https://dx.doi.org/10.22161/ijaers/3.12.23 *ISSN: 2349-6495(P) | 2456-1908(O)*

Use of Waste Plastic in Concrete Mixture as Aggregate Replacement

Patil Pramod Sambhaji

Assistant Professor, Civil Engineering Department , R.C.Patel Institute of technology Shirpur District Dhule, Maharashtra, India

Abstract— *One of the environmental issues in most regions of Iran is the large number of bottles made from poly-ethylene terephthalate (PET) deposited in domestic wastes and landfills. Due to the high volume of these bottles, more than 1 million m3 landfill spaces are needed for disposal every year. The purpose of this experimental study was to investigate the possibility of using PET waste in asphalt concrete mixes as aggregate replacement (Plastiphalt) to reduce the environmental effects of PET disposal. Concrete is the most widely used man made construction material in the w and its second only to water as the most utilized substance in the planet. Seeking aggregates for concrete and to dispose of the waste from various commodities is the present concern. Today sustainability has got top priority in construction industry. In the present study the recycled plastics were used to prepare the coarse aggregates thereby providing a sustainable option to deal with the plastic waste There are many recycling plants across the world, but as plastics are recycled they lose their strength with the number of recycling. So these plastics will end up as earth fill. In this circumstance instead of recycling it repeatedly, if it is utilized to prepare aggregates for concrete, it will be a boon to the construction industry. Most of the failures in concrete structures occur due to the failure of concrete by crushing of aggregates. Plastic aggregate which have low crushing values will not be crushed as easily as the stone aggregates. These aggregates are also lighter in weight compared to stone aggregates. Since a complete substitution for Conventional Aggregate was not found feasible, a partial substitution with various percentage of plastic aggregate was done. Both volumetric and grade substitution was employed in this investigation.*

Keywords— Waste Plastic, poly-ethylene terephthalate, Plastiphalt.

I. INTRODUCTION

The changed lifestyle and endlessly increasing population has resulted in a significant rise in the quantity of post-consumer plastic waste. The world's annual consumption of plastic materials has increased from around 5 million tons in the 1950's to nearly 100 million tons in recent times, resulting in a significant increase in the amount of plastic waste generation. Out of this waste, a significant part is recycled but the majority of post-consumer plastic wastes, like shampoo sachets, carry-bags, nitro packs, milk and water pouches etc. though recyclable, remains comparatively untouched as they are difficult to separate from household garbage**.** In most of the cases, such post-consumer waste either litters all around or is disposed of by land filling. The disposal of post-consumer plastic waste in this manner poses significant environmental hazards as it results in reduction in soil fertility, reduction in water percolation, emission of toxic gases, health hazard to animals and birds consuming the wastes, poor drainage due to landfill, pollution of ground water due to leaching of chemicals from these waste products etc.

Disposal of waste plastic consumer bags from the domestic has become a major problem to the agencies in the town and cities. The waste plastic bags available in the domestic waste mainly consist of low density polyethylene (LDPE). Plastic bags dumped in the dustbins find their way into the drainage system and clog them. Often, these are burnt along the roadside, which produces fumes causing air pollution.

II. WHY THE PLASTICS

- Polymers have a number of vital properties, which exploited alone or together, make
- a significant and expanding contribution to constructional needs.
- Durable and corrosion resistant.
- Good Insulation for cold, heat and sound saving energy and reducing noise pollution.
- It is economical and has a longer life.
- Maintenance free (such as painting is minimized).
- Hygienic and clean.
- Easy to processing / installation.
- Light weight.

III. SOURCE OF EMPLOYMENT IN THE MANAGEMENT OF WASTE PLASTICS

Plastic recycling was taking place on a significant scale in an India. As much as 60 % of both industrial and urban plastic waste is recycled which obtained from various

https://dx.doi.org/10.22161/ijaers/3.12.23 *ISSN: 2349-6495(P) | 2456-1908(O)*

sources. People in India have released plastic wastes on large scale have huge economic value, as a result of this, recycling of waste plastics plays a major role in providing employment. This helps for the economic development of the country. Indian construction industry creates lot of employment opportunities and accounts for major portion of the capital outlay in successive 5-year plans of our country. The projected investment in this industrial sector continues to show a growing trend.

