

WASTE PLASTIC AS PARTIAL REPLACEMENT FOR AGGREGATES

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Abstract: Presently Solid waste management is the biggest disquietude for environment in our country. Utilization of plastic is growing constantly, even though efforts are being made to reduce the use of plastic. For environment and human wellness, it is very harmful to throw away or discard these solid waste. Everyday it produces a lot of garbage which is very bad for human beings. There are many benefits of robust and feasible reuse of these plastic waste. This project is a point of view for a more comprehensive examination on the use of plastic aggregate as a substitute for coarse aggregate in concrete. In this current project research were done by putting distinctive percentages of plastic aggregate e.g. 0%, 5%, 10%, 15% to get the best possible result (percentage) and to conclude the performance of plastic aggregates on concrete. Research is conducted to determine mechanical and durability properties of concrete consisting of plastic aggregates. And to check its compatibility as a construction material. Studies was done on properties of concrete mix with plastic aggregates. And comparison is done of control mix with normal aggregates.

Keywords: Plastic Aggregates, Concrete, construction material, plastic waste.

I. INTRODUCTION

Plastic needs no introduction. It is the most used Material on earth. Due to its various properties such as strength, durability, and easy processing, it is used in various works. It has been proved by various types of research that it is less affected by various types of chemicals and gives good durability. Plastic disposal is a big problem because it lacks organic compounds. It is non domposable material and it is also not good for our environment and human health. Due to increasing industries and large scale infrastructure development, there is a shortage of construction materials. This paper appears to be a review on recycled plastic waste. As replacement of natural coarse aggregate.

Plastic have number of necessary properties.

1. Plastic is corrosion resistive and durable
2. It provides good insulation against cold & heat .
3. It has longer life and this is budget friendly.
4. Plastic is light in weight

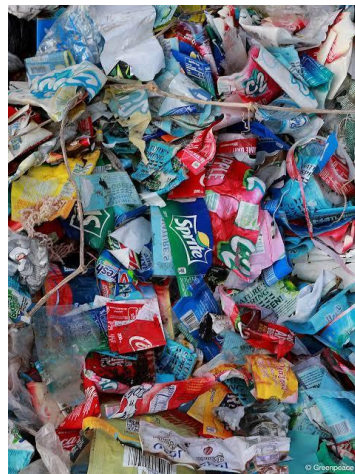


fig 1 : Waste Plastic

II. OBJECTIVE OF THE STUDY

Objective of this study was to modified concrete property using plastic are its

1. Compressive strength
2. Split tensile strength

Other important properties like workability were also be under consideration

III. METHODOLOGY

1. Literature study was done on the use of plastic in fresh concrete.
2. Plastic was collected from the available waste material like water bottle , plastic bags , plastic cups etc.
3. Plastic was melted in container.
4. Then melted plastic was poured in another container and allowed to cool down .
5. Hard and cooled plastic sheets were broken into smaller pieces with the help of hammering and then sieved for getting required size .
6. Necessary tests are done to find out property of cement, sand and aggregate.
7. Mix design was done with the help of is10262:2019
8. Based on the literature survey following percentage of plastic coarse aggregate were adopted

S.No	Concrete Name	Coarse Aggregate % (CA)	Plastic Coarse Aggregate % (PCA)
1	M1	100	0
2	M2	95	5
3	M3	90	10
4	M4	85	15

Table 1 : percentage replacement of CA by PCA

IV. EXPERIMENTAL INVESTIGATION**A. Material properties**

- 1) Cement : ordinary Portland cement (43 grade) was used.
- 2) Water : portable water was used for casting as well as curing of the concrete specimens.
- 3) Fine aggregate : Locally available river sand (zone I) was used for the experiments. to find out various physical properties, laboratory tests was conducted as per IS 383 (part III) - 1970. sieve analysis was done to fine out grain size distribution. specific gravity of fine aggregate is 2.47.
- 4) Coarse aggregate : for proper grading combination of 20 mm and 10 mm aggregate are used . various lab test was conducted to find out physical properties of coarse aggregate as per IS 383 (part III) - 1970 . specific gravity of coarse aggregate was 2.74.
- 5) Admixture: superplasticizer (**fosroc conplast WL**) was used . this increases the workability and strength of concrete.

