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USE OF PLASTIC WASTE AS A PARTIAL REPLACEMENT OF AGGREGATE IN PAVER BLOCKS

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Abstract - *There are many studies evaluating industrial by-product in cement as binder and aggregate in concrete industries. In the recent decades, the efforts have been made to use industry by-products such as Fly ash, silica fume, ground granulated blast furnace slag, glass cullet, etc., in civil construction. The potential application of industry by-product in concrete is as partial aggregate replacement or as partial cement replacement, depending on their chemical composition and grain size. In this study, the effects of use of such waste product on resultant properties of concrete mix are studied. This waste product is used as replacement of coarse aggregate.*

Key Words: **Compressive stength , concrete, plastic waste, Paver Block, worlability.**

1. INTRODUCTION

The rapid industrialization and urbanization in the country leads lot of infrastructure development. This process leads to several problems like shortage of construction materials, increased productivity of waste and other products. This paper deals with the reuse of waste plastic as partial replacement of coarse aggregate in M20 concrete. Usually M20 concrete is used for most constructional works. Waste Plastic were immediately added in 0%, 2%, 2.5%, 3%, 3.5%, 4%, 8% , and 10% to replace the same amount of Aggregate. Tests were conducted on coarse aggregate, cement, and waste plastic to determine their physical properties. Paver blocks of size 200mm X 200mm X 60mm was casted and tested for 7, 14, and 21 days strength.The result shown that the compressive strength of M20 concrete.

.1.1 Paving Block:

Paving blocks have made a fast inroad into the construction industry, and have almost become the defector choice. Most construction firms nowadays prefer paving blocks over slabs, asphalt, stone or clay. Mass production of paving blocks has reduced their price, and made it easily affordable. With the advent of paving block machines, it has become even simpler to complete their laying.

1.2 Types of paver blocks

- Concrete Paving Blocks**:**

Concrete blocks are mass manufactured to standard sizes. This makes them interchangeable. Typical concrete paving blocks have one smooth face and one rough, although some paving blocks so come with reversible surfaces (can be used both sides). The performance characteristics of concrete paving blocks make it suitable for the heaviest duty applications, able to support substantial loads and resist shearing and braking forces. These blocks come in different colours. The colours typically come from metallic oxides. However, these colours tend to fade over a period of time, so it is helpful to exercise caution while selecting them! Concrete paving blocks are the most preferred choice for laying of pavements driveways, etc.

- Clay Paving Blocks

Clay paving blocks (also called as bricks or cobbles) are generally available as typical, rectangular bricks, although custom shapes can be made for specific projects. Unlike the concrete paving blocks, both the surfaces of most clay blocks are fully useable or interchangeable. Clay bricks do not use any dyes to impart color; they come in natural color. Consequently, the color of these blocks does not usually fade with time. Clay paving blocks are more difficult to cut than their concrete counterpart.

2. Advantages and disadvantages of using plastics

➢ Advantages of using plastic in concrete

- Extreme versatility and ability to be tailored to meet specific technical needs.
- Lighter weight than competing materials reducing fuel consumption during transportation.
- Durability and longevity.
- Resistance to chemicals, water and impact.
- Excellent thermal and electrical insulation properties.
- Comparatively lesser production cost.
- Far superior aesthetic appeal.

- Material of choice – human life style and plastic are inseparable.

➢ Disadvantages of using plastic in Concrete

- Plastics are having low bonding properties so that the strength of concrete gets reduced such as compressive, tensile and flexural strength.

3. Experimental work

❖ Materials

➢ Aggregates (Coarse and Fine Aggregates)

Various properties of aggregates can influence the performance of concrete; therefore various considerations have to be kept in mind while selecting the material. Aggregates used in present study, were tested for their specific gravity and other properties and results have been tabulated.

➢ Cement

Ordinary Portland cement of 43 – grade was used as it satisfied the requirements of IS: 269 – 1969 and results have been tabulated

➢ Mixing and Curing Water

IS: 456 – 2000 (Cl. 2.20) water, used for mixing and curing of concrete. Permissible limits for solids in water are as per IS: 456 – 2009. The maximum permissible limit of chloride content in water for RCC work has been reduced from 1000mg per litre in IS: 456 – 1978 to 500mg per litre in IS: 456 – 2000. In addition to these requirements acidity and alkalinity for water has to be considered.

➢ Plastics

Plastics that cannot be degraded further is been powdered into fine particles. These plastics con-sits mainly of High Density Polyethylene (HDPE).

➢ Casting and Curing

Usually M20 concrete is used for most constructional works, hence in this project M20 concrete is taken and waste plastics is used as Replacement of aggregate. Aggregates such as 0%, 2%, 2.5%, 3%, 3.5%, 4%, 8% and was added in percentage, in order to replace the same amount of Aggregate. Tests were conducted on coarse aggregates, fine aggregates, cement and waste plastics to determine their physical properties. Concrete blocks (Paver Block) and 200 mm X 200 mm X 60 mm were casted and tested for 7, 14 and 21 days strength.

