Implementation of Plastic Waste in Manufacturing of Paving Blocks for Different Shapes

RUGVED G. WANKHADE[1], DR. S. G. MAKARANDE[2], R. S. KEDAR[3]
[1] *PG Student, Bapurao Deshmukh College of Engineering, Sevagram,Wardha*
[2, 3] *Professor, Bapurao Deshmukh College of Engineering, Sevagram,Wardha*

Abstract- ***Block Paving is a commonly used decorative method of creating a pavement or hardstanding. The main benefit of Paving Blocks Over other materials is that it can later be replaced. Also from Asthetic point of view, Pavers are good. Paving Blocks are generally used for Pedestrian, Parking, etc. Different types of manufacturing methods are now carried out to use some non-degradeable material. Plastic Waste is increasing day by day which pollutes the environment. So, it is very much important to implement these waste material such that it can be used for different purposes like recycling and reusing. The disposal of waste plastics (PET, PP, etc.) is a biggest challenge, as repeated recycling of PET bottles poses a potential danger of being transformed to a carcinogenic material and only a small proportion of PET bottles are being recycled. Because of costly conventional recycling techniques, there has been an increased demand for more scientific and innovative technologies to effectively recycle these materials. But it is not completely possible to reuse and recycle those waste again and again due to danger of cancer. In this project we will use plastic waste in the manufacturing of paving blocks for different shapes and compare their strengths.***

Indexed Terms- Poly ethylene teryphthalate (PET), PolyPropylene (PP).

I. INTRODUCTION

Plastic is a very useful substance in our daily life work, but after the use of plastic it is very difficult for us to dispose of it because it is a non-biodegradable substance. After its usage it is a hazardous material. The properties of plastic are very unique and it can mix with every kind of material. Plastic is a composition of synthetic and semi synthetic organic compounds. They are malleable and ductile and remold into any solid substance. Plastic is used in various objects which we use in our daily life like polythene, plastic cups, furniture, bags, packaging of food and other accessories, drinking containers, bottles, frames, basins etc. We need to use better advance techniques and methods to dispose plastic waste properly, otherwise, the time is not too far away where we see it as a big challenge for us to dispose it. Researchers suggest that if plastic isn't disposed of soon, it can sustain for 4500 years without degradation. Now, these days the rate of plastic use keeps increasing. So the collection of plastic waste is increasing at a rapid speed. The usage of plastic can't be banned, but we can reuse it in many ways. Plastic can be reused in various sectors like marketing, manufacturing, transportation etc. In construction sector, we can use the plastic waste on a very large scale after recycling it, which means the problem of plastic waste can be removed for a long time period. It seems to be more practicable and efficient method to solve this problem.

II. AIM & OBJECTIVE

Aim: To Implement the Plastic Waste which is harmful for environment/Ecological imbalance by using them in manufacturing of paving blocks.

Objective:

- To learn about new waste management techniques, which will help in reducing the harmful substances present in the environment.
- To develop an alternative material which could satisfy requirements of good material.
- To reduce the consumption of natural resources.
- Develop appropriate environmental assessment, implementation and monitoring activities related to different waste collection methodologies and the respective benefits to improve current waste management practices.

III. LITERATURE VIEW

- Influence of non-metals recycled from waste printed circuit boards on flexural properties and fracture behaviour of polypropylene composites, Yanhong Zheng, Zhigang Shen
  It has been done the work to describes Flexural strength and flexural modulus of the composites can be successfully improved by filling nonmetals recycled from waste printed circuit boards (PCBs) into polypropylene (PP). By using scanning electron microscopy (SEM), the influence of IJTSRD38110International Journal of Trend in Scientific Research and Development (IJTSRD) @ www.ijtsrd.com eISSN: 2456-6470 @ IJTSRD | Unique Paper ID – IJTSRD38110 | Volume – 5 | Issue –1 | November-December 2020 Page 967 nonmetals on fracture behavior of PP composites is evaluated by in situ flexural test.

- Use of recycle plastic bag waste in the concrete, YoucefGhernouti et al.
  The study presents the partial replacement of fine aggregate in concrete by using plastic fine aggregate obtained from the crushing of waste plastic bags. Plastic bags waste was heated followed by cooling of liquid waste which was then cooled and crushed to obtained plastic sand having fineness modulus of 4.7. Fine aggregate in the mix proportion of concrete was replaced with plastic bag waste sand at 10%, 20%, 30% and 40% whereas other concrete materials remain same for all four mixes. In fresh properties of concrete, it was observed from the results of slump test that with increase of waste content workability of concrete increases which is favorable for concrete because plastic cannot absorb water therefore excessive water is available.

