

Original Article

A Study on Utilization of Plastic Waste in Paver Block

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Abstract : As a sustainable substitute for traditional cement concrete pavers, this research investigates the creation and performance assessment of composite paver blocks (CPB) made from waste plastic and river sand. This study intends to reduce the environmental impact of the exponential increase in plastic pollution by using non-biodegradable waste—specifically, LDPE and HDPE—as a binding agent. Shredded plastic trash is thermally processed, melted, and combined with sand in different ratios of 1:2 and 1:3 for plastic to sand. To guarantee high density, the resultant slurry is compressed into molds using a hydraulic press. These plastic-sand paver (PSP) abrasion resistance (AR), water absorption (WA), and compressive strength (CS) were used to assess their performance. According to preliminary findings, these composite pavers have enough compressive strength for pedestrian and light-traffic applications and much less water absorption (almost 0%) than conventional blocks. The study comes to the conclusion that plastic-sand pavers successfully divert plastic waste from landfills while providing an affordable, long-lasting, and environmentally beneficial alternative for contemporary urban infrastructure.

Keywords: Composite paver blocks, Plastic-sand paver, Abrasion resistance, Water absorption, Compressive strength.

I. INTRODUCTION

The consumption of plastic materials has significantly increased globally as a result of the rapid rise of urbanization and industrialization. Because plastics are not biodegradable, their inappropriate disposal has become a serious environmental issue, causing drainage system blockages, land contamination, and damage to marine and terrestrial life. Because they either take up a lot of land or emit harmful gasses into the atmosphere, traditional ways of disposing of plastic garbage, such as landfilling and incineration, are not sustainable. Therefore, the development of creative and environmentally friendly techniques for the efficient use of plastic trash is urgently needed.

To lessen its influence on the environment and preserve natural resources, the building sector has recently investigated a number of sustainable materials. The creation of plastic sand paver bricks, which blend sand and waste plastic as a binding medium, is one such promising approach. Waste plastic is heated, melted, and mixed in precise amounts with sand to create these paver blocks, which are then molded into the required forms. By doing away with the need for cement, this method lowers the carbon dioxide emissions related to cement manufacturing.

Compared to traditional concrete paver blocks, plastic sand paver blocks have a number of benefits. They have excellent durability, low water absorption, and good compressive strength. They are also inexpensive, lightweight, and resistant to weathering and chemical impacts. By turning plastic trash into a practical building material, the use of plastic not only makes the blocks stronger but also aids in the efficient management of plastic waste.

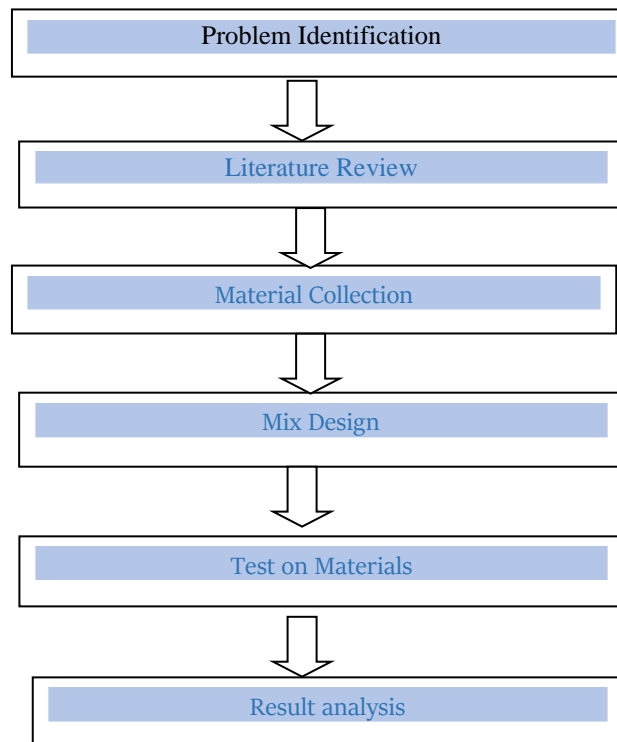
These paver blocks are especially well-suited for low-load, non-structural uses like parking lots, garden walks, pedestrian walkways, and rural roads. Reducing plastic waste and encouraging sustainable building methods are two significant issues that can be addressed concurrently by implementing this technology.

The design, production, and study of plastic sand paver blocks made from leftover plastic are the main objectives of this research. The purpose of the study is to analyze their mechanical and physical characteristics as well as their viability as a substitute for traditional paving materials. By turning garbage into useful resources, the project promotes the idea of a circular economy and helps conserve the environment.

II. LITERATURE REVIEW

A plastic waste is not biodegradable, it poses a serious threat to the ecosystem. The utilisation of plastic trash in building materials, such as paver blocks, has been the subject of numerous studies. Researchers discovered that by combining polymers like PET and LDPE with aggregates and sand, they may be utilised as a binder. According to studies, when used in the right amounts, plastic paver blocks have good water resistance, durability, and compressive strength. They are also affordable and lightweight, which makes them appropriate for low-traffic areas and walkway.

