International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 4 Issue 6, September-October 2020 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Strength and Behavior of Concrete by Partial Replacement of Fine Aggregate with Recycled Plastic

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ABSTRACT

In light of fast improvement of people in countries like India the disposing of Solid waste is a huge issue in our step by step life. Different waste materials are created from gathering measures, organization organizations and common solid wastes. The growing care about nature has colossally added to the concerns related with expulsion of the made wastes. Solid waste organization is one of the significant normal concerns on the planet. With the deficiency of space for land filling and on account of its ever-extending cost, waste use has gotten an appealing choice as opposed to expulsion. Among the waste material, plastic is the material that is the noteworthy concern to by far most of the regular effects. Investigation is being finished on the utilization of waste plastic things in concrete. The usage of waste things in solid makes it judicious, yet moreover helps in lessening expulsion issues. The progression of new improvement materials using reused plastics is basic to both the turn of events and the plastic reusing ventures. Reuse of waste and reused plastic materials in strong mix as a natural neighborly improvement material has pulled in light of experts progressing events, and endless assessments uncovering the direct of concrete containing waste and reused plastic materials have been dispersed. This paper summarizes a comprehensive review on the assessment articles on the use of reused plastics in solid reliant on whether they oversaw concrete containing plastic aggregates or plastic fibers. Additionally, the morphology of concrete containing plastic materials is to explain the effect of plastic aggregates and plastic fibers on the properties of concrete. The properties of concretes containing virgin plastic materials were moreover investigated to develop their similarities and differences with concrete containing reused plastics. Strong shape, chamber and column were casted taking 0% to 40% of plastic as midway replacement of fine aggregate and went after for 28days of compressive quality, flexural quality and split flexibility of concrete.

How to cite this paper: R. Jithendar Reddy | P. Naredndra Babu "Strength and Behavior of Concrete by Partial Replacement of Fine Aggregate with Recycled Plastic" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-4 | Issue-6, October 2020, pp.366-369, URL: www.ijtsrd.com/papers/ijtsrd33394.pdf

IJTSRD33394

KEYWORDS: *Plastic waste, strength, cement, concrete, workability*

INTRODUCTION

Exploration concerning the utilization of results to increase the properties of cement has been continuing for a long time. In the ongoing decades, the endeavors have been made to utilize industry results, for example, fly debris, silica rage, ground granulated impact heater slag (GGBS), glass cullet, and so on., in common developments. The expected uses of industry side-effects in concrete are as halfway total substitution or as incomplete concrete substitution, contingent upon their concoction organization and grain size. The utilization of these materials in solid originates from the natural requirements in the protected removal of these items.

Enormous consideration is being centered around the earth and safe guarding of normal assets and reusing of squanders materials. Numerous businesses are creating countless items which fuse scrap (buildups). Over the most recent 20 years, a ton of works concerning the utilization of a few sorts of metropolitan squanders in building materials industrials measure have been distributed. Numerous scientists have been stretched out to concentrate new sorts of squanders to research profoundly specific angles. The expansion of squanders, aside from the natural advantages, likewise creates great consequences for the properties of conclusive items.

One of the fundamental ecological issues today is the removal of the waste plastics. The utilization of plastics in different spots as pressing materials and the items, for example, bottles, polythene sheets, holders, pressing strips and so on., are expanding step by step. This outcomes underway of plastic squanders from a wide range of livings from modern makers to homegrown clients. To bypass this contamination emergency, numerous items are being created from reusable waste plastics. Reuse of waste and reused plastic materials in solid blend as an ecological amicable development material has attracted consideration of analysts late occasions. On the opposite side, the Indian development industry is confronting issues because of lacking and inaccessibility of development materials. Along these lines, we have to look for new development materials just as a technique to arrange the plastic waste. To discover

an answer for the above issues, one of them can be utilized to unravel the other.

Table-1: Types of recycled plastics

S.no	Name of Plastic	Description	Uses for Plastic made from Recycled Waste Plastic
1	Polyethylene Terephthalate	Clear tough Plastic	Soft drink bottles; detergent bottles; clear packaging film; fleecy jackets; carpet fibers
2	High density polyethylene (HDPE)	Usually white or colored. Very common plastic	Compost bins; Mobile garbage bins; agricultural pipes.
3	Un plasticized polyvinyl chloride (UPVC) Plasticized polyvinyl chloride (PPVC)	Hard rigid plastic may be clear. Flexible clear elastic plastic.	Detergent bottles; hoses; tiles; plumbing pipes & fittings.
4	Low density polyethylene (LDPE)	Soft, flexible plastic.	Film & bags for building and packaging.
5	Polypropylene (PP)	Hard but flexible plastic	Compost bins; Kerb side recycling crates.
6	Polystyrene (PS) Expanded polystyrene (EPS)	Rigid, brittle plastic. May be clear or glassy.	Clothes pegs, coat hangers, video & CD boxes.