- Use of plastic in a concrete to improve its properties, Raghatate Atul M
  The paper is based on experimental results of concrete sample casted with use of plastic bags pieces to study the compressive and split tensile strength. He used concrete mix by using Ordinary Portland Cement, Natural River sand as fine aggregate and crushed granite stones as coarse aggregate, portable water free from impurities and containing varying percentage of waste plastic bags (0%, 0.2%, 0.4%, 0.6% 0.8% and 1.0%).

- innovative technique of waste plastic use in concrete mixture, Pramod S. Patil.et al
  This study presents the use of plastic recycled aggregate as replacement of coarse aggregate for production of concrete. They used forty-eight specimen and six beams/cylinders casted from variable plastic percentages (0, 10, 20, 30, 40 and 50%) used as replacement of coarse aggregate in concrete mixes. They have conducted various tests and observed decrease in density of concrete with increase percentage of replacement of aggregate with recycle plastic concrete. They also reported decrease in compressive strength for 7 and 28 days with increase in percentage of replacement of coarse aggregate with recycle plastic aggregate. They have recommended feasibility of replacing 20 % will satisfy the permissible limits of strength. Again, these researchers limited their research to only compressive strength property and no work was carried out to study the other important properties of concrete. Their research also lacks use of various admixtures in concrete to cater for the loss in strength.

- Study of Strength Property of Concrete Using Waste Plastics and Steel Fibers, KhileshSarwe. [2014]
  This study presents the results of addition of waste plastics along with steel fibers with an objective to seek maximum use of waste plastic in concrete. Two different categories of mix were casted in cubes (150mm x 150mm x 150mm), one with varying percentages of plastic wastes (0.2%, 0.4%, 0.6%, 0.8% and 1% weight of cement) and another mix of plastics waste/steel fibers (0.2/0.1, 0.4/0.2, 0.6/0.3, 0.8/0.4 and 1/0.5 % by weight of cement) to study the compressive strength at 7- and 28-days strength. The combine mix of plastic waste and steel fibers has shown more strength as compare to concrete mix prep only with plastic waste. He has reached to conclusion that a plastic waste of 0.6% weight of cement when used with steel fiber of 0.3 % (weight of cement) has shown the maximum compressive strength.

IV. MIX DESIGN

4.1 Definition

Mix design is the process of selecting suitable ingredient if concrete and determines their relative proportions with the object of certain minimum strength and durability as economically as possible.

4.2 Objective of Mix Design

The objective of concrete mix design as follows.

- The first objective is to achieve the stipulated minimum strength.
- The second objective is to make the concrete in the most economical Manner. Cost wise all concrete's depend primarily on two factors, namely cost of material and cost of labor.

4.3 Mix Proportion

Cement	Fine aggregate	Coarse aggregate	Water
288	790.02	994	170.39
1	2.21	3.09	0.45

V. MATERIAL PROPERTIES

5.1 Cement

Ordinary Portland cement of 43 grade conforming to Indian Standard IS 12269-1987 **9** was used throughout the experimental program. The standard consistency was 28%, whereas the initial and final setting times were 95 min. and 210 min. respectively. The specific gravity of cement was 3.14 and its compressive strength after 28 days was 57 MPa.

5.2 Coarse Aggregate

In this investigation, two types of coarse aggregates were used for preparation of concrete, Natural Coarse Aggregate. (NCA) and Plastic Coarse Aggregate.

5.3 Natural Coarse Aggregate (NCA)

Crushed hard granite chips of maximum size 20 mm were used in the concrete mixes. The bulk density of aggregate was 1460 kg/m3 and specific gravity was found to be 2.65.

5.4 Sand

Fine aggregate (sand) used for this entire investigation for concrete was river sand conforming tozone-II of IS: 383-1970 10. The fineness modulus was 2.81.

5.5 Water

Potable water conforming to IS 456-200011 was used for casting and curing

5.6 Plastic Waste

In this work Crushed Plastic is used in place of coarse aggregate as partial replacement which is a crushed stone. Plastic bottles were taken to nearby MIDC, Sewagram area and the bottles were crushed in the grinder and small plastic chips were formed.

VI. PREPARATIO OF SPECIMENS

6.1 Batching

All cement, sand, coarse aggregate and coconut shell measured with digital balance. Water is measuring cylinder of capacity 1 lit and measuring jar of capacity 100 ml and 200 ml.

6.2 Mixing of concrete

The ingredients are thoroughly mixed in concrete mixer. The sand, cement and aggregate are measured accurately.

6.3 Rubber Moulds

Rubber Moulds are of two different shapes, cleaned first and oiled for easy stripping. The rubber moulds for conducting tests on fresh concrete were made ready and inner surface was oiled.

