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Original Article

Experimental of Turning the Plastic Waste Into Urban Infrastructure

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***Abstract**: The increasing accumulation of plastic waste poses a serious environmental challenge, highlighting the urgent need for sustainable material alternatives to mitigate pollution. This study investigates the feasibility of utilizing various types of plastic waste—LDPE, HDPE, PET, PP, and PS—as a binding agent in paver block production. In this method, water is completely eliminated and replaced with 600 grams of shredded molten plastic per specimen. Experimental results show that the 7-day compressive strength of plastic paver blocks (10.83 N/mm^2) is slightly lower than conventional blocks (11.96 N/mm^2). However, the 28-day strength is nearly identical at 19.17 N/mm^2.These findings confirm that plastic waste does not significantly affect long-term durability. Therefore, plastic paver blocks are suitable for non-traffic applications such as parks, footpaths, and residential areas.*

***Keywords**: Plastic waste, Paver blocks, Sustainable materials, Recycling, Compressive strength.*

I. INTRODUCTION

The escalating global plastic waste crisis prese nts a significant environmental challenge, demanding innovative and sustainable solutions. With landfills overflowing and plastic debris polluting ecosystems, the need to repurpose this ubiquitous material is more critical than ever. Simultaneously, the construction industry faces a growing demand for durable and cost-effective building materials. This report explores the potential of combining these two challenges into a single, beneficial solution: the production of paver blocks utilizing plastic waste.

This initiative aims to address two pressing issues: reducing plastic waste and providing a sustainable alternative to traditional concrete pavers. By incorporating recycled plastic into the paver block matrix, we can divert significant amounts of waste from landfills and reduce the reliance on virgin materials. This approach not only mitigates environmental damage but also offers potential economic benefits through reduced material costs and the creation of new recycling streams

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II. METHODOLOGY

The manufacturing process focuses on identifying optimal blends for durable production.

Material Selection: Ordinary Portland Cement (OPC) with a specific gravity of 3.15 and 10 mm coarse aggregates were used.

Plastic Processing: Waste plastic was cleaned, dried, and shredded before being melted in a closed chamber to prevent toxic emissions.

Melting & Mixing: Plastic was melted at temperatures between and mixed with dry cement, quarry dust, and aggregates.

Casting: The mixture was poured into round dumbbell-shaped moulds and compacted manually to eliminate voids.

Curing: Unlike conventional concrete, these blocks require no water curing and are allowed to solidify under ambient conditions for 24 hours.

III. RESULTS AND DISCUSSION

A. Specimen Preparation for Plastic Paver Blocks

The preparation of plastic paver block specimens involves a systematic procedure encompassing the selection of suitable materials, processing of waste plastic, proportioning of constituents, mixing, casting, and curing. The objective of the procedure is to ensure the effective utilization of plastic waste in construction applications, thereby contributing to environmental sustainability and material efficiency.

a) Material Selection and Characterization

For the preparation of plastic paver blocks, the following constituent materials were utilized:

Cement

Ordinary Portland Cement (OPC) was used as a primary binding agent. The specific gravity was determined to be 3.15, with a standard consistency of 33%. The initial and final setting times were 45 minutes and 480 minutes respectively.

Coarse Aggregates

10 mm aggregates were used with a specific gravity of 2.60 and water absorption of 3.0%. These aggregates contribute to the structural integrity of the paver blocks.

Waste Plastic

Thermoplastic waste primarily comprising LDPE, HDPE, PET, PP, and PS was sourced from municipal solid waste streams, including plastic bags, bottles, packaging materials, and disposable items. A total of 600 grams of shredded waste plastic was used per specimen, serving as the binding medium in place of water.

b) Plastic Processing and Melting

The waste plastic was cleaned, dried, and shredded into manageable pieces. The shredded plastic was then subjected to a controlled melting process in a closed chamber to prevent toxic emissions. The melting temperature was maintained within the plastic softening point range (typically 150–250°C, depending on plastic type), ensuring homogeneous liquefaction.

