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Strength Analysis by Utilization of Plastic PET Bottles In Concrete Material

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Abstract- **Plastic waste disposal in the environment is a big problem since it is impossible to biodegrade and has a broad footprint. Plastic recycling was practised on a wide scale in India. Recycling from various sources accounts for up to 60% of industrial and urban plastic waste. Recently, plastic waste has been studied as a possible replacement for a portion of the current concrete aggregates. In this study, trials and measurements were carried out in order to evaluate the effectiveness of waste plastic reuse in concrete building. Waste plastic was used to partially replace sand in 0 percent, 1 percent, 2 percent, 3 percent, 4 percent, and 5 percent of concrete blends. The concrete cubes were tested at room temperature. Slumping and compression are needed for these measurements. This study ensures that reusing plastic waste as a substitute for fine concrete aggregates will result in lower material costs while still addressing the waste disposal problem.**

Keywords- **PET bottles, Compressive strength, flexural test, concrete, workability, M25 mix.**

I. INTRODUCTION

The efficient usage of waste material is a way of alleviating such problems with the handling of solid waste. [10]. through a number of points of view, again usage of waste is crucial. It helps renewable resources not refilled or recharged to be saved or retained, eliminates pollution in the atmosphere and also preserves and recycles electricity production processes. Wastes and agricultural by-products must be considered as highly costly tools pending adequate maintenance and use. Plastic waste is combined with this waste; due to its long biodegradation period, its disposal has a negative influence upon the atmosphere, so the use of this substance in various sectors is a sensible mechanism for reducing its harmful effects.

Betons perform a significant part in the useful use of these building materials. Whereas any of these components may be used in concrete as part of the cement binder stage or as aggregates. Beton consists of a number of faults and micro fractures. The swift micro-crack transmission in the load is calculated in compliance with the low tensile strength of the concrete. It is fair to assume, by inserting tightly separated fibres, that the tensile strength and bending strength of concrete can be significantly increased. The cementing materials dominate the building material industry with their total efficiency in terms of mechanical strength and longevity.

A modern approach in study practises to integrate specific technological areas with sustainable science is the addition of polymer wastes into the concrete. Industrial and residential waste has in its establishment an important proportion of polymers covering a large volume of landfill. His recycling is also fascinating to investigate and develop technologies to reduce the problems created by this waste. Recycling is one of the ways to reduce the environmental impact of the waste PET bottles. But the biggest problem with plastic recycling is that it is difficult to automate the sorting of plastic waste and so is labor intensive.

II. EXPERIMENTAL PROGRAM

1. Materials Used:

1.1 Cement: Ordinary Portland cement of 43 grades used in this experimental analysis and cement properties that are used in this investigation is as follows in Table 1.

Table 1. Properties of Cement.

S. No.	Properties	Results
1.	Standard consistency %	33%
2.	Initial setting time	46 min
3.	Final setting time	300 min
4.	Specific gravity	2.96
5.	Fineness	2%

Table 2. Properties of Fine Aggregates.

Sr. No.	Test	Result
1.	Zone	II
2.	Specific gravity	2.5
3.	Fineness Modulus	3.75
4.	Water Absorption	0.59%

1.2 Fine Aggregates: Natural river sand used in this experimental analysis. That passes completely through

4.75 mm aperture size sieve and conforming to zone II. Properties of sand are as follows below in Table 2.

1.3 Coarse Aggregates: Coarse aggregates used in this study which is locally available and have 20 mm sieve size. Properties of coarse aggregates are described below in Table 3.

Table 3. Properties of Coarse Aggregates.

Sr. No.	Test	Result
1.	Type	Crushed
2.	Maximum Size	20 mm
3.	Specific gravity	2.94
4.	Fineness Modulus	7.07
5.	Water Absorption	0.40%

1.4 Plastic Waste: PET (polyethylene terephthalate) waste plastic used in this experimental analysis. For plastic waste used glucose bottles and water bottles which is locally available and this plastic used for packaging work. Properties of plastic waste are described below in Table 4.

Table 4. Properties of Waste Plastic Bottles (PET).

Sr. No.	Test	Results
1.	Specific gravity	1.34
2.	Water absorption	0.10
3.	Maximum size	4.75

1.5 Water: Potable water used in this investigation for mixing concrete mixture and curing of cubes.

B. Mix Proportions:
Materials used for making Mix M25 grade of concrete and find out their relative quantity with the aim of producing a concrete of required strength , durability as economically as possible is termed concrete mix design. Table 5 shows the mix proportion of concrete.

Table 5. Mix Proportions of Concrete Materials.

