Reusing Plastic Waste in Paver Blocks

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***Abstract*: The aim of this project is to partially replace cement with non-recyclable plastic waste (polythene bags, lessthan 40 microns) in paver blocks and to reduce the cost of paver blocks when compared to that of conventional concrete paver blocks. At present nearly 56 lakh tonnes of plastic waste is produced in India per year. The degradation rate of plastic waste is also a very slow process. Hence the project is helpful in reducing plastic waste as well as reusing it to make objects for efficient and optimum utility. In this project we have used plastic waste in different proportions with fine aggregate and cement. The paver blocks were prepared and tested and the results were discussed. In many developing countries low-density polyethylene (LDPE) sheets, bags and water sachets are a major waste problem because local collection and recycling systems do not exist. As a result, LDPE has no value and is dumped causing aesthetic, environmental and public health issues. The application of this technology is an example of a community-driven waste management initiative that has potential to impact on the global plastics waste crisis because it can transform waste LDPE and other readily available types of plastics into a valuable local resource.**

Keywords: LDPE (Low density polythene), paver blocks, optimum utility, waste management.

1.0 INTRODUCTION

Paver block paving is versatile, aesthetically attractive, functional, and cost effective and requires little or no maintenanceif correctly manufactured and laid. 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. Natural resources are depleting worldwide at the same time the generated wastes from the industry and residential area are increasing substantially. Sustainable development for construction involves the use of Unconventional and innovative materials, and recycling of waste materials in order to compensate for the lack of natural resources and to find alternative ways of conserving the environment. Plastic waste used in this work was brought from the surrounding areas. Currently about 56 lakh tonnes of plastic waste dumped in India in a year. The dumped waste pollutes the surrounding environment. As a result it affects both human beings and animals in direct and indirect ways. Hence it is necessary to dispose of plastic waste properly as per the regulations provided by our government. The replacement of plastic waste for cement provides potential environmental as well as economic benefits.

2.0 BACKGROUND

Polyethylene (PE) is one of the most versatile and widely used thermoplastics in the world because of its excellent properties like toughness, near-zero moisture absorption, excellent chemical inertness, low coefficient of friction, ease of processing and unusual electrical properties. During the last few decades, polymer-matrix composites (PMCs) have beenof interest to industry and academia, especially in the areas of automotive, aerospace, electronic systems, medical products, civil construction, chemical industries, and other consumer applications Paver block paving is versatile, aesthetically attractive, functional, and cost effective and requires little or no maintenance if correctly manufactured and laid. 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. Natural resources are depleting worldwide at the same time the generated wastes from the industry and residential areas are increasing substantially.

Sustainable development for construction involves the use of Unconventional and innovative materials, and recycling of waste materials in order to compensate the lack of natural resources and to find alternative ways of conserving the environment. Plastic waste used in this work was brought from the surrounding areas. Currently about 56 lakh tonnes of plastic waste dumped in India in a year. The dumped waste pollutes the surrounding environment. As a result it affects both human beings and animals in direct and indirect ways. Hence it is necessary to dispose of plastic waste properly as per the regulations provided by our government. The replacement of plastic waste for cement provides potential environmental as well as economic benefits. With the view to investigate the behaviour of quarry rock dust, recycled plastic, production of plastic paver blocks from the solid waste a critical review of literature was taken up. An attempt was made by us to reuse the solid waste quarry dust fly-ash and PET with an aim not to lose the strength far from original Paver blocks. From the observations of test results, PET can be reused with 50% of quarry dust and 25 % of fly-ash in Plastic Paver block. The physical and mechanical properties of materials used in Plastic Paver block were investigated. For the test 6 cubes were cast for measuring Compressive strength. We used recycled plastic aggregate in various proportions in concrete mix and checked their stability. Amount of waste plastic being accumulated in the 21st century has created big challenges for their disposal,

thus obligating the authorities to invest in felicitating the use of waste plastic coarse aggregate in a concrete is fundamental to the booming construction industry. Three replacement levels of 10 %, 20 %, 30 by weight of aggregates were used for the preparation of the concrete.

3.0 CONTROL 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 a compressive testing machine. The mix proportion were in the ratio of (1:2, 1:3, 1:4, 1:5, 1:6) These are the ratio which represent the plastic, sand respectively In first step we should collect the waste plastic bags andthe bags are sorted out and remaining are disposed of safely. Next the collected waste bags are cleaned with water and dried to remove the water present in it after this the plastics are burned out by using stones and firewood. The stones are arranged to hold the drum and the firewood is placed in the gap between the stones and it is ignited. The drum is placed over the above setup and it is heated to remove the moisture present in it. Then the plastic bags are added to the drum one by one and the river sand is added to the plastic when it turns into hot liquid. The sand is mixed thoroughly using rod and trowel before it hardens. The mixture has a very short setting hence the mixing process must not consume more time on the other hand the process should be complete. In case of Paver blocks, Red oxide is added (less than 10% of the total weight) to impart dark red colour. These mixtures are then poured into the brick mould and they are compacted using steel rod and the surface is finished using a trowel. Before placing the mixture into the mould, the sides of the mould are oiled to easy removal of bricks.

