International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2025: 7.089

Utilization of Plastic Waste in the Production of Eco-Friendly Paver Blocks

Dipali G. Bagul[1], Prithviraj A. Waghmare[2], Shreenivas S. Banbare[3], Atharva G. Bhondve[4], Ganesh C. Nelogi[5]

Department of Civil Engineering, JSPM's Rajarshi Shahu College of Engineering Polytechnic, Tathawade (Academic Year: 2025–26)

Abstract: ***Plastic waste has become one of the most serious environmental problems due to its non-biodegradable nature and the large quantity generated every day. Improper disposal of plastic causes pollution and creates major challenges for modern waste management systems. Therefore, finding effective methods for plastic waste reuse is essential for protecting the environment. One of the innovative approaches is the production of plastic paver blocks by incorporating waste plastic into construction materials. These blocks can be used in footpaths, parking areas, and pedestrian walkways. The use of plastic waste in pavement block manufacturing supports sustainable construction practices by reducing environmental pollution and conserving natural resources such as sand and aggregates. This study focuses on the preparation of plastic paver blocks using waste plastic along with cement, sand, and aggregates. The resulting blocks demonstrate good compressive strength, durability, and low water absorption. These characteristics make them suitable for the development of eco-friendly pavement in light traffic areas. Thus, the reuse of plastic waste in pavement block production provides an effective waste management solution while promoting environmentally responsible construction practices.***

Keywords: plastic waste reuse, plastic paver blocks, sustainable construction, waste management solution, eco-friendly pavement

1. Introduction

Plastic is one of the most widely used materials in modern society because it is lightweight, durable, strong, and inexpensive. It is commonly used in packaging materials, plastic bottles, carry bags, containers, and many other household and industrial products. However, the excessive use of plastic has led to the generation of a large amount of plastic waste, which has become a major environmental concern across the world.

Plastic materials are **non-biodegradable**, which means they do not decompose naturally and can remain in the environment for hundreds of years. Improper disposal of plastic waste causes serious problems such as soil pollution, water contamination, and harm to animals and marine life. In urban areas, plastic waste often blocks drainage systems and contributes to flooding during heavy rainfall. Therefore, effective methods of **plastic waste reuse** are necessary to reduce environmental pollution and improve waste management practices.

One of the most effective approaches to addressing this issue is the development of construction materials using waste plastic. The use of plastic waste in the manufacturing of **plastic paver blocks** has emerged as an innovative and practical solution. Pavement blocks are widely used in infrastructure development such as footpaths, parking areas, pedestrian pathways, and landscaping works.

Incorporating waste plastic in pavement block production supports the concept of **sustainable construction**, as it helps reduce the consumption of natural resources such as sand and aggregates. At the same time, it provides an effective **waste management solution** by converting plastic waste into useful construction materials.

Plastic-based pavement blocks offer several advantages including durability, low water absorption, and resistance to chemicals. These properties make them suitable for applications in walkways, gardens, and parking areas. The development of such blocks contributes to the creation of **eco-friendly pavement** systems that are both economical and environmentally responsible.

Therefore, the reuse of plastic waste in pavement block manufacturing not only helps manage plastic waste effectively but also promotes sustainable infrastructure development.

2. Objectives

The main objectives of this project are:

1) To utilize waste plastic effectively in the construction industry.
2) To reduce environmental pollution caused by plastic waste.
3) To minimize the use of natural resources such as sand and cement.
4) To develop environmentally friendly pavement blocks.

3. Literature Review

Many researchers have studied the use of plastic waste in construction materials, particularly in pavement blocks.

A study conducted by **Pathare et al. (2022)** investigated the preparation of pavement blocks using waste plastic such as HDPE. Different proportions of plastic were used in the production of paver blocks. The results showed that a plastic content of around 15% provided the best performance in terms of compressive strength and durability.

Another research carried out by **Chandak et al. (2024)** focused on developing sustainable pavement blocks using waste plastic bottles and demolished concrete. In this study, plastic was used as a binding material while demolished concrete was used as an aggregate replacement. The findings showed that the blocks were cost-effective and environmentally friendly.

