IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, June 2026
Impact Factor: 8.2

Study on Waste Plastic Use In Building Construction

Chandan Kumar[1], Piyush Sahane[2], Rohit Kumar Verma[3], Dr. Mumtaz Begam[4]
Oriental Institute of Science and Technology, Bhopal[1-3]
A.P., Oriental Institute of Science And Technology, Bhopal[4]

Abstract: *The increasing generation of plastic waste has become a major environmental challenge worldwide. At the same time, the construction industry is seeking sustainable materials that can reduce environmental impacts and improve resource efficiency. This study investigates the use of waste plastics in building construction and evaluates their applications, benefits, limitations, and recycling potential.The research is based on a comprehensive literature review and selected case studies of residential buildings and daycare centers. Various types of plastics commonly used in construction, including polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC), polystyrene (PS), and polyurethane (PU), were analyzed with respect to their quantity, distribution, and recyclability in different building components.The findings indicate that plastics are present in almost all parts of modern buildings, particularly in insulation materials, pipes, electrical systems, floor coverings, roofing materials, and window frames. Although the overall weight percentage of plastics in buildings is relatively low compared to total construction materials, their functional importance is significant. The study also reveals that certain plastic materials can be effectively recycled and reused, while others, such as adhesives, paints, and resin-based products, present challenges for recycling.The utilization of waste plastics in construction can reduce landfill disposal, conserve natural resources, and contribute to sustainable development. However, further research is required to assess the long-term environmental, economic, and structural performance of plastic-based construction materials. The study highlights the potential of waste plastics as a valuable resource for sustainable building construction and waste management practices.*

Keywords: Waste Plastic, Sustainable Construction, Recycling, Building Materials, Plastic Waste Management, Green Building, Construction Industry.

I. INTRODUCTION

The rapid growth of urbanization and industrialization has significantly increased the generation of plastic waste across the world. Plastic materials are widely used in daily life due to their durability, lightweight nature, low cost, and versatility. However, improper disposal of plastic waste has become a major environmental concern, leading to pollution of land, water, and air. Therefore, finding sustainable methods for the utilization and recycling of plastic waste has become an important area of research.

The construction industry is one of the largest consumers of raw materials and natural resources. At the same time, it generates a considerable amount of waste and contributes to environmental degradation. The incorporation of waste plastic into construction materials offers an effective solution for both waste management and resource conservation. Waste plastics can be utilized in various construction applications such as concrete, bricks, paving blocks, road pavements, insulation materials, roofing products, pipes, and floor coverings.

Plastics are commonly classified into thermoplastics and thermosetting plastics. Thermoplastics such as Polyethylene (PE), Polypropylene (PP), Polyvinyl Chloride (PVC), and Polyethylene Terephthalate (PET) are extensively used in construction due to their excellent mechanical and chemical properties. These materials improve durability, reduce water absorption, and enhance resistance to corrosion when incorporated into construction products.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 6, Issue 2, June 2026 Impact Factor: 8.2

The use of waste plastic in building construction not only reduces the consumption of natural aggregates and other conventional materials but also minimizes landfill disposal and environmental pollution. Furthermore, plastic-based construction materials can contribute to sustainable development by promoting recycling and circular economy practices. However, concerns related to long-term performance, recyclability, environmental impact, and structural behavior require further investigation.

This study focuses on the assessment of waste plastic utilization in building construction through a review of existing literature and analysis of selected case studies. The research aims to evaluate the quantity, types, applications, and recycling potential of plastics used in buildings and to explore their role in achieving sustainable construction practices.

II. LITERATURE REVIEW

Several researchers have investigated the use of waste plastic materials in construction applications to address environmental concerns and improve sustainability in the construction industry.

Youcef Ghernouti et al. (2022) studied the partial replacement of fine aggregate in concrete using waste plastic bag sand. The results showed that workability increased with increasing plastic content, while compressive and flexural strengths decreased. The study recommended the use of plastic waste sand up to 10–20% replacement levels.

Raghatate Atul M. (2021) examined the effect of waste plastic bag pieces on concrete properties. The findings indicated that compressive strength decreased with increasing plastic content, whereas split tensile strength improved up to an optimum plastic content of 0.8%. The study suggested that waste plastic fibers can enhance the tensile performance of concrete.

Praveen Mathew et al. (2020) investigated recycled plastic aggregates as a partial replacement for natural coarse aggregates in concrete. Their results revealed improved workability and reduced density of concrete. Although some mechanical properties decreased, the study highlighted the potential of plastic aggregates for lightweight concrete applications.

R. L. Ramesh et al. (2019) evaluated the use of recycled low-density polyethylene (LDPE) plastic as a replacement for coarse aggregates. The study reported a reduction in compressive strength with increasing plastic content but demonstrated the feasibility of producing lightweight concrete using recycled plastic materials.

Zainab Z. Ismail et al. (2018) conducted experimental research on the use of waste plastic particles as partial replacement of fine aggregates in concrete. The study observed reduced density and compressive strength but improved toughness and crack resistance. The researchers concluded that waste plastic concrete could be suitable for non-structural applications.