IV. METHODOLOGY

The main research of that project is to utilized recycled concrete as a coarse aggregate for the production of concrete. It is essential to know the replacement of Plastic Aggregate (PA) in concrete is acceptable there are for the making of concrete used coarse aggregate having size 20mm, natural river sand used for making a concrete and plastic aggregate used in crushed concrete from the tested cubes. Test carried out on these aggregate specific gravity and Bulk density, and sieve analysis. After testing, a mix design is produced in accordance with the properties obtained from test results after testing; a mix design is produced in accordance with the properties obtained from test results. Concrete is then produced with replacement of 10%, 20%, 30%, 40% and 50% of plastic aggregate replacement of plastic aggregate with the same mix proportion. Tests conducted on these concretes include the slump of fresh concrete. For the hardened concrete, compressive strength, were determined. 7and28 days and the results at each testing age are reported as an average. The engineering **properties of the PA were also compared to those of the reference concrete.** The main research of that project is to utilized recycled concrete as a coarse aggregate for the production of concrete. It is essential to know the replacement of Plastic Aggregate (PA) in concrete is acceptable there are for the making of concrete used coarse aggregate having size 20mm, natural river sand used for making a concrete and plastic aggregate used in crushed concrete from the tested cubes. Test carried out on these aggregate specific gravity and Bulk density, and sieve analysis. After testing, a mix design is produced in accordance with the properties obtained from test results after testing; a mix design is produced in accordance with the properties obtained from test results. Concrete is then produced with replacement of 10%, 20%, 30%, 40% and 50% of plastic aggregate replacement of plastic aggregate with the same mix proportion. Tests conducted on these concretes include the slump of fresh concrete. For the hardened concrete, compressive strength, were determined. 7and28 days and the results at each testing age are reported as an average. The engineering properties of the PA were also compared to those of the reference concrete.

V. EXPERIMENTAL

Total Forty-eight specimens and six beams & cylinders each for M20 grade of concrete
with four different volume percentages of plastic (0%,10%, 20%, 30%,40%,50%) were
cast as recommended by IS: 10262- 1982.

Water: Water used conforms IS 3025 (Part 22, 23).

Plastic Pallet as Fine Aggregate:

The waste material used in this study was virgin plastic and was used as a partial replacement for fine aggregate. It was obtained from the Central Institute of Plastic Engineering and Technology (CIPET) Hajipur, Bihar, India. The fineness modulus and specific gravity for plastic waste were 3.2 and 0.91, respectively

Concrete Mix Design:

The concrete mix design as recommended by IS: 10262-1982 was used to prepare test samples and its details are shown in above.36 cubes specimens and six beams & cylinders each for M20 grade of concrete with four different volume percentages of plastic pallets (0%, 10%, and 20%, 30%, 40%, 50%) were cast. Six cubes were cast for each percentage of plastic pallets and six cubes for each varying percentages of plastic pallets have been casted with Sizes of cu specimens are 150mm X 150mm X 150 mm, and sizes of beams specimens are 750mm X 150mm X 150 mm

Proportion as per Design 1 : 2 : 4							
Material propertion in Weight batching							
Material	**Propertion**	**0%**	**10%**	**20%**	30%	40%	50%
Cement in kg	1	8 kg	8 kg	8 kg	8 kg	8 kg	8 kg
Sand	2	16 kg	16 kg	16 kg	16 kg	16 kg	16 kg
C.A.	Nil		29.5 kg	27 kg	24.5 kg	22 kg	19.5 kg
P.A.	Nil		3.2 kg	6.4 kg	9.6 kg	12.8 kg	16.0 kg
Aggregate	4	32 kg	32 kg	32 kg	32 kg	32 kg	32 kg

https://dx.doi.org/10.22161/ijaers/3.12.23 *ISSN: 2349-6495(P) | 2456-1908(O)*

VI. VARIOUS TEST ON CONCRETE

- **Aggregate Crushing Value (IS: 2386 PART 4 - 1963)**
- **Aggregate Abrasion Value (IS 2386 PART 4-1963)**
- **Fineness Modulus and Particle Size Distribution of CA and FA by sieve analysis.**

VII. RESULTS & DISCUSSION

Results should be the major findings of your experiment. You have to compare the results with previous studies done in same.

Test	Impact Value	Crushing Value	Abrasion Value	Specific Gravity	Water Absorption
Conventional Aggregate	12.29 %	3.4%	2.2%	2.65%	21.15%
Plastic Aggregate	2.26%	0.24%	0.42%	3.05%	1.52%
Sand	10.26%	2.75%	3.2%	2.36%	23.87%

Compaction Factor test

Replacement of aggregate by PA in %	Partially Compacted Weight in kg	Fully Compacted Weight in Kg	Compaction Factor in %
0	18.8	19.2	97.92
10	18.36	18.82	97.56
20	17.94	18.42	97.39
30	16.78	17.86	93.95
40	15.78	17.12	92.17
50	15.12	16.59	91.14