Olubunmi et al. (2023) studied the use of plastic waste as a partial replacement for aggregates in concrete paver blocks. The research concluded that replacing about 10% of the aggregate with plastic waste provided good compressive strength and reduced water absorption.

A review by **Kumar et al. (2024)** discussed different techniques for converting plastic waste into paver blocks. The study highlighted that plastic paver blocks are durable, economical, and suitable for areas with light to medium traffic loads.

These studies demonstrate that plastic waste can be successfully reused in pavement block manufacturing while maintaining acceptable strength and durability.

Materials Required

The following materials are required for the production of pavement blocks using plastic waste:

1) **Waste Plastic:** Waste plastic collected from plastic bottles used in the production process. The plastic is cleaned and shredded into smaller pieces before use.
2) **Cement:** Cement acts as a binding material that holds the aggregates and plastic particles together.
3) **Sand:** Sand is used as fine aggregate and helps improve the strength and stability of the block.
4) Coarse Aggregate: Crushed stones or aggregates provide structural strength to the pavement block.
5) **Water:** Water is required for mixing the materials and for curing the blocks.
6) **Moulds:** Special moulds are used to shape the pavement blocks into required sizes and designs.

4. Methodology

The manufacturing of plastic pavement blocks involves several steps.

First, waste plastic is collected from scrap store. The collected plastic is cleaned to remove impurities and then shredded into small pieces.

Next, the required materials such as cement, sand, aggregates, and plastic waste are measured according to the mix design. These materials are then mixed thoroughly to achieve a uniform mixture.

The prepared mixture is placed into moulds and compacted properly to remove air gaps. Proper compaction ensures the strength and durability of the pavement blocks.

After filling the moulds, the mixture is allowed to set for some time. The blocks are then removed from the moulds carefully.

Finally, the blocks are cured by keeping them in a moist condition for several days. Curing helps in gaining strength and improving durability.

Mix Design

Mix design refers to the process of selecting suitable proportions of materials to produce pavement blocks with the desired strength and durability.

In this project, plastic waste is used as a partial replacement for natural aggregates. Different percentages of plastic can be used to determine the optimum mix.

A typical mix proportion used for plastic pavement blocks is shown below:

Material	Percentage
Cement	23%
Sand	42%
Coarse Aggregate	30%
Plastic Waste	5%

This mix provides adequate strength and good performance for pavement blocks used in light traffic areas.

Moulding and Unmoulding

After preparing the mixture, it is placed into moulds to give the desired shape and size.

The moulds are first cleaned and lubricated to prevent the mixture from sticking. The mixture is then poured into the mould and compacted properly.

Once the mixture begins to set, the mould is carefully removed to obtain the pavement block. Proper handling during this stage is important to avoid damage to the block.

Curing

Curing is an essential process that helps improve the strength and durability of pavement blocks.

The blocks are kept in water or moist conditions for a certain period, usually between 7 to 14 days. During curing, cement reacts with water and forms strong bonds between the materials.

Proper curing ensures better strength, durability, and resistance to cracking.

Testing

Various tests are conducted to evaluate the quality and performance of pavement blocks.

Compressive Strength Test

This test measures the maximum load that the pavement block can withstand before failure.

Water Absorption Test

This test determines the amount of water absorbed by the block. Lower water absorption indicates better durability.

Observation Table & Test Results:			
Compressive strength of Paving block			
Sr.	Test Particulars	1	Test Method
1	ID mark		--
2	Thickness (mm)	60.22	--
3	Plan area of paving block (sq mm)	43440	--
4	Max Load (kN)	1715.9	--
5	Apparent Compressive Strength (N/sq mm)	39.50	--
6	Correction Factor	1.06	--
7	Corrected Compressive Strength (N/sq mm)	41.9	IS 15658 : 2021
Water absorption of paving block			
1	Saturated surface dry wt (Ww) (gm)	7003	--
2	Constant Oven dry wt .(Wd) (gm)	6740	--
3	Water absorption (%)	3.90	IS 15658 : 2021

