethylene(LDPE):
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.I. Properties of LDPE

S.NO	Particulars	Value
1.	Melting point	150°C
2.	Thermal coefficient of expansion	100 to 200 x10^{-6} $Wm^{-1}K^{-1}$
3.	Density	0.91-0.94
4.	Tensile strength	0.2-0.4N/mm^2

Polyethylene(PET or PETE):
The workhorse of America's plastic drinking bottle industry, polyethylene terephtalate (PET) is one of the most versatile and widely used types of scrapplastic.

Table .2. Properties of pet or Pete

S.NO	Particulars	Value
1.	Melting point	> 250 °C
2.	Thermal coefficient of expansion	0.15 to 0.24 $Wm^{-1}K^{-1}$
3.	Density	1.3g/cm^3(20°C)

***Quarry dust*:**
Crushed sand less than 4.75 mm is produced from rock using tate of crushing plants. Production of quarry fine sis a consequence of extraction and processing in a quarry and collected from the near-by quarry.

Table.3. Properties of quarry dust

S.NO	Descriptions	Value
1.	Specific gravity	2.39
2.	Grading zone	Zone 2 of soil
3.	Finess modulus	4.992

V. MIX RATIO:

Block type 1: Five paver blocks were casted using mix ratio provided below,
Plastic waste – 1.75kg
Quarry dust – 3.5kg.
Block type 2: Five paver blocks were casted using mix ratio provided below,
Plastic waste – 1.5kg
Quarry dust – 4.5 kg.

Preparation of Test Specimens:
Plastic wastes are heated in a metal pan at a temperature of above 150˚. As a result of heating the plastic waste melts .The materials quarry dust and plastic waste as described in previous chapter are added to it in right proportion at molten state of plastic and well mixed with quarry dust. The rubber 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 2 hours so that they harden. After drying the paver block is cooled using water and removed from the moulds and ready for the use.

Figure.1. Heating and Mixing

Figure.2. Casting And Drying

VI. TESTING OF SPECIMEN:

Compressive strength for paver blocks:
Compressive strength or compression strength is the capacity of a material or structure to withstand loads tending to reduce size, as opposed to tensile strength, which withstands loads tending to elongate. In other words, compressive strength resists compression, whereas tensile strength resists tension. Plastic paver blocks of size 250X120X60 mm were casted. The maximum load at failure reading was taken and the average compressive strength is calculated using the following equation.
Compressive strength (N/mm^2) = (Ultimate load in N / Areaof cross section (mm^2))

Figure.3. Block Type 1 **Figure.4. Block Type 2**

Figure.5. Conventional Paver Block

Flexural strength for paver blocks:
Flexural strength, also known as modulus of rupture, or bend strength, or transverse rupture strength is a material property, defined as the stress in a material just before it yields in a flexure test. Plastic paver blocks of size 250X120X60 mm were casted. The maximum load at failure reading was taken and the average flexural strength is calculated using the following equation.
Flexural Strength Test (N/mm^2)

$$f = \frac{3PL}{2BD^2}$$

Figure.6. Block Type 1 **Figure.7. Block Type 2**

Figure.8. Conventional Paver Block

Water absorption test:

This test method is used to determine the rate of absorption of water by measuring the increase in the mass of a specimen resulting from absorption of water as a function of time when only one surface of specimen is exposed to water. The amount of water absorbed is calculated using the formula,

$$\frac{\textit{Dry weight} - \textit{Wet weight}}{\textit{Wet weight}} \; X100$$

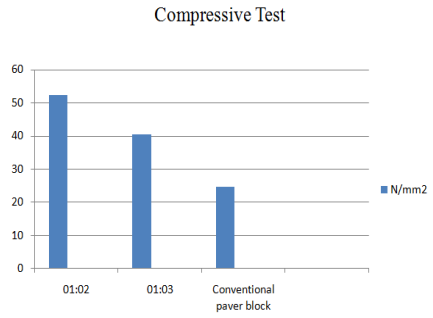
VII. RESULTS:

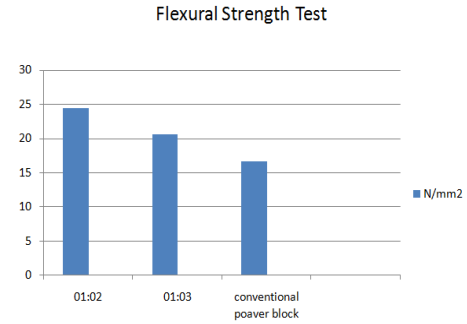
The values of the all three compressive strength test, flexural strength test and water absorption tests are tested and the results are tabulated below,

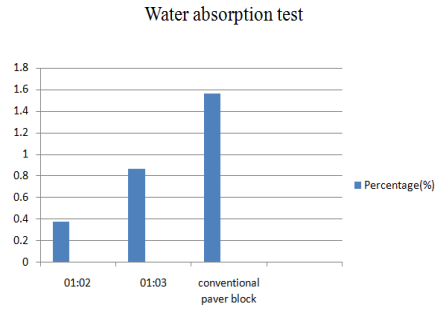
Table.4. Experimental results

Ratio	1:2	1:3	Conventional (M25)
Compressive strength	52.37	40.47	24.76
Flexural strength	24.39	20.6	16.67
Water absorption	0.36%	0.87%	1.56%

VIII. GRAPHS:







IX. 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 have shown better results.
- The compressive strength and flexural strength is high compared to conventional paver block.
- The water absorption is less than the conventional paver block.
- It can be used in heavy traffic roads.

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