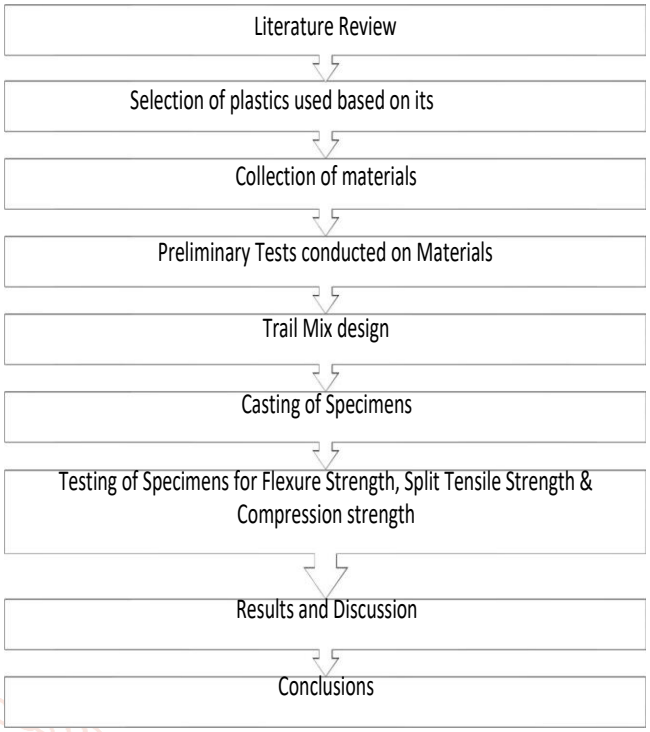
MATERIALS:

Physical Properties of LDPE

S. No.	Characteristics	Value
1	Tensile Strength	0.20 - 0.40 N/mm^2
2	Notched Impact Strength	No break
3	Thermal Coefficient of Expansion	100 - 220 x 10^{26} Max.
4	Continued Use Temperature	65˚C (149 ˚ F)
5	Melting Point	110 ˚C (230 ˚ F)
6	Glass Transition Temperature	-125˚ C (-193 ˚ F)
7	Density	0.910 - 0.940 kg/m^3

Fig-1Three types of plastic aggregates (smaller, medium and coarser size)

METHODOLOGY



EXPERIMENTAL PROCEDURE

Moulds cubes, cylinders

WORKABILITY TEST

Workability of fresh concrete is an important characteristic. It can be defined as the ease with which concrete can be worked. Working includes mixing, placing, compacting and finishing. It can be assessed by conducting two tests they are

1. Slump cone test
2. Compaction factor test

Fig-1Slump cone test

RESULTS&DISCUSSIONS

Table-1: Compressive strength results of the cubes

Type of concrete	Specimen	Initial Crack Load(KN)	Compressive strength (N/mm^2)	Average value
Conventional Concrete	1	893.47	39.71	40.315
	2	920.7	40.92	
10% Replacement of FA with PA	1	750.15	33.34	31.25
	2	656.32	29.17	
20% Replacement of FA with PA	1	813.15	36.14	35.82
	2	798.52	35.49	
30% Replacement of FA with PA	1	860.4	38.24	39.015
	2	895.27	39.79	
40% Replacement of FA with PA	1	776.1	34.49	32.86
	2	702.7	31.23	

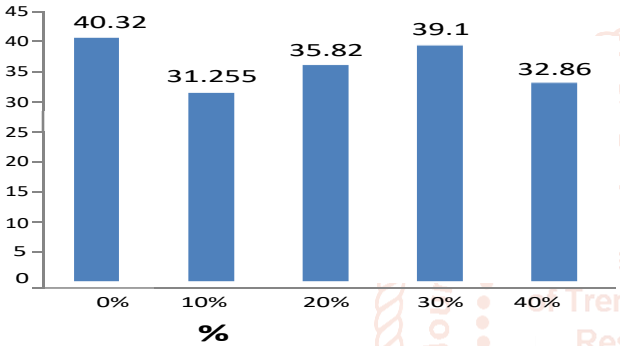


Fig-2Graph between percentage of fine aggregate replacement and respective compressive strength of the plastic replaced concrete

Type of concrete	Specimen	Initial Crack Load(KN)	Flexure strength (N/mm^2)	Average value
Conventional Concrete	1	11.85	4.74	4.53
	2	10.4	4.28	
10% Replacement of FA with PA	1	9.4	4.08	3.92
	2	10.2	4.94	
20% Replacement of FA with PA	1	11.98	4.79	4.37
	2	9.89	3.95	
30% Replacement of FA with PA	1	12.35	4.94	4.97
	2	12.5	5	
40% Replacement of FA with PA	1	10.4	4.16	4.11
	2	10.15	4.06	

