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UTILISATION OF WASTE PLASTIC IN CONCRETE PAVER BLOCK AS A PARTIAL REPLACEMENT OF COARSE AGGREGATE

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Abstract - *Concrete paving blocks are ideal materials on the footpaths and roads for easy laying, better look and finish. Plastic bottles was cleaned and shredded into small irregular shape. Then, it was incorporate with the concrete and the test was conducted to find out the suitable strength for concrete that will be applied as paver block. The study was conducted by using paver mould to investigate the compressive strength of the M20 grade of concrete with percentage variation of 2.5, 5, and 7.5% of waste plastic replacing coarse aggregate.*

Key Words: **Concrete**, **Paver blocks, compressive strength, concrete, waste plastic.**

1. INTRODUCTION

Cement concrete paving blocks are precast solid products made out of cement concrete. The product is made in various sizes and shapes viz. rectangular, square and round blocks of different dimensions with designs for interlocking of adjacent tiles blocks. The raw materials required for manufacture of the product are Portland cement and aggregates which are available locally in every part of the country. Cement concrete paving blocks find applications in pavements, footpaths, gardens, passenger waiting sheds, bus-stops, industry and other public places. The product is commonly used in urban areas for the above applications. Hence, the unit may be set up in urban and semi-urban areas, near the market. A lot of face-lift is being given to roads, footpaths along the roadside. Concrete paving blocks are ideal materials on the footpaths for easy laying, better look and finish.

Paver block paving is versatile, aesthetically attractive, functional, and cost effective and requires little or no maintenance if correctly manufactured and lay. 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. The sustainable development for construction involves the use of nonconventional and innovative materials, and recycling of waste materials in order to compensate the lack of natural resources and to find alternative ways conserving the environment. Plastic waste used in this work was brought from the surrounding areas. The dumped waste pollutes the surrounding environment. As the result it affects both human beings and animals in direct and indirect ways. Hence it necessary to dispose the 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 OBJECTIVES:

The present study aims at the performance of waste plastic in concrete paver blocks for use in pavements and other application areas. The compressive strength properties for concrete paver blocks have been studied for various concrete mixes with varying percentages of material. In this study on the use of plastic in concrete without any admixtures and compares the performance with conventional concrete. This Concrete paver block has M20 mix which is suitable for non-traffic areas like pathways, public gardens, pedestrian plazas and shopping complex.

3. SCOPE AND BENEFITS

PVC plastic waste is used in this project to reduce the environmental pollution. Plastic in concrete gives durability, resistance to corrosion, good insulation for heat, cold and sound saving energy, light weight and economically valuable. This research is carried out to investigate the performance of concrete containing Polyethylene Terephthalate (PET) bottle waste as coarse aggregate. PET bottle waste was chosen because it is being thrown after single use and cause environmental problem. This PET concrete then will be applied as a paver block for pedestrian walk. To reduce the waste, bottles was shredded and used in concrete mixture as a coarse aggregate.

4. MATERIALS AND DESIGN:

4.1 Cement: Cement used for the work was ordinary Portland cement of 53 grade confirming to IS: 12269-1987.

Table1: Physical requirements for cement

Sl. No.	Property	Result
1.	Specific gravity	2.94
2.	Normal consistency	29%
3.	Initial setting	30mins
4.	Final setting	5hours 10mins

4.2 Fine aggregate: Locally available natural river sand was used as fine aggregate. The properties of sand conducting tests as per IS: 2386 (Part- I).

Table2: Physical properties of fine aggregate

Sl. No.	Property	Result
1.	Specific gravity	2.57
2.	Fineness modulus	3.23
3.	Water absorption	0.6%

4.3 Coarse aggregate: Obtained from the local quarry, consisting of 20 mm maximum size of aggregates with specific gravity of 2.7.

4.4 Water: Portable water free from impurities and salt used for casting and curing the concrete paver blocks as per IS – 456-2000.Water cement ratio of 0.45 is adopted.

4.5 Waste plastic: PET bottles were cleaned and shredded into small irregular shape. Then, it was incorporated with the concrete and the test was conducted to find out the suitable strength for PET concrete that will be applied for paver block.

MIX design:

The experimental program was designed to compare the compressive strength properties of M20 grade of concrete with different replacement levels of coarse aggregate with waste plastic 0%, 2.5%, 5%, and 7.5% of coarse aggregate as per IS: 10262:2009 for 7 and 28 days of testing.