Supply form	Liquid
pH	7.04
Sp.g.	1.16
Chloride content	< 0.2%
Colour	Brown
Solid content	31.02 % solids

Table 2 : Properties of Admixture

6) Plastic aggregate : plastic was collected from waste plastic shredded factory situated in umarda, Udaipur Rajasthan. Then plastic was melted and form suitable size aggregates. Specific gravity of plastic coarse aggregate is 2.12.



fig 2 : Plastic aggregate

B. Mix proportion

The final proportion was 1 : 2.01 : 3.24 (cement : sand : aggregate) with water cement ratio 0.48 .

V. PROPERTIES OF CONCRETE

A. Fresh properties of concrete

1) Workability of concrete

Slump test is performed with green concrete to find the workability of concrete. it is defined as the ease to do work. this is very important property of fresh concrete.



fig 3 : Slump Test

B. Mechanical properties of hardened concrete**1) Compressive strength of hardened concrete**

To find out compressive strength of concrete specimen, specimen shape will be in cubical and having a size 150*150*150 mm .tests were conducted after 3 days , 7 days and 28 days. The test was done according to indian standard.



fig 4 : Compression test of concrete cube

1) Split tensile strength

Split tensile strength test is performed to find out tensile strength of concrete. In this test tensile strength is obtained by placing the concrete cylinder in the compression testing machine . Compressive force acts horizontally and failure will occurs along the vertical axis. The rate of loading was 2.1 kn/s.

The Split Tensile Strength can be calculated as

$$\sigma_t = \frac{2P}{\pi DL}$$

where, P = load in KN

D= diameter of cylinder

L= Length of cylinder



fig 5 : Split Tensile Strength of concrete specimen

VI. RESULT AND DISCUSSION**A. Workability of concrete**

Mix Name	Slump value (mm)
M1	70
M2	63
M3	41
M4	25

Table 3 : Slump values for different mixes

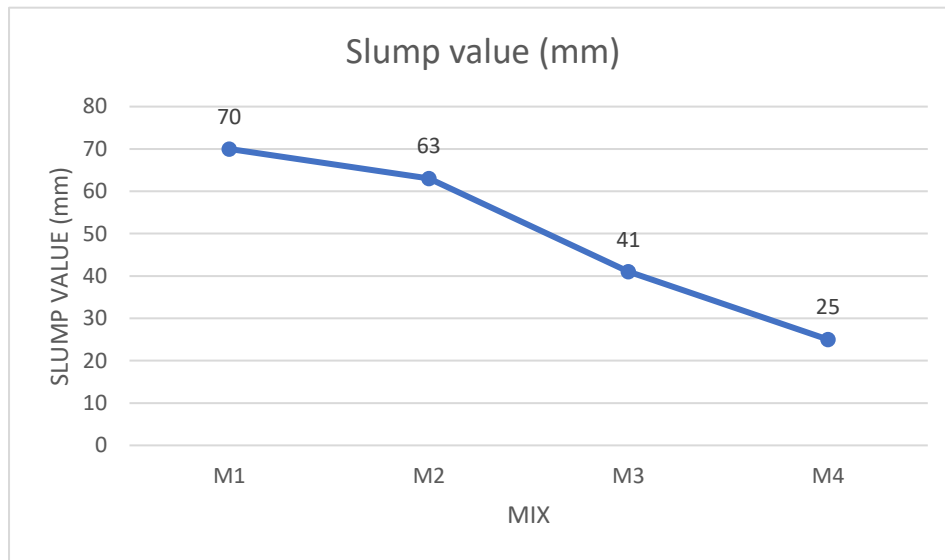


fig 5 : Variation of slump for different mix proportions
Slump test results shows that slump value continuously start decreasing

	% Replacement	3 Days Strength (N/mm ²)	7 Days Strength (N/mm ²)	28 Day Strength (N/mm ²)
M1	0%	15.66	23.55	35.33
M2	5%	12.5	19.8	33
M3	10%	13.23	17.33	29.99
M4	15%	11.52	13.55	27.55