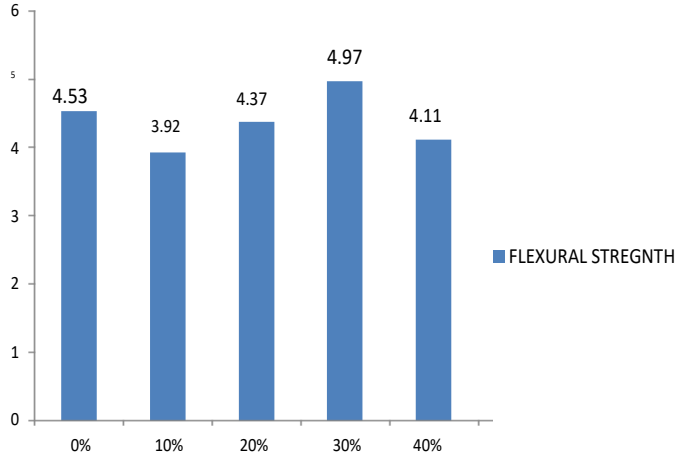


Fig-3 Graph between percentage of fine aggregate replacement and respective Flexural strength of the plastic replaced concrete

Type of concrete	Specimen	Initial Crack Load(KN)	Split Tensile strength (N/mm^2)	Average value
Conventional Concrete	1	291.22	4.12	3.80
	2	254.98	3.48	
10% Replacement of FA with PA	1	223.75	3.165	2.67
	2	153.55	2.17	
20% Replacement of FA with PA	1	248.1	3.51	3.41
	2	232.55	3.29	
30% Replacement of FA with PA	1	281.3	3.98	4.01
	2	289.8	4.1	
40% Replacement of FA with PA	1	250.22	3.54	3.25
	2	208.52	2.95	

Test	Plastic Waste (%)	Slump (mm)	Compaction Index (mm)
1	0	30	1.33
2	10	40	1.31
3	20	40	1.25
4	30	35	1.25
5	40	20	1.29

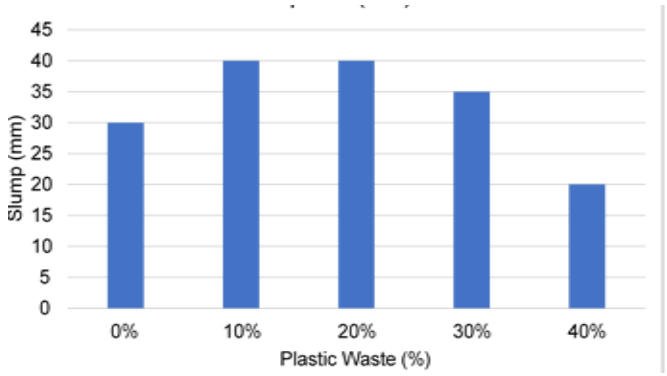


Fig-4 slump values for different percentages of plastic waste

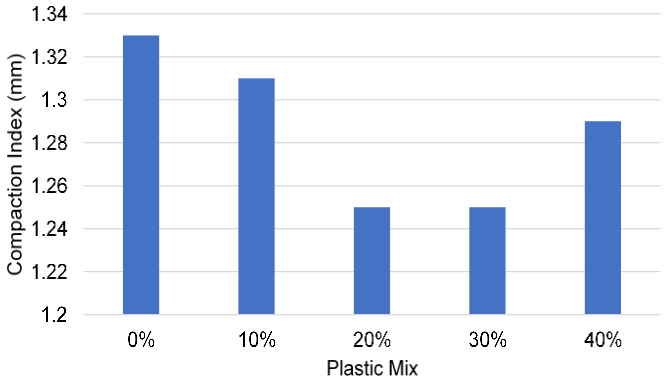


Fig-5 Compaction Index values for different percentages of plastic waste

CONCLUSIONS

In the present work, recycled plastics were used as fine aggregates and the properties of resultant mix was studied and compared with the control mix having normal aggregates. The conclusions drawn from the present study and the scope for further research are discussed in this chapter.

- The purpose of using plastic fibers in concrete is to enhance the mechanical and durability properties of conventional concrete in addition to securing environmental benefits.
- Concrete containing plastic aggregates exhibits lower slump than conventional concrete. Plastic aggregates with a smooth surface and spherical shape have a lower negative influence on the workability of concrete.
- For a given w/c ratio, the compressive strength, elastic modulus, splitting tensile strength, and flexural strength of concrete containing Plastic aggregates decrease with an increase in Recycled Plastic Aggregates (substitution level of plastic aggregates).
- The water absorption and porosity of concrete containing Plastic aggregates increases with an increase Recycled plastic aggregates
- Plastics can be used to replace some of the aggregates in a concrete mixture. This contributes to reducing the unit weight of the concrete. This is useful in applications requiring nonbearing lightweight concrete, such as concrete panels used in facades.
- The effect of water-cement ratio of strength development is not prominent in the case of plastic concrete. It is because of the fact that the plastic aggregates reduce the bond strength of concrete. Therefore, the failure of concrete occurs due to failure of bond between the cement paste and plastic aggregates.
- Introduction of plastics in concrete tends to make concrete ductile, hence increasing the ability of concrete to significantly deform before failure. This characteristic makes the concrete useful in situations where it will be subjected to harsh weather such as expansion and contraction or freeze and thaw.

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