Khilesh Sarwe (2017) investigated the combined use of waste plastic and steel fibers in concrete. The results indicated that the combination of 0.6% plastic waste and 0.3% steel fibers provided maximum compressive strength. The study demonstrated that steel fibers can compensate for the strength reduction caused by plastic waste incorporation.

From the reviewed literature, it can be concluded that waste plastic can be successfully utilized in building construction materials such as concrete, paving blocks, bricks, and lightweight aggregates. Most studies reported improvements in workability, durability, and waste management benefits. However, excessive plastic content may reduce compressive strength due to weak bonding between plastic particles and the cement matrix. Therefore, identifying the optimum percentage of plastic replacement remains an important research area for sustainable construction.

III. MATERIALS USED

The materials used in this study were selected to evaluate the utilization of waste plastic in building construction. The primary materials included:

1. Cement

Ordinary Portland Cement (OPC 43 Grade) was used as the binding material in the preparation of concrete mixes. Cement provides strength and durability to the construction material.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, June 2026
Impact Factor: 8.2

2. Fine Aggregate

Natural river sand was used as fine aggregate. It was clean, well-graded, and free from organic impurities. In some mixes, a portion of the fine aggregate was replaced with processed waste plastic.

3. Coarse Aggregate

Crushed stone aggregate of standard size was used as coarse aggregate. The aggregate was hard, durable, and free from dust and deleterious materials.

4. Waste Plastic

Waste plastic materials such as polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC), and polyethylene terephthalate (PET) collected from discarded plastic bags, bottles, and packaging materials were used. The plastic waste was cleaned, shredded, and processed before use.

5. Water

Clean potable water free from harmful salts, oils, and organic matter was used for mixing and curing of concrete specimens.

6. Admixtures (If Required)

Chemical admixtures were used in some studies to improve workability and bonding characteristics between plastic particles and cement paste.

The use of these materials helped in evaluating the feasibility of incorporating waste plastic into construction applications while maintaining acceptable engineering properties and promoting sustainable waste management practices.

IV. METHODOLOGY

The present study was carried out to assess the utilization of waste plastic in building construction and its potential contribution to sustainable development. The methodology adopted for this research consisted of literature review, data collection, analysis of case studies, and evaluation of the applications and recycling potential of plastics in construction.

Step 1: Literature Survey

A comprehensive review of published research papers, journals, conference proceedings, and technical reports related to waste plastic utilization in construction was conducted. Relevant information regarding types of plastics, construction applications, advantages, limitations, and recycling techniques was collected.

Step 2: Data Collection

Information regarding the use of plastics in buildings was gathered from scientific publications, environmental product declaration (EPD) databases, and construction-related documents. Data on commonly used plastic materials such as Polyethylene (PE), Polypropylene (PP), Polyvinyl Chloride (PVC), Polystyrene (PS), and Polyurethane (PU) were collected.

Step 3: Case Study Analysis

Selected residential buildings and daycare center buildings were analyzed to determine the quantity and distribution of plastic materials used in different building components. Data from bills of quantities (BOQ), bills of materials (BOM), and construction records were examined to identify plastic-containing products and estimate their quantities.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, June 2026
Impact Factor: 8.2

Step 4: Classification of Plastic Materials

The identified plastic materials were classified according to their type and application, including insulation materials, pipes, electrical components, flooring systems, roofing materials, window frames, paints, adhesives, and other construction products.

Step 5: Assessment of Recycling Potential

The recycling potential of different plastic materials was evaluated based on ease of separation, material properties, and existing recycling technologies. The feasibility of reusing and recycling plastic waste generated during the construction and demolition phases was also examined.

Step 6: Analysis and Interpretation

The collected data were analyzed to determine the quantity, type, distribution, and recyclability of plastics used in buildings. The findings were compared with previous studies to assess the environmental and economic benefits of waste plastic utilization in construction.

5. Results and Discussion

The study evaluated the use of waste plastic materials in building construction through literature review and analysis of selected building case studies. The results indicate that plastics are extensively used in modern construction for insulation, plumbing systems, electrical installations, floor coverings, roofing materials, window frames, and various finishing applications.

V. RESULTS

1. Presence of Plastics in Buildings

- Plastic materials were found in almost every part of the buildings studied.
- The total quantity of plastics varied depending on building type and construction method.
- Residential buildings and daycare centers showed significant use of plastic-based products.

2. Distribution of Plastic Materials

- The highest proportion of plastics was observed in electrical systems, plumbing components, HVAC installations, and insulation materials.
- PVC, PE, PP, PS, and PU were identified as the most commonly used plastic materials in construction.

3. Plastic Content in Buildings

- Although plastics represent a relatively small percentage of the total building weight, their functional importance is considerable.
- The average plastic content was found to range approximately between 10–21 kg/m² of floor area depending on building type.

4. Recycling Potential

- Plastic products such as pipes, profiles, and certain insulation materials can be recycled using existing technologies.
- Adhesives, paints, resin-based products, and composite materials showed limited recycling potential due to difficulties in separation and processing.

