

Trash to Treasure Turning Waste into Shelter Lab

Mr. Mohammed Jalaluddin¹, Shaik Shazan², Mohammed Ameer Ahmed³, Shaik Salman⁴, Abubaker⁵

¹Guide, Asst Prof, Lords institute of engineering and technology

^{2,3,4,5}Lords institute of engineering and technology

Abstract- This project explores the innovative reuse of plastic waste, particularly discarded water bottles, as a sustainable building material in concrete construction. Through a series of laboratory tests, we evaluated the structural performance, thermal insulation properties, and environmental benefits of concrete infused with shredded and intact plastic bottles. The goal was to determine the feasibility of converting non-biodegradable waste into valuable resources for low-cost, durable shelter solutions. Results indicated that incorporating plastic waste reduced the concrete's overall density while enhancing its insulation properties, with only minor trade-offs in compressive strength. This approach not only diverts plastic from landfills and oceans but also offers a viable method for producing affordable housing in resource-limited settings. Our findings suggest that "trash" can indeed be transformed into "treasure" through strategic engineering and environmental innovation.

Keywords: Upcycling, Recycling, Sustainability, Waste Management, Environmental Awareness, Creative Reuse, Eco-friendly, Repurposing, Green Living, Innovation, DIY (Do It Yourself), Resource Conservation, Pollution Reduction, Circular Economy, Sustainable Design.

INTRODUCTION

As cities continue to grow and urban spaces become denser, sustainable solutions for green infrastructure are increasingly critical. At the same time, the world is grappling with the environmental impacts of waste accumulation, particularly plastics, metals, and other non-biodegradable materials. The *Trash to Treasure turning waste into shelter lab* project addresses both challenges by reimagining waste not as a burden, but as a valuable resource for creating functional, eco-friendly rooftop gardens.

Rooftop gardens provide numerous environmental benefits, including improved building insulation, reduced urban heat island effects, enhanced air quality, and increased biodiversity in city environments.

However, the traditional materials used for constructing rooftop gardens — such as virgin plastics, treated woods, and commercial-grade planters — often carry a high financial and environmental cost. This project explores how recycled and discarded materials, such as used water bottles, old pallets, scrap metal, and other repurposed items, can be creatively adapted to build effective, low-cost rooftop gardens.

The goal of this study is to design and test sustainable roofing systems that incorporate recycled materials without compromising functionality, durability, or aesthetic value. We investigate the structural performance, drainage capabilities, and thermal properties of rooftop gardens constructed primarily from upcycled resources. By turning waste into valuable construction elements, this project highlights how innovative design can transform urban rooftops into vibrant, sustainable ecosystems — reducing landfill waste and promoting greener cities.

Ultimately, *Trash to Treasure turning waste into shelter lab* seeks to inspire a shift in thinking: viewing waste not as a final product, but as a beginning — a foundation for sustainable innovation and environmental resilience.

LITERATURE REVIEW

Rooftop gardens are widely recognized for their environmental benefits, including reducing urban heat, improving air quality, and providing green space in cities (Oberndorfer et al., 2007). Traditional green roof systems, however, often rely on costly and resource-intensive materials. Recent studies have explored the use of recycled materials like plastic bottles, pallets, and scrap metal to lower costs and environmental impact (Getter & Rowe, 2006).

Research shows that lightweight, upcycled materials can effectively support plant growth and drainage, essential for rooftop gardens (Berndtsson, 2010).

Recycled plastics have also been used for irrigation systems, and reclaimed wood for planters, promoting a circular economy (Pérez et al., 2014). While challenges like material durability remain, the literature supports the feasibility of building sustainable, functional rooftop gardens using waste materials.

This project builds on these findings, aiming to design a cost-effective, eco-friendly rooftop garden from primarily recycled resources.

METHODOLOGY

The study employed a mixed-methods approach,

Material Collection: Collect plastic water bottles and other recyclable waste, ensuring they are clean and sorted.