Compressive Strength Test For 7 days						
Replacement of Plastic Aggregate in %	0	10	20	30	40	50
Average Compressive strength of Concrete N/mm27 Days	12.8	8.15`	7.1	6.96	6.1	5.4

Compressive Strength Test For 2 days						
Replacement of Plastic Aggregate in %	0	10	20	30	40	50
Average Compressive strength of Concrete N/mm2 28 Days	20	13.46	11.5	9.36	9.13	9.11

Flexural Strength Test For 7 days						
Replacement of Plastic Aggregate in %	0	10	20	30	40	50
Average Compressive strength of Concrete N/mm2 7 Days	40.47	41.28	37.95	38.32	36.42	35.86

https://dx.doi.org/10.22161/ijaers/3.12.23 *ISSN: 2349-6495(P) | 2456-1908(O)*

Flexural Strength Test						
Replacement of Plastic Aggregate in %	0	10	20	30	40	50
Average Compressive strength of Concrete N/mm2 28 Days	53.4	59.03	51.07	51.59	49.28	48.32

REFERENCES

[1] Madan Mohan Reddy ,K, Ajitha .B,and Bhavani .R , "Melt-Densified Post Consumer Recycled Plastic Bags Used As Light Weight Aggregate In Concrete"," International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 Vol. 2, Issue4, July-August 2012, pp.1097-1101.

[2] V. Kasselouri - Rigopoulou, S. Gavela, S. Kolias "Use Of Polymeric Wastes In The Concrete Production" Polymers in concrete: a vision for the 21st century, Cement & Concrete Composites 21: (1999) 449-452.

[3] Baboo Rai, S. Tabin Rushad, Bhavesh Kr, and S. K. Duggal "Research Article Study of Waste Plastic Mix Concrete with Plasticizer" International Scholarly Research Network ISRN Civil Engineering Volume 2012, Article ID 469272, 5 pages doi:10.5402/2012/469272 2005.

[4] Manual on Cement Concrete & Aggregates Australia Use of Recycled Aggregates in Construction May 2008Removal and Reuse of Hardened Concrete (ACI 555R- 01), American Concrete Institute.

[5] Alessandra Passaro" recycled plastic lightweight aggregate for concrete"

[6] S. Gavela , C. Karakosta , C. Nydriotis , V. Kaselouri-Rigopoulou , S. Kolias , P. A. Tarantili , C. Magoulas , D. Tassios and A. Andreopoulos "A Study Of Concretes Containing Thermoplastic Wastes As Aggregates"

[7] L. R. Bandodkar, A. A. Gaonkar, N. D. Gaonkar, & Y. P. Gauns " Pulverised PET Bottles as Partial Replacement for Sand" International Journal of Earth Sciences and Engineering 1009 ISSN 0974-5904, Volume 04, No 06 SPL, October 2011, pp. 1009-1012

[8] Dr. Prahallada M.C and Dr. Prakash K.B "Strength and Workability Characteristics of Waste Plastic Fibre Reinforced Concrete Produced From Recycled Aggregates" International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622

[9] V. Vytlacilov "The fibre reinforced concrete with using recycled aggregates" International Journal Of Systems Applications, Engineering & Development Issue 3, Volume 5, 2011

[10] Casanova-del-Angel, and Vzquez-Ruiz.C Manufacturing Light Concrete with PET Aggregate"

[11] R. Lakshmi and S. Nagan"Investigations On Durability Characteristics Of E Plastic Waste Incorporated Concrete" Asian Journal Of Civil Engineering (Building And Housing) Vol. 12, No. 6 (2011) Pages 773-787

[12] Colin Lobo and William F. Guthrie and Raghu Kacker "A Study on the Reuse of Plastic Concrete Using Extended Set-Retarding Admixtures" Volume 100, Number 5, September-October 1995 Journal of Research of the National Institute of Standards and Technology.

[13] Isabel Martnez Lage and Cristina Vzquez Herrero "Generation Of Recycled Aggregates And Technical Requirements For Some Applications" Dyna, year 77, Nro. 161, pp. 8997. Medelln, March, 2010. ISSN 00127353

[14] Yong, P.C. and Teo, D.C.L. "Utilisation of Recycled Aggregate as Coarse Aggregate in Concrete" UNIMAS E-Journal of Civil Engineering, Vol. 1: issue 1 /August 2009

[15] SABINA "Performance Evaluation of Waste Plastic/Polymer Modified Bituminous Concrete Mixes 975" Journal of Scientific & Industrial Research Vol. 68, November 2009, pp. 975-979

[16] Aggregates for Concrete Advancing concrete knowledge American Concrete Institute 38800 ISBN 978-0-87031-248-9