Specification Limits as per IS 15658:2006						
Sr.No	Tests	M-30	M-35	M-40	M-50	M-55
1	Individual Min.Comp.Strength in N/mm 2	25.50	29.75	34.00	42.50	46.75
2	Avg.28 days Comp.Strength in N/mm 2	>,= 30+0.825 X SD	>,= 35+0.825 X SD	>,= 40+0.825 X SD	>,= 50+0.825 X SD	>,= 55+0.825 X SD
3	Water absorption,Percent	Shall not be more than 6 percent by mass for individual sample,should be restricted to 7 Percent				

Observation Table & Test Results:			
Compressive strength of Paving block			
Sr.	Test Particulars	1	Test Method
1	ID mark		--
2	Thickness (mm)	60.38	--
3	Plan area of paving block (sq mm)	43440	--
4	Max Load (kN)	2315.4	--
5	Apparent Compressive Strength (N/sq mm)	53.30	--
6	Correction Factor	1.07	--
7	Corrected Compressive Strength (N/sq mm)	57.0	IS 15658 : 2021
Water absorption of paving block			
1	Saturated surface dry wt (Ww) (gm)	6527	--
2	Constant Oven dry wt .(Wd) (gm)	6305	--
3	Water absorption (%)	3.52	IS 15658 : 2021

Specification Limits as per IS 15658:2006						
Sr.No	Tests	M-30	M-35	M-40	M-50	M-55
1	Individual Min.Comp.Strength in N/mm 2	25.50	29.75	34.00	42.50	46.75
2	Avg.28 days Comp.Strength in N/mm 2	>,= 30+0.825 X SD	>,= 35+0.825 X SD	>,= 40+0.825 X SD	>,= 50+0.825 X SD	>,= 55+0.825 X SD
3	Water absorption,Percent	Shall not be more than 6 percent by mass for individual sample,should be restricted to 7 Percent				


Galaxy A55 5G


LOAD = 01715.8 KN
P LOAD = 01715.8 KN
STRESS = 0076.25 MPa
Galaxy A55 5G
Galaxy A55 5G

5. Analysis and Results

The results obtained from the tests indicate that plastic waste can be effectively used in the production of pavement blocks.

The blocks manufactured using plastic waste show satisfactory compressive strength and durability. They also exhibit water absorption within permissible limit.

Plastic paver blocks are resistant to moisture, which makes them suitable for footpaths, parking areas, gardens, and pedestrian roads.

The use of plastic waste in pavement blocks not only reduces environmental pollution but also provides a cost-effective construction material.

6. Scope of the Project

The use of plastic waste in pavement blocks has significant future potential.

This technology can help reduce the large amount of plastic waste generated every day. It can also decrease the demand for natural construction materials such as sand and aggregates.

Plastic paver blocks can be used in various infrastructure projects including walkways, parking areas, landscaping, and public parks.

Further research and development can improve the strength and performance of these blocks, making them suitable for wider construction applications.

7. Conclusion

Plastic waste has become a major environmental concern due to its nonbiodegradable nature. Reusing plastic waste in construction materials provides an effective solution to this problem.

This project demonstrates that waste plastic can be successfully used in the manufacturing of pavement blocks. The blocks produced using plastic waste are durable, economical, and environmentally friendly.

The use of plastic paver blocks helps reduce plastic pollution and promotes sustainable construction practices. Therefore, this method can be considered an innovative and practical approach for managing plastic waste while developing eco-friendly infrastructure.

References

[1] Pathare, P., Shinde, Y., Kamble, S., & Patil, T. (2022). Preparation of pavement blocks using waste plastic. International Journal of Creative Research Thoughts.
[2] Chandak, M. A., Wakodikar, K., Sahare, S., Roy, B., & Chopkar, P. (2024). Development of sustainable pavement blocks using waste plastic. IJIRT Journal.
[3] Olubunmi, A., Olamoju, R., & Taiye, A. (2023). Solid waste management and reuse of plastic waste in construction materials. Journal of Sustainability and Environmental Management.
[4] Kumar, S., Maurya, S., Kumar, V., Singh, V., & Kumar, A. (2024). Transforming plastic waste into paver blocks: A sustainable solution. International Research Journal of Engineering and Technology.