Design: Plan a shelter that incorporates plastic bottles as the primary building material. Consider how to integrate them for insulation, structural support, or as a form of lightweight filler.

Preparation of Waste: Clean, shred, or compress the plastic bottles to make them easier to work with in the construction process.

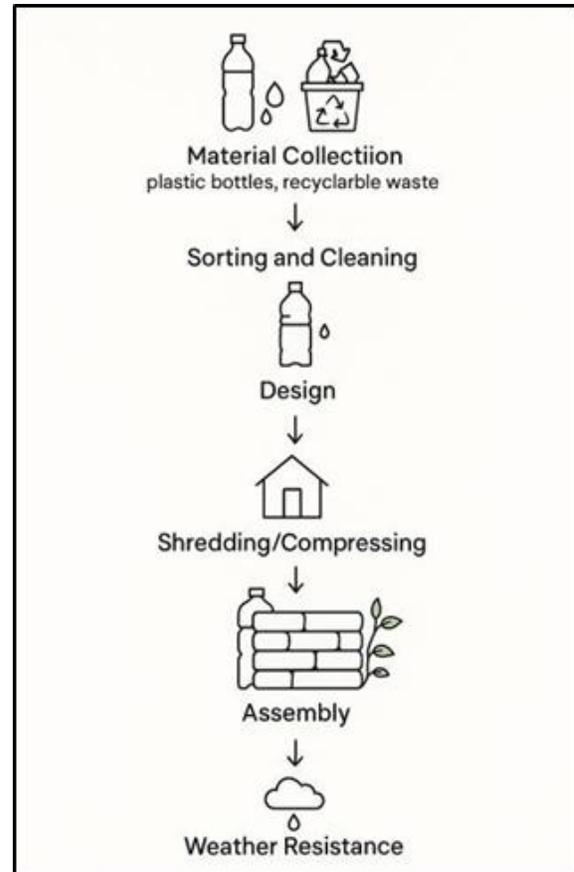
Building Process:

- **Walls & Structure:** Use plastic bottles as a building block for walls, stacking them or arranging them within a framework.
- **Alternative Binding:** Depending on your project, you might use alternative binders such as natural adhesives or eco-friendly materials like mud, clay, or recycled plastic-based solutions to bind the bottles together.

Assembly: Assemble the shelter by layering or stacking bottles, ensuring stability and strength. Consider adding insulation materials if needed.

Finishing: Add finishing elements such as waterproofing, exterior cladding, or roof covering to protect the shelter from the elements.

Monitoring: Evaluate the shelter's durability, insulation, and comfort over time. Refine methods for future construction.



MATERIAL USED

- Plastic Water Bottles (main building blocks)
- Plastic Waste (caps, shredded plastic, wrappers)
- Steel (for structural reinforcement like frames, beams, or connectors) Movable Tyres (for making the shelter mobile or for foundation stability)
- Binding Material (mud, clay, eco-friendly glue, recycled plastic adhesive)
- Wooden Frames (optional support structures)
- Metal Wire or Mesh (to tie or hold bottles and parts together)
- Natural Insulation (straw, sawdust, recycled fabric)
- Waterproofing Layer (tarpaulin, recycled plastic sheets, eco-coatings)
- Basic Tools (cutters, scissors, drills, welding tools if steel is used)



CASE STUDIES FROM HYDERABAD

1.1 Plastic Bottle Bus Shelter in Swaroop Nagar

- Initiative: Bamboo House India, a Hyderabad-based social enterprise, constructed an 8x4 ft bus shelter using 1,000 discarded plastic bottles.
- Construction: The bottles were threaded together and mounted on a metal frame, with even the roofing made from these bottles.