III. METHODOLOGY



IV. MATERIALS USED

Sand, plastic trash, and occasionally extra ingredients like aggregates and cement are the primary resources used to make paver blocks with plastic waste. Before being used, plastic waste—which often consists of materials like polyethylene (PE), polypropylene (PP), and polystyrene (PS)—is gathered, cleaned, and shredded. When melted, it serves as a binding agent. The main fine aggregate, sand, gives the paver bricks strength, stability, and the right shape. To increase load-bearing capacity, coarse materials like crushed stone or gravel are occasionally incorporated. Small amounts of cement may also be added to improve strength, but plastic is sometimes used in place of cement in eco-friendly designs.

Table 1: Specific gravity on fine aggregate

S.NO	Description	Trail 1	Trail 2
1	Empty weight of container (W 1)	630	610
2	Container + fine aggregate (W 2)	1027	1353
3	Container + fine aggregate + Water (W 3)	1785.5	1924
4	Container + Water (W 4)	1479.5	1478
5	Specific gravity	2.31	2.5

Table 2 : Bulk density on fine aggregate

State	Weight of container + aggregate (kg)	Weight of container (kg)	Weight of aggregate (kg)	Bulk density (kg/m ³)
Loose	8	3.4	4.6	1625.44
Compacted	8.5	3.4	5.1	1832.12

Table 3 : Water absorption on fine aggregate

S.No	Weight of dry aggregate (W ₁) (g)	Weight of wet aggregate (W ₂) (g)	Water absorption (%)
1	2000	2200	2%
2	2000	2200	2%

V. EXPERIMENTAL PROCEDURE

Plastic trash, such PET and LDPE, is first gathered, cleaned, and then shredded into tiny bits. Sand and other fine aggregates are prepared and sieved. In a container, the shredded plastic is heated at a controlled temperature until it melts entirely. To create a homogenous mixture, the aggregates are then added gradually and completely mixed with the molten plastic. In order to eliminate air spaces, the heated slurry is poured into greased moulds shaped like paver blocks. After then, it is left to cool and harden at ambient temperature. The blocks are taken out of the moulds and stored for stabilisation after cooling. Lastly, tests are conducted on the durability, water absorption, and compressive strength of the paver blocks.

VI. RESULT AND DISCUSSION

The findings of the experiment demonstrate that, when manufactured with the ideal mix proportion, paver blocks made from plastic waste have good strength and durability. It is discovered that the blocks' compressive strength is either slightly higher or equal to that of traditional paver blocks. Plastic's non-porous nature reduces water absorption, increasing durability and moisture resistance. Strength is found to decrease when plastic content is increased over the ideal amount because of inadequate material bonding. The blocks are inexpensive, lightweight, and have good chemical and weather resistance. Therefore, plastic waste paver blocks offer an environmentally appropriate waste management solution for low-traffic areas like gardens and walkways.

Table 1 :Performance Evaluation of Plastic Sand Paver Block

Sample	Mix ratio (Plastic : Sand)	Compressive strength (Mpa)
A	1 : 2	22 - 26 Mpa
B	1 : 3	18 - 22 Mpa
C	1 : 4	14 - 18 Mpa

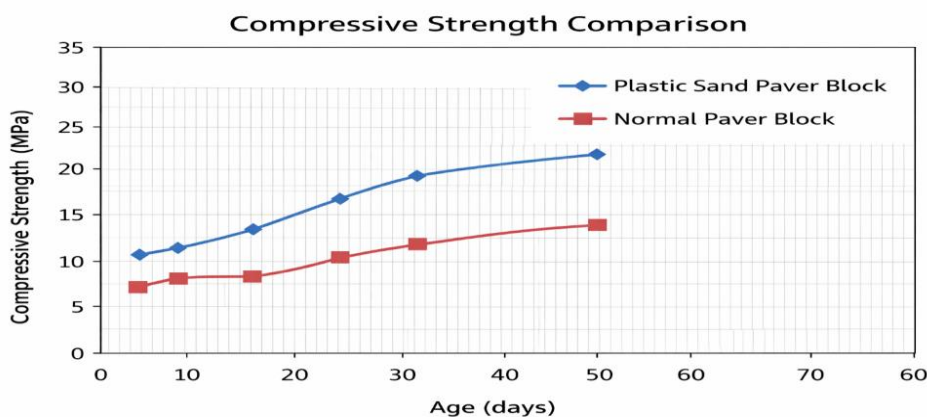


Figure 1: Normal Paver Block vs Plastic Paver Block

VII. CONCLUSION

According to the study of plastic trash may be efficiently used to make paver blocks, offering a sustainable and environmentally beneficial waste management option. When the ideal amount of plastic is utilised, the resulting paver blocks show good compressive strength, minimal water absorption, and great durability. They are affordable, lightweight, and appropriate for places with little traffic, such gardens and walkways. Therefore, using plastic waste in paver blocks promotes sustainable development by minimising the use of traditional building materials and reducing environmental pollution.

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