% of Plastic waste	Weight of CA. (kg/m^3)	Weight of Cement (kg/m^3)	Weight of F.A. (kg/m^3)	Weight of Plastic waste (kg/m^3)	Weight of Water (kg/m^3)
0%	1250	413	572	0	192
1%	1250	413	566.28	5.72	192
2%	1250	413	560.56	11.44	192
3%	1250	413	554.84	17.16	192
4%	1250	413	549.12	22.88	192
5%	1250	413	543.4	28.6	192

III.EXPERIMENTAL RESULTS

The casted concrete cubes are subjected to different experiments in this experimental study to determine the intensity and extra properties of the casted concrete. The main goal of the experimental study is to look at the developed intensity of the concrete at different testing days after curing. In general, proper casting and curing of concrete can improve its strength. For this project, each test is performed with three samples for each mix ratio and is measured at the appropriate curing period. The average values are then included in the inquiries. The sequence of research activities is outlined below:

This procedure is carried out to ensure the functioning of the freshly cast material. In order to find the workability, it has been done separately on newly-grown concrete and replaced by fine aggregates with wastes of plastic. The downturn is very important for recognizing differences in the accuracy of a combination of trivial proportions. Download changes as seen in Tables 6 and figure 1.

Table 6. Slump value of Concrete Mix M25.

% Replacement	Slump Value (mm)
0%	74
1%	73
2%	70
3%	69
4%	67
5%	63

During early concreting days, the rough aggregates dictated the water quality and the water determined the slump as concrete was made out of asphalt, aggregate and water. A smaller decline was lower water content during this period which often implied better concrete consistency.

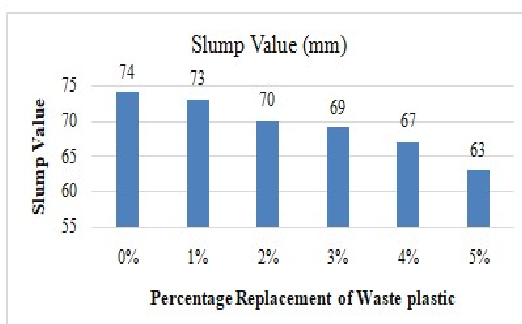

Fig 1. Slump Variations.

1. Compressive Strength Test:
Beton is weak in friction and low in compression such that the concrete can achieve high compression. This research has checked three samples per blend and contrasts the overall power with M25 nominal mix. Compressive

strength test shows that a substance may have a strong compressive load below the factor cap. Table 7 and Figure 2 demonstrate the effects of compressive intensity at age 7 & 28 days.

Table 7. Compressive Strength on Concrete M25 Cubes.

Percentage Replacement of Waste Plastic bottles	Compressive Strength (N/mm²)	
	7 Days	28 Days
0%	20.51	32.04
1%	22.24	34.92
2%	21.72	34.12
3%	20.66	30.66
4%	18.74	29.21
5%	17.14	27.56

Table 7 shows that the compressive power of the cubes is 30.66 N/mm2, which is more than 31.6 N/mm2 at 3 percent substitution of fine aggregate by plastic (PET bottles) (i.e.the target mean strength for M 25 grade of concrete).

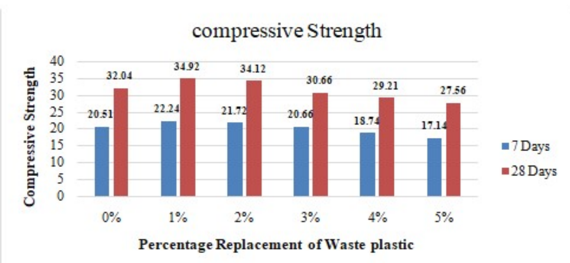

Fig 2. Compressive Strength of Concrete M25.

2. Flexural strength:

The Flexural strength was also called the breakdown module. The curvature of the bending of concrete results from the load under which there is a compression from an overhead and a lower tensile stress on the concrete beam. Test beams are stressed and concrete shearing occurs under load. The work of this experiment is based on 6 slips of a scale of 700 X 100 x 100 mm cast with a design blend of M25 concrete, and a varying percentage of substitutes of 0%, 2%, 3% 4% and 5% plastic waste weight. Comparison of the principles of all concept mixes. The flexural values of various mixes seen in Tables.8 and figure 3.

Table 8. Flexural Strength of Concrete at 28 days.