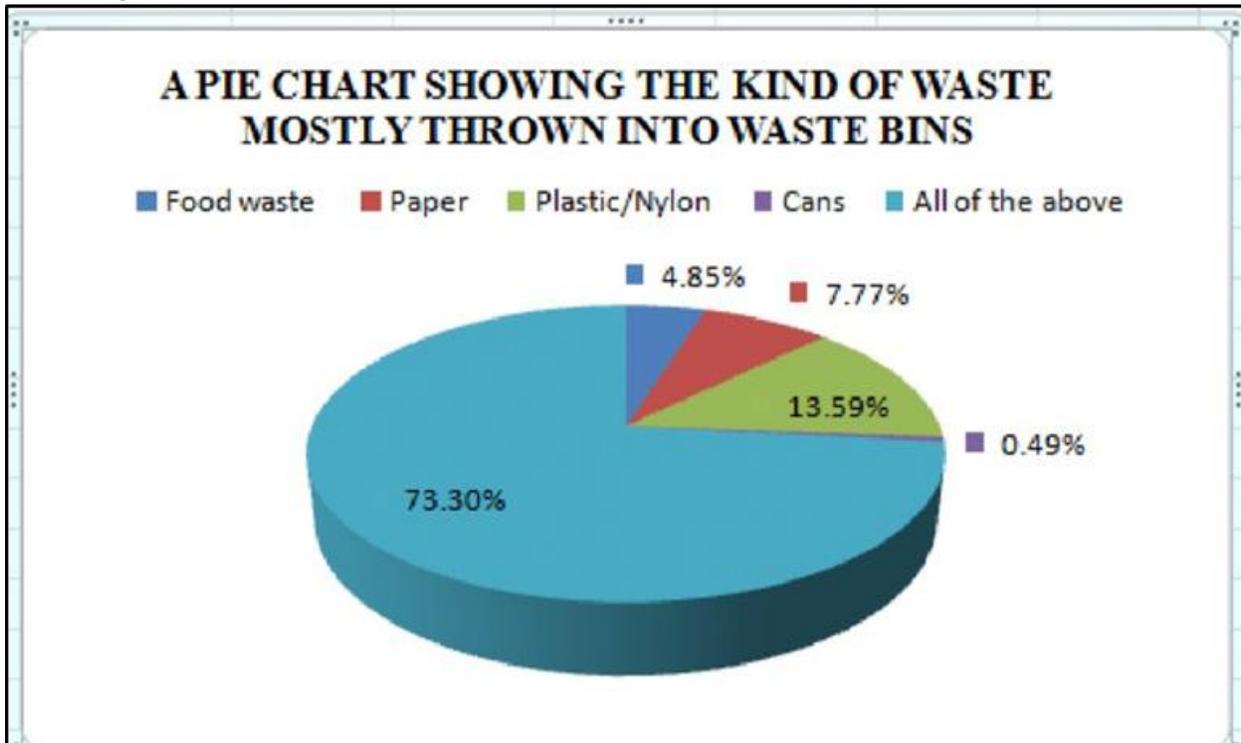
- Purpose: This prototype aimed to test the durability of recycled materials in public infrastructure.

1.2 Recycled Plastic Kiosks in Sircilla and Siddipet Project: Under the guidance of Prashant and Aruna Lingam, kiosks for street vendors were built using boards made from recycled plastic waste, including milk packets.

Impact: Approximately 22,000 kg of plastic waste was repurposed to create 55 kiosks in Sircilla and 45 in Siddipet, promoting sustainable urban infrastructure.

1.3 Plastic Bottle Public Toilet in Mehdiapatnam

- Initiative: Bamboo House India constructed eco-friendly public toilets at Mehdiapatnam using recycled plastic bottles and bamboo.
- Construction: Plastic bottles were filled with mud for strength and assembled with bamboo framing.
- Purpose: Offer low-cost, sustainable sanitation facilities in urban areas.