4. RESULTS AND DISCUSSIONS

To evaluate the compressive strength of paver block, the Compressive testing machine is used. Compressive strength is calculated by following formula:

Compressive Strength = Load/cross section area of paver

Table 3: Compressive strength test for 7 days

Case 1: Conventional concrete

Sl.No.	Load (kN)	Compressive strength (N/mm²)	Average Compressive strength (N/mm²)
1.	430	13.71	14.56
2.	460	14.67	
3.	480	15.31	

Case 2: 2.5% plastic replacement of coarse aggregate

Sl.No.	Load (kN)	Compressive strength (N/mm²)	Average Compressive strength (N/mm²)
1.	450	14.35	14.88
2.	460	14.67	
3.	490	15.62	

Case 3: 5% plastic replacement of coarse aggregate

Sl.No.	Load (kN)	Compressive strength (N/mm²)	Average Compressive strength (N/mm²)
1.	480	15.31	16.05
2.	500	15.94	
3.	530	16.90	

Case 4: 7.5 % plastic replacement of coarse aggregate

Sl.No.	Load (kN)	Compressive strength (N/mm²)	Average Compressive strength (N/mm²)
1.	410	13.07	12.96
2.	430	13.71	
3.	380	12.12	

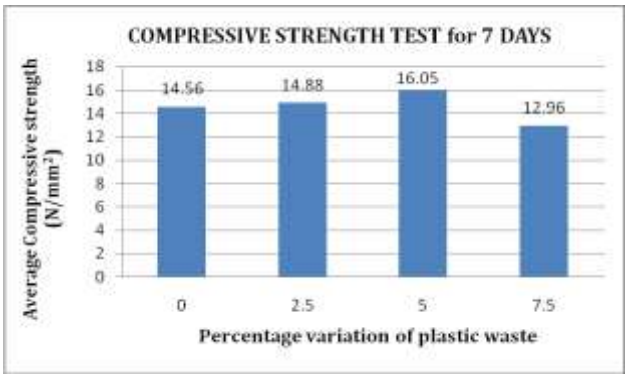

Figure 1: Average 7 days compressive strength

Table 4: Compressive strength test for 28 days

Case 1: Conventional Concrete

Sl.No.	Load (kN)	Compressive strength (N/mm²)	Average Compressive strength (N/mm²)
1.	720	22.96	23.70
2.	760	24.24	
3.	750	23.92	

Case 2: 2.5% plastic replacement of coarse aggregate

Sl.No.	Load (kN)	Compressive strength (N/mm²)	Average Compressive strength (N/mm²)
1.	710	22.65	24.13
2.	760	24.24	
3.	800	25.51	

Case 3: 5% plastic replacement of coarse aggregate

Sl.No.	Load (kN)	Compressive strength (N/mm²)	Average Compressive strength (N/mm²)
1.	780	24.88	24.40
2.	800	25.51	
3.	810	25.83	

Case 4: 7.5 % plastic replacement of coarse aggregate

Sl.No.	Load (kN)	Compressive strength (N/mm^2)	Average Compressive strength (N/mm^2)
1.	720	22.96	23.56
2.	730	23.28	
3.	750	23.92	

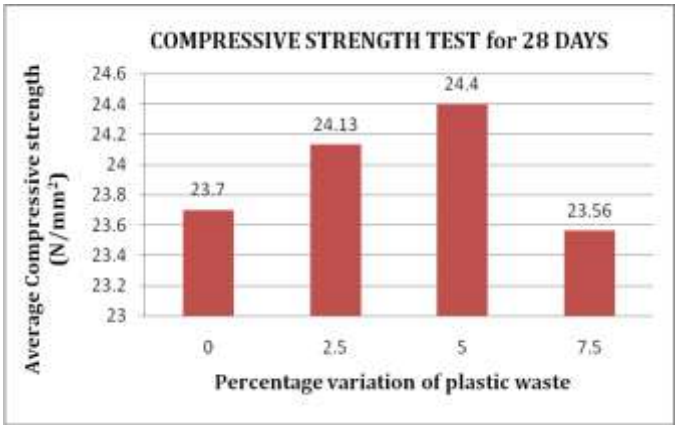

Figure 2: Average 28 days compressive strength

5. CONCLUSIONS

From the above discussion we can conclude that,

1. The optimum percentage addition of plastic waste is 5% of coarse aggregate.
2. The compressive strength is increased by 2.95% for 28 days strength test when compared with conventional concrete.
3. The compressive strength is increased by 10.23% for 7 days strength test when compared with conventional concrete.
4. Partial addition of plastic waste can improve the strength properties of concrete paver blocks.
5. Use of plastic can be possible to improve the properties of concrete which can act as a one of the plastic reusable method.

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BIOGRAPHY

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