4.0 PREPARATION OF SPECIMEN

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A. Casting & Curing :

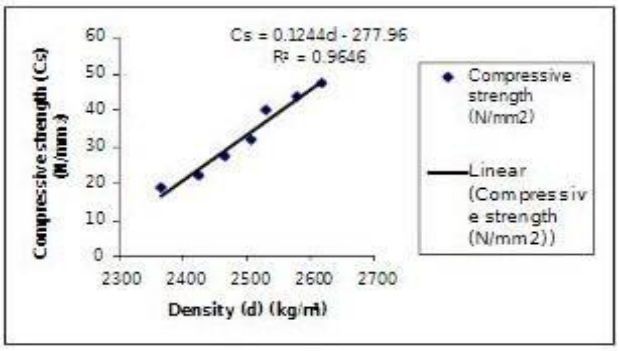
Usually for constructional work the mostly M20 Grade of concrete is used. Hence in this project M20 concrete is used and waste plastic is replaced by aggregate. aggregates such as 0% 2% 4% 6% 8% 10% were added in percentage and it was replaced by cement and waste plastics. Concrete block and solid block of size 200mm*150mm*60*mm (paver block) & 200*100*65 mm were casted and tested for 7 and 28 days' strength

Table : Effect of plastic content on density and water absorption

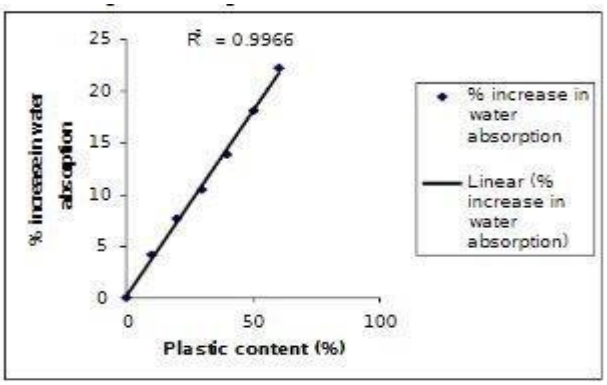
Water cement ratio	Plastic content (%)	Density (Kg/m^3)	Reduction in density (%)	Water absorption (%)	% rise in water absorption
0.45	0	2617.50	0.00	1.44	0.00
	10	2578.23	1.5	1.50	4.17
	20	2531.25	3.29	1.55	7.64
	30	2507.92	4.19	1.59	10.42
	40	2467.08	5.75	1.64	13.89
	50	2426.25	7.31	1.70	18.06
	60	2367.50	9.55	1.76	22.22

B. Influence of Plastic Content on Density and Water Absorption: The influence of plastic content on density and water absorption is demonstrated in the Table above. It is observable that the density decreases as the plastic content increases. The density was lowered by about 10% when 60% of the total fine aggregate was replaced by plastic. The slump in density may be due to the low specific gravity of plastic (1.1) as compared to that of sand (2.6). The difference in the specific gravity exhibits that sand is heavier than plastic. Partially replacing volume of the sand by plastic would certainly reduce the masses of the PCPBs. The relationship between plastic content and % increase in water absorption was found to be linear. The R2 = 0.9966 indicates that 99.66% of the variation in water absorption can be explained by plastic content.

C. Relationship between Density and Compressive Strength:
The graph displays the relationship between density and compressive strength of the PCPBs for water cement ratio of 0.45. It is apparent that there is linear correlation between the density and the compressive strength. The R2 was found tobe 0.9646. This suggests that 96.46% of the variation in compressive strength can be explained by the density of the PCPBs. It is also noticeable that compressive strength (Cs) = – 277.96 + 0.1244d. The – 277.96 is the constant value for determining the compressive strength. The 0.1244 means if density (d) is increased by one unit compressive strength will on average increase by 0.1244. A Pearson correlation was conducted to determine whether the correlation is statistically significant. It was realized that r = 0.982 and P < 0.001 (Table 6). Positive value of rindicates that as density increases, compressive strength increases. P < 0.001 shows that the correlation is statisticallysignificant.



Relationship between density and compressive strength for w/c ratio



Relationship between density and compressive strength for W/C Ratio of 0.45

5.0 CONCLUSION:

- The following conclusions were drawn from the experimental investigation

1. The utilization of waste plastic in production of paver blocks has a productive way of disposal of plastic waste.
2. The cost of paver block is reduced when compared to that of concrete paver block.
3. Paver blocks made using plastic waste, quarry dust, coarse aggregate and ceramic waste have shown better results.
4. It also shows good heat resistance.
5. Though the compressive strength is low when compared to the concrete paver block it can be used in gardens, pedestrian path and cycle way etc.
6. It can be used in Non-traffic and light traffic roads.
7. Not suitable in areas of heavy traffic.