Table 4 : Compressive strength of concrete

B. Compressive strength of hardened concrete

Case 1 : compressive strength after 3 days

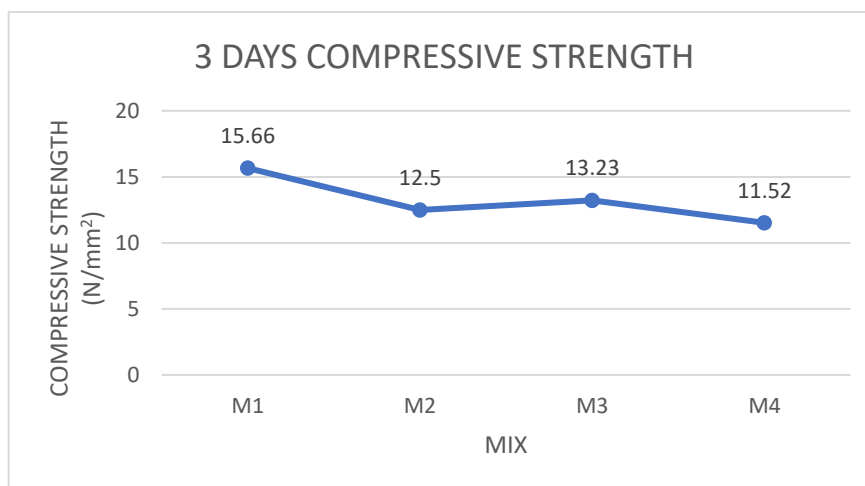


fig 6 : Variation of compressive strength of concrete after 3 days

Case 2 : compressive strength after 7 days

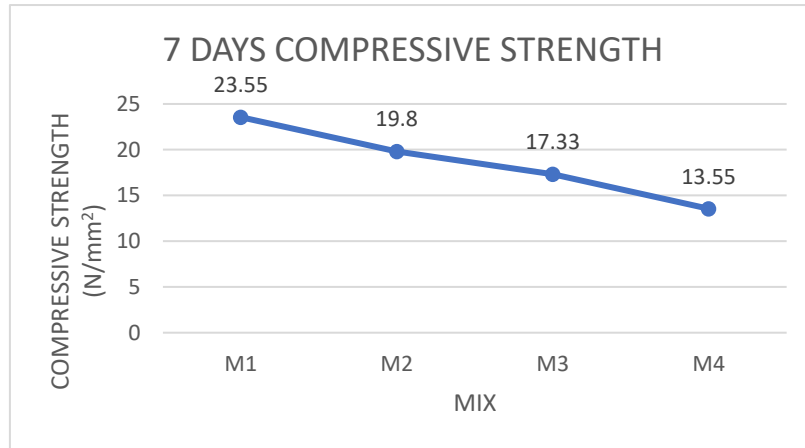


fig 7 : Variation of compressive strength of concrete after 7 days

Case 3 : compressive strength after 28 days

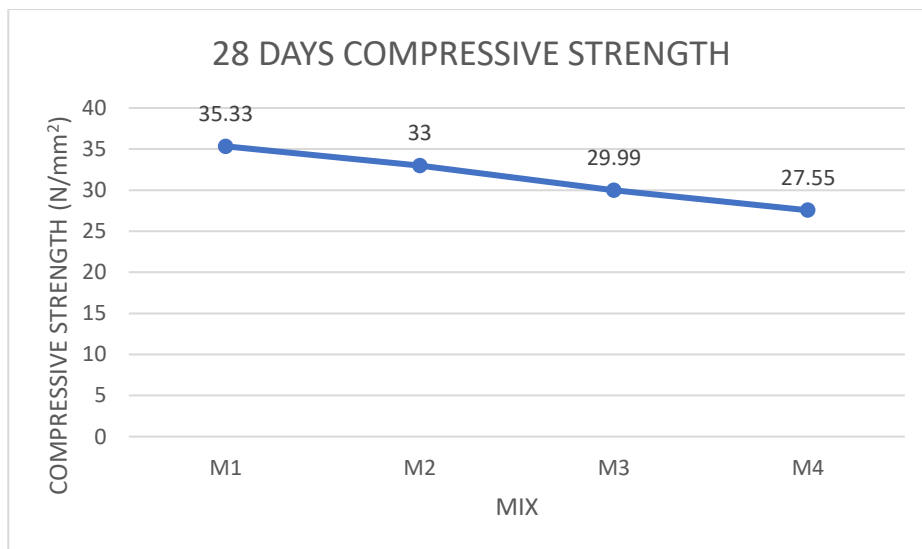


fig 8 : Variation of compressive strength of concrete after 28 days

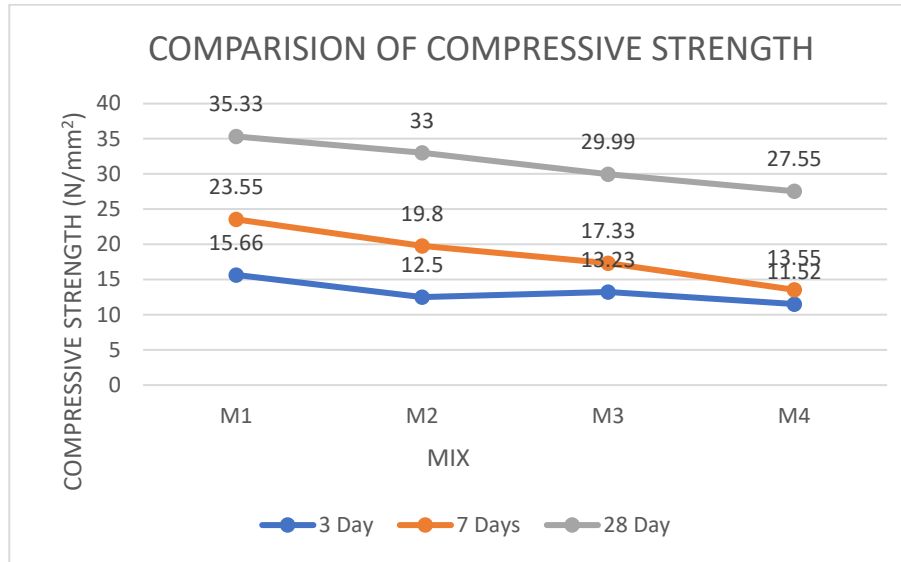


fig 9 : comparison of compressive strength of concrete at 3 days, 7 days and 28 days

C. *Split Tensile Strength of concrete*