6.4 Placing and Compaction

To avoid the bond formation between moulds and concrete just clean and oil the moulds before pouring concrete. Place the fresh concrete and tamp each surface 25 time. Clean the mounds and apply grease. Fill the concrete in the moulds in 3 equal layers.

6.5 Demoulding

After leveling the fresh concrete in the mould, it was allowed to set for 24 hours. The identification marks of concrete specimens were done with permanent markers and the specimens were removed from the mould. The moulds were cleaned and kept ready for next batch of concrete mix.

6.6 Curing

Curing is an important process to prevent the concrete specimens from losing their moisture while they are gaining their required strength. Inadequate curing is also the cause of unexpected cracks on the surface of concrete specimen.

XII. COMPRESSIVE TEST RESULT

%Replaced byplastic waste	Days	sample	0 %	5%	10%	15
Compressive Strength (N/mm2)	7 Days	P1	22.30	19.40	18.25	16.30
		P2	21.15	20.10	18.50	16.70
		P3	20.60	19.70	19.10	16.90
		Avg	21.35	19.73	18.61	16.63

Table No.1 Result of compressive Strength of U-shaped paving block after 7 days (N/mm2)

% Replaced by plastic waste	Days	samples	0%	5%	10%	15%
ompressive Strength (N/mm2	7 Days	P1	23.25	21.10	19.20	16.20
		P2	23.20	21.60	18.75	16.00
		P3	22.80	20.50	18.60	17.10
		Avg	23.08	21.06	18.85	16.43

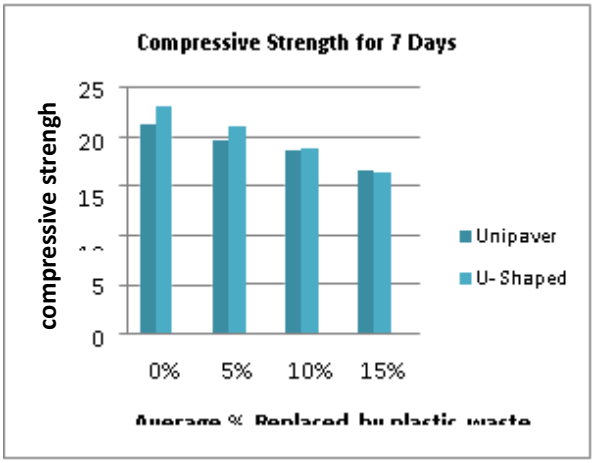
Table No.2 Result of compressive Strength of *Rectangular* paving block after 7 days (N/mm2)

%Replaced by plastic waste	Days	sample	0 %	5%	10%	15
Compressive Strength (N/mm2)	14 Days	P1	24.40	23.10	22.50	20.30
		P2	26.10	22.70	21.60	21.05
		P3	25.10	22.40	21.20	21.30
		Avg	25.20	22.73	21.76	20.88

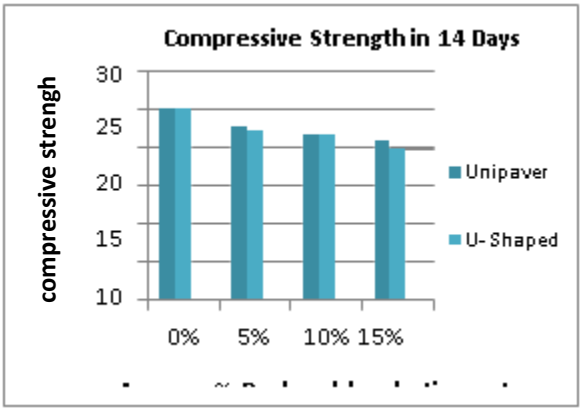
Table No.1 Result of compressive Strength of U-shaped paving block after 7 days (N/mm2)

% Replaced by plastic waste	Days	samples	0%	5%	10%	15%
ompressive Strength (N/mm2	14Days	P1	25.20	22.10	21.60	20.80
		P2	24.60	22.35	22.05	19.40
		P3	25.60	22.55	21.90	19.90
		Avg	25.13	22.33	21.85	20.03

Table No.2 Result of compressive Strength of *Rectangular* paving block after 7 days (N/mm2)



Average % Replaced by plastic waste



Average % Replaced by plastic waste

CONCLUSION

- Up to 10% of aggregate replaced by Plastic waste is good according to strength.
- Plastic waste can be used as a replacement upto a certain limit, after that the strength starts to decrease.
- It is observed that around 15% to 20% of compressive strength can be gained by replaced the aggregate with 10% of plastic waste.

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