▪ Various test conducted in lab:

1) Physical properties of cement

Specific Gravity	3.15
Initial setting time	38 min
Final setting time	329 min

2) Physical properties of plastic

Specific Gravity	0.95
Density(gm/cc)	0.58
Melting Point	75-100
Softening Point	110

3) Physical properties of aggregate

Type of aggregate	Coarse
Specific Gravity	2.6
Water Absorption	0.5%
Surface Moisture	Nil
Aggregate impact value	18.57%
Aggregate crushing value	17.88%
Los Angeles Abrastion value	23.60%

➢ Casted Paver Blocks

➢ Curing of Paver blocks

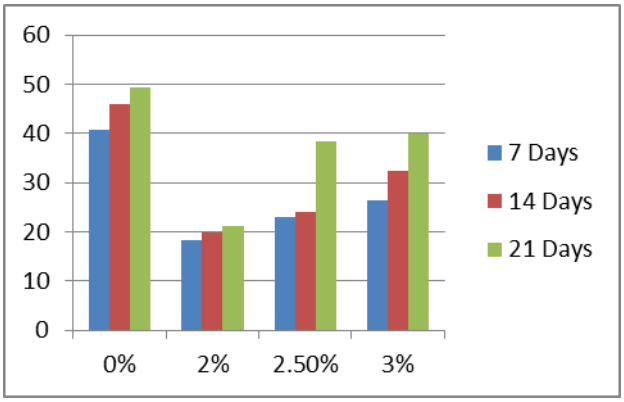
4. RESULT ANALYSIS

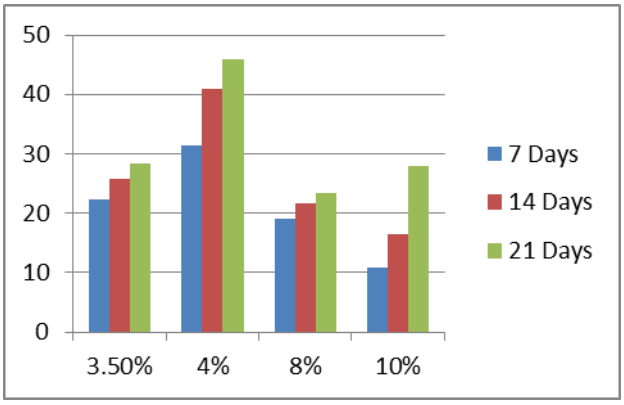
➢ COMPRESSIVE STRENGTH TEST

Cubical specimens of size 200mm X 200mm X 60mm were cast for conducting compressive strength test for each mix. The compressive strength test was carried out as per IS: 516-1979. This test was carried at the end of 7, 14 and 21 days of curing. The compressive strength of any mix was taken as the average of strength of three cubes.

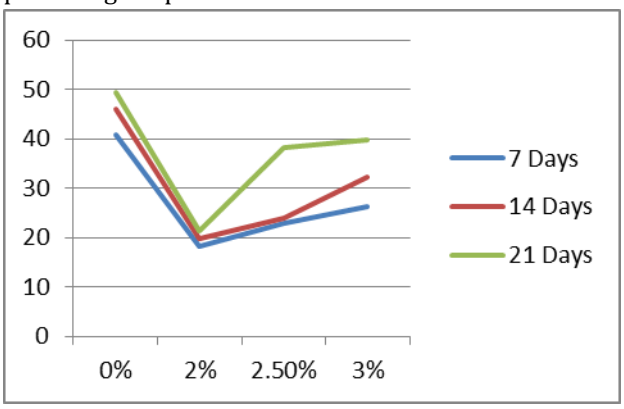
Sr.No.	% of Replacement	Weight(KN)	Curing Period (Days)	Strength(KN)	Compressive Strength (N/mm^2)
1.	0%	5.500	7	1632	40.800
	0%	5.420	14	1840	46.000
	0%	5.700	21	1971	49.275
2.	2%	6.200	7	731	18.275
	2%	5.960	14	794	19.850
	2%	6.020	21	850	21.250
3.	2.5%	6.060	7	920	23.000
	2.5%	6.260	14	960	24.000
	2.5%	6.380	21	1530	38.250
4.	3%	6.160	7	1054	26.350
	3%	6.320	14	1294	32.350
	3%	6.100	21	1594	39.850
5.	3.5%	6.240	7	891	22.275
	3.5%	6.480	14	1031	25.775
	3.5%	5.960	21	1132	28.300
6.	4%	5.800	7	1253	31.325
	4%	5.700	14	1636	40.900
	4%	6.100	21	1835	45.875
7.	8%	6.360	7	759	18.975
	8%	6.200	14	867	21.675
	8%	6.120	21	937	23.425
8.	10%	6.300	7	430	10.750
	10%	5.920	14	656	16.400
	10%	5.920	21	1117	27.925

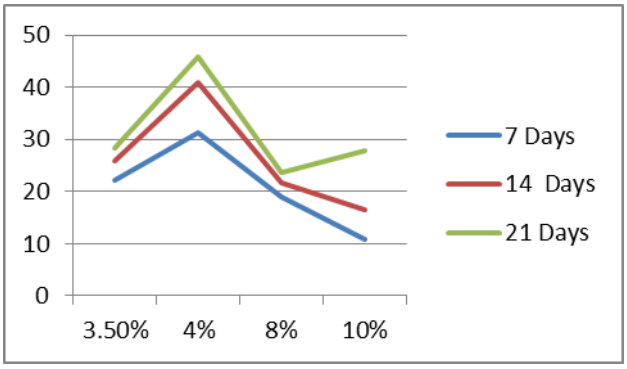
- Effect of change of different percentage of Aggregate on compressive strength of concrete with % plastic.





- Comparison of compressive strength with different percentage of plastic





5. Conclusion

Paver block is casted using partial replacement of coarse aggregate in this experiment. Here we used M20 concrete mix for casting paver blocks. Paver blocks using 0%, 2%, 2.5%, 3%, 3.5%, 4%, 8% and 10% of plastic coarse aggregates are casted. From the results, it is observed that the compressive strength for 2.5%, 3%, 4% replacement of plastic coarse aggregate is **HIGH** and decreases at 10% replacement of plastic coarse aggregate.

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