c) Concrete Mix Design and Proportioning

The concrete mix design was prepared according to IS 10262:1982 and IS 456:2000 guidelines for M20 grade concrete. However, in plastic paver blocks, water was entirely eliminated and replaced with molten plastic, which functions as both a binder and filler material. The volumetric proportions of materials per 0.00205 m^3 specimen were:

d) Mixing Procedure

Once the plastic attained a fully molten state, it was immediately mixed with dry cement, quarry dust, and coarse aggregates. The mixing was carriedout manually using a steel trowel over a metal platform. Quick and uniform mixing was essential to prevent premature cooling of the plastic, which could result in poor bonding and segregation.

e) Casting and Compaction

The homogenous mixture was then transferred into custom-fabricated round dumbbell-shaped moulds, each with a volume of 0.00205 m^3. The mix was compacted manually using tamping rods to eliminate voids and ensure proper consolidation within the mould cavity.

f) Cooling and Curing

Unlike conventional concrete, plastic paver blocks do not require water curing. Instead, the specimens were allowed to cool and solidify under ambient conditions for a minimum period of 24 hours before demoulding. Postdemoulding, the blocks were stored in a shaded area and allowed to stabilize for seven to twenty-eight days.

After sufficient curing of both ordinary and plastic concrete block it hasto be checked under compression testing machine (CTM) to know its compressive strength under gradually applied compressive force on the specimen. After placing the paver block on the platform and applied the load on a smooth surface steadily and uniformly at the rate of 35N/sq.mm/minute till the block failed. Noted the load at which it failed and divided it by the cross-sectional area of paver block gives the compressive strength of the specimen.

IV. COMPRESSIVE STRENGTH FOR 7 DAYS CURING

Blocks	Compressive Strength of Ordinary Paver Block (N/mm^2)	Compressive Strength of Plastic Paver Block (N/mm^2)
1	11.45	10.79
2	12.39	10.92
3	12.06	11.10
Average	11.96	10.93

From the above table it is clear that average compressive strength for ordinary paver block is 11.96 N/mm2 and for plastic paver block it is 10.93 N/mm2 which is slight less than ordinary block so plastic paver blocks can be the alternative for it. Similarly, compressive strength checked for the paver blocks after 28 days curing for both the samples. The test result found to be as follows.

V. COMPRESSIVE STRENGTH FOR 28DAYS CURING

Blocks	Compressive Strength of Ordinary Paver Block (N/mm^2)	Compressive Strength of Plastic Paver Block (N/mm^2)
1	19.54	19.55
2	19.55	19.34
3	19.55	19.19
Average	19.54	19.27

The above test results describe that average compressive strength of ordinary concrete paver block on its complete curing of 28th day is 19.54 N/mm2 where in case of plastic paver block it is 19.27 N/mm2.

IV. CONCLUSION

The results obtained from the study clearly indicate that plastic paver blocks exhibit strength characteristics that are almost equal to those of conventional paver blocks. This demonstrates that the incorporation of waste plastic does not significantly compromise the structural integrity of the blocks. Based on the compressive strength values observed, it can be concluded that plastic paver blocks are suitable for practical applications in areas such as parks, footpaths, and residential as well as commercial building yards. Their strength is adequate to withstand regular pedestrian movement and light vehicular loads, ensuring smooth and reliable utility for users. Furthermore, the use of waste plastic in the production of paver blocks provides an effective and productive method for the disposal of plastic waste, which is otherwise a major environmental concern. By integrating plastic waste into construction materials, this approach not only reduces environmental pollution but also promotes sustainable construction practices. It has been observed that approximately 600 kg of plastic waste can be utilized in the production of 1000 paver blocks, highlighting the significant potential for waste reduction.In addition, the large-scale adoption of this method can substantially decrease the amount of plastic present in municipal solid waste. This, in turn, can lead to a considerable reduction in landfill usage, thereby minimizing land pollution and extending the lifespan of landfill sites. Overall, the implementation of plastic paver block technology offers both environmental and functional benefits, making it a promising solution for sustainable waste management and construction.

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