

# Techno-economic Analysis of Paver Blocks by Use of Plastic Waste and Recycled Aggregate

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## Abstract:

The aim of this project is to detect the strength between the plastic paver block and concrete paver block. In this paper we have discussed about the convenient use of plastic waste in a proper way. In this project we have used plastic waste in different proportions (molten state) mixed with recycled aggregate. The paver blocks were casted, tested and the results were discussed. By the use of waste plastic in paver blocks the cost of paver block is comparatively reduced.

*Keywords* – Plastic Paver Block, Recycled Aggregate, Plastic Waste.

## I. INTRODUCTION

Plastic Paver block is eco-friendly and cost efficiency. The increasing use of plastic is a great threat and contaminate to living beings and earth. This can be reduced only by recycling or reusing process. Plastic waste may also be reduced by using in these types of projects. After the demolition of a building or a construction the scrap materials (aggregates) have been leave off. So, the scrap materials may be used in an efficient manner. So, the recycled aggregate have been used in the making of plastic paver block. These types of paver block can be used in such areas like garden areas, side-ways on roads, parks etc

Plastic waste used in this project was brought from the nearing dump-yard. The recycled aggregate used in this work has been brought from the near-by areas. The reuse of plastic waste and recycled aggregate have potential to reduce the pollution and utilization of recycled aggregate can be increased.

To investigate the behaviour of plastic waste and recycled aggregate the literature review was taken up. The plastic waste (molten state) and the recycled aggregate were mixed together in different proportions. The mix was transferred into the

mould and the plastic paver blocks were casted and tested and the results were discussed.

## II EXPERIMENTAL PROCEDURE

### 2.1 Properties of Materials

#### A. Plastic waste (HDPE)

Plastic waste used in making paver block was collected from the dump-yard. The basic properties of HDPE are provided below.

Table I.  
PROPERTIES OF HDPE

| Sl.No. | Particulars           | Value                     |
|--------|-----------------------|---------------------------|
| 1      | Melting point         | 120°                      |
| 2      | Flexural modulus      | 1-1.5 GPa                 |
| 3      | Density               | 930-970 kg/m <sup>3</sup> |
| 4      | Tensile strength      | 30-40 MPa                 |
| 5.     | Water absorption rate | 0.3% (by volume)          |

#### B. Recycled Coarse Aggregate

Collected recycled coarse aggregates were used in this work. Aggregates passing through 10mm sieve and retained on 8mm sieve were sieved and tested as per Indian standard specification.

#### C. Fine Aggregate

Fine aggregate are usually sand or crushed stone that are less than 4.75mm. The fine aggregate used with the specific gravity is 2.8.

2.2 Mix Ratio

Table II. PLASTIC PAVER BLOCKS

| S. No | SPECIMEN | NO. OF SPECIMENS | MIX RATIO   |
|-------|----------|------------------|-------------|
| 1     | A        | 3                | 0.5:0.3:0.6 |
| 2     | B        | 3                | 1:0.3:0.7   |
| 3     | C        | 3                | 2:0.3:0.9   |

Table III. CONCRETE PAVER BLOCKS

| S.No | SPECIMEN | NO. OF SPECIMENS | MIX RATIO |
|------|----------|------------------|-----------|
| 1.   | D        | 3                | 1:2:4     |

2.2 Preparation of Test Specimens

The metal mould is cleaned through by using waste cloth. The materials Plastic waste, recycled coarse aggregate and Fine Aggregate as described in previous chapter are added to it in right proportion at molten state of plastic and well mixed and this mixture is transferred to the mould in it. The blocks were allowed to dry for 12 hours so that they can become harden. After drying the plastic paver block (specimen) is removed from the mould.



Fig 1. Preparation of specimens



2.3 Testing of Specimens

Compressive strength for paver blocks

Plastic paver blocks of size-1 (250X120X20), size-2 (250x120x35), size-3 (250x12x55) were casted. The maximum load at failure reading was taken and the average compressive strength is calculated using the following equation

$$\text{Compressive strength (N/mm}^2\text{)} = \text{Ultimate load (N)} / \text{Area of cross section (mm}^2\text{)}$$

Fig 2 Experimental Setup for Compression test

III RESULTS

Compressive Strength

A.RESULTS OF PPB

Table IV.



Compression Strength Result for Mix Proportion I

| Specimen | Plastic waste | FA  | RCA | Compressive stress (N/mm <sup>2</sup> ) |
|----------|---------------|-----|-----|---|
| PPB-1    | 0.5           | 0.3 | 0.6 | 26.67                                   |
| PPB-2    | 0.5           | 0.3 | 0.6 | 20.83                                   |
| PPB-3    | 0.5           | 0.3 | 0.6 | 23.33                                   |
|          |               |     | Avg | 23.61                                   |

Table V.

CompressionStrengthResultforMix ProportionII

| Specimen | Plastic waste | FA  | RCA | Compressive stress (N/mm <sup>2</sup> ) |
|----------|---------------|-----|-----|---|
| PPB-4    | 1             | 0.3 | 0.7 | 9.05                                    |
| PPB-5    | 1             | 0.3 | 0.7 | 8.10                                    |
| PPB-6    | 1             | 0.3 | 0.7 | 9.76                                    |
|          |               |     | Avg | 8.97                                    |

TABLE VI  
Compression Strength Result for Mix Proportion III

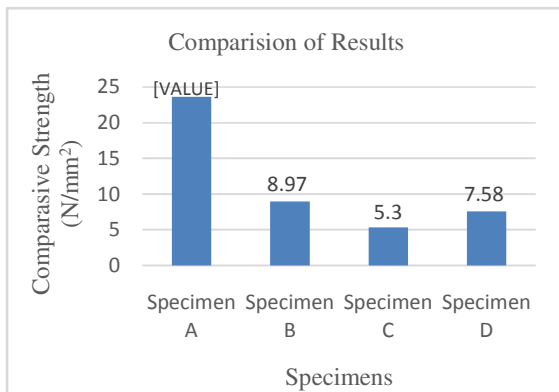
| Specimen | Plastic waste | FA  | RCA | Compressive stress (N/mm <sup>2</sup> ) |
|----------|---------------|-----|-----|---|
| PPB-7    | 2             | 0.3 | 0.9 | 5.30                                    |
| PPB- 8   | 2             | 0.3 | 0.9 | 5.60                                    |
| PPB-9    | 2             | 0.3 | 0.9 | 5.00                                    |
|          |               |     | Avg | 5.30                                    |

## B. RESULTS OF CPB

Table V  
Compression Strength Result for CPB

| Specimen | Plastic waste | FA | RCA | Compressive stress (N/mm <sup>2</sup> ) |
|----------|---------------|----|-----|---|
| CPB-1    | 1             | 2  | 4   | 6.97                                    |
| CPB- 2   | 1             | 2  | 4   | 7.58                                    |
| CPB-3    | 1             | 2  | 4   | 8.18                                    |
|          |               |    | Avg | 7.58                                    |

## C. COMPARISION OF RESULTS OF CPB AND PPB



## IV CONCLUSION

As a result, an average value of 5.30 N/mm<sup>2</sup> and 7.58 N/mm<sup>2</sup> have been obtained for Plastic Paver Block and Concrete Paver Block respectively.

- Specimen C and Specimen D having similar cross-section has an average value of 5.30 kN and 7.58 kN.
- When a load is applied over Specimen A and Specimen B it undergoes elongation

because of excess of plastic content in the mix and hence it is not considered.

- 15% - 20% of weight can be reduced when waste plastic is used in paver block.
- Cost is comparatively reduced than that of concrete paver block.

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