Partial Replacement of Recycled plastic waste for Coarse and Fine aggregates in Concrete Paver Blocks

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Introduction

Plastics contribute to an enormous amount of solid waste and take centuries to breakdown in the land fill or the ocean. Disposal of these plastic wastes has become a serious problem globally. At the same time natural resources like aggregates which form an important part in Road construction are depleting day by day. Utilizing certain types of Plastic wastes as an alternative material in road construction can reduce the consumption of natural resources to some extent and at the same time solve their disposal problems. It also helps in maintaining a sustainable Environment.

In the present study attempts were made to replace natural aggregates by recycled plastic aggregates (RPA) in the manufacture of concrete paver blocks.

P. Chinnadurai et.al, (2017) conducted a study on Paver blocks using Waste plastic as a substitute for coarse aggregates. Waste plastics have been added incrementally to replace natural coarse aggregates by 0%, 2%, 4%, 6%, 8%, 10% and the blocks were tested for compressive strength. Results indicated that M20 Grade concrete had satisfactory strength value with 4% plastic replacement.

An attempt was made by Shubhankar Anant Bujone et.al, (2017) to use Fly ash and plastics in Paver blocks, the waste plastic was used as fibres in the concrete mix to improve the blend. Results showed that use of plastic in paver blocks could increase its strength by 30% - 40% and also proved to be cost effective.

Materials and Methods

a) **Cement** –OPC 53 grade *Birla super*
b) A**ggregates –** of different sizes**,** *procured from Chennigaraya stone crusher, Tumkur district*
c) **Plastic aggregates -** size passing 12mm and retained on 6mm sieve*,*
- Size less than 2mm,

Procured from Nayandahalli, Bengaluru.

METHODS

- Basic tests on the selected materials were done as per specifications.
- Mix design for M30 and M40 grade concrete was done as per IS: 10262-2009. Two sets of paver blocks were prepared.
  - First set of paver blocks - coarse aggregates of size passing 12mm and retained on 6mm were replaced with recycled plastic coarse aggregates in varying proportions of 5%, 10%, 20%, 30% and 40%.
  - Second set of paver blocks – Fine aggregates of size finer than 2 mm were replaced with recycled plastic fine aggregates in varying proportions of 5%, 10%, 20%, 30% and 40%.
- Tests such as I) Compressive Strength, ii) Flexural Strength, iii) Split Tensile strength, iv) Abrasion Resistance and v) Durability were conducted on M30 and M40 grade conventional and modified Paver blocks**.**
- Tests results for conventional Paver Blocks of M30 & M40 grade were compared with modified paver blocks and reported

Results and Concluding Remarks

Table 1.Results of the M30 and M40 grade conventional & modified paver blocks (for optimum replacement of 30% RPCA and 10% RPFA).

Experiment	Conv paver blocks		Modified paver blocks			
			M30		M40	
	M30	M40	30% RPCA	10%RPFA	30%RPCA	10%RPFA
Compressive strength (N/mm^2)	32	41.03	26.20	25.68	35.91	35.42
Flexural strength (N/mm^2)	7.10	6.72	5.10	4.55	5.90	6.60
Split tensile strength (N/mm^2)	4.50	4.62	2.68	2.92	3.01	3.28

(**RPCA- Recycled plastic coarse aggregate, RPFA- Recycled plastic fine aggregate)*

- From Table 1, it can be observed that although the test results obtained for the modified paver blocks is less than that obtained for conventional paver blocks, yet it is within the desired tolerance limits. i.e. ± 5 N/mm^2. Hence it is concluded that replacement of coarse RPA up to 30% and Fine RPA up to 10% is effective in yielding optimum strength.

- Hence based on the present study, it is recommended to use recycled plastic aggregates as partial replacement to natural aggregates up to 30% for coarse and 10% for fine aggregates respectively in the construction of low volume roads. This paves a new way for disposal of waste plastic & helps in reducing pollution of our environment.

References

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