Mix Name	7 days strength (N/mm2)	14 days strength (N/mm2)	28 days strength (N/mm2)
M2	2.02	2.085	2.32

Table 5 : Split Tensile strength of concrete

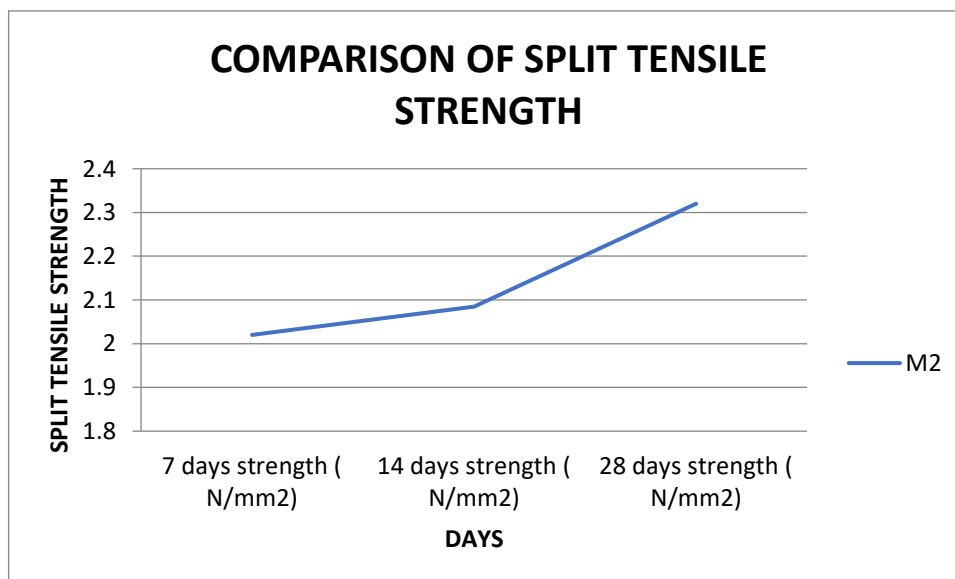


fig 10 : comparison of Split Tensile strength of concrete at 7 days, 14 days and 28 days

**VII. CONCLUSIONS**

Plastic was replaced with coarse aggregate (10 mm size) by proportion of 0, 5, 10, 15 % . From the present study following conclusion were drawn

1. The material was good and workable.
2. Plastic aggregate specific gravity was lesser than natural aggregates.
3. It was observed that the compressive strength of concrete decreases with increase in plastic coarse aggregate.

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