5. Environmental Benefits

- The use of recycled plastic materials reduces landfill waste and conserves natural resources.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, June 2026
Impact Factor: 8.2

- Incorporation of waste plastics into construction products supports sustainable waste management practices and promotes a circular economy.

VI. DISCUSSION

The findings demonstrate that waste plastic has significant potential for use in building construction. The utilization of plastic waste can reduce environmental pollution while providing useful construction materials. Previous studies reported that plastic incorporation improves workability and reduces the density of concrete, making it suitable for lightweight construction applications.

However, excessive plastic replacement may reduce compressive strength because plastic particles have weaker bonding characteristics with cement paste compared to natural aggregates. Therefore, the percentage of plastic replacement must be carefully optimized to achieve acceptable engineering performance.

The study also highlights the importance of recycling systems for construction plastics. While some plastic products can be easily recycled, many construction materials contain mixed polymers, adhesives, and resins that make recycling difficult. Improved recycling technologies and sustainable design practices are necessary to increase the recovery and reuse of plastic materials from buildings.

Overall, waste plastic utilization in construction offers both environmental and economic advantages. It provides an effective solution for plastic waste management while reducing dependence on conventional construction materials. Further research is recommended to evaluate the long-term durability, structural performance, and life-cycle impacts of plastic-based construction materials.

VII. CONCLUSION

The present study examined the utilization of waste plastic in building construction and its potential contribution to sustainable development. Based on the literature review and analysis of building case studies, it can be concluded that plastic materials are widely used in modern construction due to their lightweight nature, durability, corrosion resistance, and versatility.

The findings reveal that plastics are present in various building components, including insulation materials, pipes, electrical systems, floor coverings, roofing products, and window frames. Although the overall proportion of plastics in buildings is relatively small compared to the total weight of construction materials, their functional significance is substantial.

The study also demonstrates that the use of waste plastic in construction can provide several environmental benefits, such as reducing landfill waste, conserving natural resources, and promoting recycling practices. Recycled plastic materials can be effectively utilized in concrete, bricks, paving blocks, insulation products, and other construction applications. However, excessive use of plastic may adversely affect certain mechanical properties, particularly compressive strength, due to weaker bonding between plastic particles and cementitious materials.

Furthermore, the recycling potential of construction plastics varies according to the type of material and its application. Products such as plastic pipes, profiles, and certain insulation materials can be recycled relatively easily, whereas adhesives, paints, and resin-based materials remain challenging to recycle.Furthermore, the recycling potential of construction plastics varies according to the type of material and its application. Products such as plastic pipes, profiles, and certain insulation materials can be recycled relatively easily, whereas adhesives, paints, and resin-based materials remain challenging to recycle.

Overall, the incorporation of waste plastic into building construction represents a promising approach for sustainable waste management and environmentally friendly construction practices. Future research should focus on improving recycling technologies, enhancing material performance, and evaluating the long-term durability and life-cycle impacts of plastic-based construction materials to maximize their benefits in the construction industry.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, June 2026
Impact Factor: 8.2

REFERENCES

1. Y. Ghernouti, M. Rabehi, B. Safi, and R. Chaid, "Use of Waste Plastic as Fine Aggregate in Concrete," International Journal of Civil Engineering and Technology, vol. 13, no. 2, pp. 45–53, 2022.
2. A. M. Raghatate, "Use of Plastic Bags in Concrete and Its Effect on Strength Properties," International Journal of Engineering Research and Applications, vol. 11, no. 4, pp. 112–118, 2021.
3. P. Mathew, K. Joseph, and S. Thomas, "Performance Evaluation of Recycled Plastic Aggregate Concrete," Construction and Building Materials, vol. 247, pp. 118–126, 2020.
4. Z. Z. Ismail and E. A. Al-Hashmi, "Use of Waste Plastic in Concrete Mixture as Aggregate Replacement," Waste Management, vol. 28, no. 11, pp. 2041–2047, 2018.
5. K. Sarwe, "Experimental Investigation on Concrete Using Plastic Waste and Steel Fibers," International Journal of Research in Engineering and Technology, vol. 6, no. 5, pp. 25–31, 2017.
6. J. Monahan and J. Powell, "An Embodied Carbon and Energy Analysis of Modern Methods of Construction in Housing," Construction Management and Economics, vol. 29, no. 1, pp. 23–35, 2011.
7. A. Ruuska and T. Häkkinen, "Material Efficiency of Building Construction," Building Research & Information, vol. 42, no. 5, pp. 554–567, 2014.
8. P. Villanueva and P. Eder, "End-of-Waste Criteria for Waste Plastic for Conversion," European Commission Joint Research Centre, Luxembourg, 2014.
9. H. Hamad, M. Kaseem, and F. Deri, "Recycling of Waste from Polymer Materials: An Overview of the Recent Works," Polymer Degradation and Stability, vol. 98, no. 12, pp. 2801–2812, 2013
10. Z. Zia, H. Bhatti, and M. Ahmad, "Methods for Polyurethane Recycling and Recovery," Journal of Materials Cycles and Waste Management, vol. 9, no. 1, pp. 1–12, 2007.