Percentage Replacement of Stone Sand	Flexural Strength (N/mm²)
	M-25
0%	5.82
1%	5.91
2%	4
3%	4.1
4%	3
5%	2.8

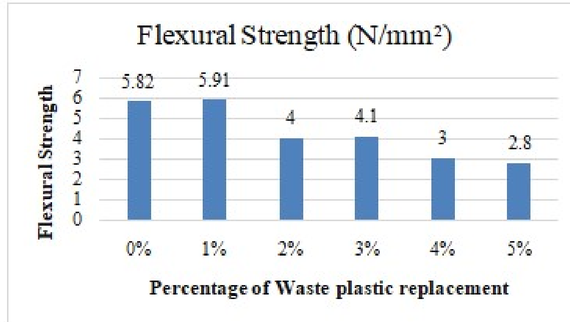

Fig 3. Flexural Strength at 28 Days.

Table 4.3 demonstrates that the flexural resistance of beams when applying waste plastic to concrete increases by 10 percent. The bending strength then diminishes. Concrete flexing strength is higher than that of tensile bending ability (3, 1 N/mm2), with 30% replacement.

IV. WASTE MANAGEMENT

Increase of the plastics supply worldwide has contributed to a rising market and citizens every day. Millions of tonnes of plastic waste are generated every day in all countries, so adequate plastic disposal is crucial for protecting the world. The loss of plastic waste is a long-term stage of the natural world, but environmental concerns are posed, in comparison to most waste plastic disposal methods.

In this experimental study, waste plastic was used as a replacement source for fine aggregates. In this study, concrete grade M25 is prepared and the 0% fine aggregate test for various alternatives, 1%, 2%, 3%, 4% and 5% is performed on concrete prepared with plastic bottle waste.

V. CONCLUSION

A conclusion will be presented in this chapter that describes the key results and potential suggestions for more study. In this study, the causes of crushed PET waste substitution by rough aggregates in concrete are identified.

Based on the experimental investigation following assumptions are as follows:

This investigation's waste PET bottles prove to be low-cost materials for dealing with waste disposal and avoiding environmental pollution.

The test results for materials such as cement, sand, and traditional are within the permissible limits specified by IS codes.

The modified concrete mix, which involves a 3 percent substitution of normal fine aggregates with plastic aggregate, provides force with an acceptable seal.

Concrete made from PET waste bottles may become an effective plastic waste management practise in the future.

REFERENCES

[1] G.murali, C.M. Vivek Vardhan, R. Prabhu, Z.Mohammed Sadaqauth Ali Khan, T. Aarif Mohamed and T. Suresh "Experimental Investigation On Fibre Reinforced Concrete Using Waste Material" International Journal of Engineering and Applications (IJERA) ISSN: 2248-9622 www.ijera.com, Volume 2, Issue 2, Mar-Apr 2012, pp.278-283.
[2] Indian Standard: 383-(1970):" Specification for Ordinary Portland Cement ".
[3] Indian Standards: 456-2000, "Plain and reinforced concrete-code of practice.
[4] Khilesh Sarwe "Study of Strength Property of Concrete Using Waste Plastics and Steel Fiber" International Journal of Engineering and science (IJES), ISSN (E):2319-1813 ISSN (P):2319-1805, Volume 3 Issue 5, pages 09-11-2014.
[5] Manhal A Jibrael and Farah Peter, "Strength and Behavior of Concrete Contains Waste Plastic", Journal of Ecosystem & Ecography, 2016.
[6] Mansi Jain, Rajeev Kansal,"Study on Utilization of Waste Polypropylene Particles on The Strength of Concrete", IJRASET, Volume 4 Issue XI, November 2016.
[7] P.Ganesh Prabhu, C.Arun Kumar, R.Pandiyaraj, P.Rajesh & L.Sasi Kumar "Study on Utilization of Waste PET Bottle Fibre in Concrete" International Journal of Research in Engineering &Technology (IMPACT: IJRET), ISSN (E): 2321-8843; ISSN (P): 2347-4599 Volume 2, Issue 5, May 2014, 233-240.
[8] Pramod S. Patil, J.R.Mali, Ganesh V.Tapkire, H. R. Kumavat, "Innovative Techniques of Waste Plastic Used In Concrete Mixture", IJRET: International Journal of Research in Engineering and Technology e-ISSN: 2319-1163, Volume: 03, Special Issue: 09, June 2014.
[9] R.Kandasamy and R. Murugesan "Fibre Reinforced Concrete Using Domestic Waste Plastics as Fibres" ARPN Journal of Engineering and Applied Science, ISSN 1819- 6608, Volume 6 No. 3, March 2011.
[10] Zainab Z. Ismail, Enas A. AL-Hashmi, "Use of waste plastic in concrete mixture as aggregate replacement", waste management journal, Elsevier, 2008.