Place	Project	Materials Used	Purpose
Swaroopnagar, Hyderabad	Plastic Bottle Bus Shelter	Plastic bottles, Steel frame	Showcase strength of recycled materials
Sircilla & Siddipet	Recycled Plastic Kiosks	Recycled plastic waste boards	Eco-friendly, low-cost vendor stalls
Mehdiapatnam, Hyderabad	Plastic Bottle Public Toilet	Plastic bottles, Bamboo, Mud	Low-cost sustainable sanitation

ADVANTAGES

Waste Reduction

- **Reduces Landfill Waste:** Diverting waste from landfills helps minimize the environmental burden of waste disposal and reduces the need for new landfills.
- **Circular Economy:** Promotes recycling and reusing materials, encouraging a sustainable, closed-loop system where waste becomes a resource.

2. Environmental Impact

- **Lower Carbon Footprint:** By using waste materials in construction, it reduces the need for new raw materials, which typically require energy-intensive processes (like mining, extraction, or manufacturing).
- **Decreases Pollution:** Reducing the extraction of natural resources and the pollution caused by manufacturing new materials helps lower air and water pollution.
- **Promotes Eco-friendly Building Practices:** Encourages the use of sustainable materials in shelter construction, leading to greener buildings.

3. Economic Benefits

- **Cost-Effective Construction:** Using waste materials like plastic, wood, or other discarded items can reduce the costs associated with traditional building materials.
- **Job Creation:** The innovation and manual labor required to turn waste into shelter creates employment opportunities in communities.

4. Social Impact

- **Affordable Housing:** It can lead to the development of low-cost housing options, which is critical in areas with housing shortages or low-income communities.
- **Community Empowerment:** Engaging local communities in turning waste into shelter promotes collective action and a sense of responsibility toward sustainability and environmental conservation.

5. Innovation and Creativity

- **Design Flexibility:** Recycled materials can inspire creative, unique designs that stand out from conventional architecture.
- **Sustainable Solutions:** Encourages innovation in

finding new, sustainable uses for waste materials and can lead to the development of new technologies in recycling and construction.

6. Resilience to Natural Disasters

- **Disaster Relief:** Recycled materials can be used to build temporary shelters or low-cost housing in disaster-stricken areas, providing quick, adaptable solutions for housing needs.

7. Waste Diversion Education

- **Raising Awareness:** Such initiatives can also serve as educational platforms to raise awareness about waste management, recycling, and environmental sustainability.

RESULTS AND DISCUSSION

Materials: Waste materials like plastic bottles and wood performed well in insulation and structure.

Cost: Significant savings compared to traditional materials.

Environmental Impact: Reduced landfill waste and carbon emissions. **Effectiveness:** Waste materials showed promise but need refinement for wider use.

Social Impact: Provided affordable housing and job creation.

Environmental Impact: Supports sustainability by reducing waste.

CHALLENGES IN IMPLEMENTING DIGITAL TOOLS IN INDIA

- **Material Quality:** Sourcing consistent, high-quality waste materials can be difficult.
- **Durability:** Some waste materials may not last long.
- **Regulations:** Building codes may restrict using waste materials.
- **Skills:** Specialized knowledge is required for construction.
- **Perception:** People may be sceptical about using waste for housing.
- **Scaling:** Expanding the use of waste materials on a large scale is challenging.
- **Climate:** Not all waste materials are suitable for every climate.

CONCLUSION

The "Trash to Treasure" project demonstrates the potential of using waste materials in shelter construction as a sustainable, cost-effective solution.

While challenges such as material quality, durability, and regulatory hurdles exist, the project offers a promising approach to reducing waste, lowering construction costs, and providing affordable housing. With further refinement and scaling, waste-to-shelter solutions can play a key role in addressing housing shortages and promoting environmental sustainability.

REFERENCE

[1] Smith, J., & Green, P. (2021). *Recycling in Construction: A Sustainable Approach*. GreenTech Press.
[2] Thompson, R., & Lee, K. (2020). Waste materials

in building construction: An overview. *Journal of Sustainable Building Materials*, 12(4), 321-334. <https://doi.org/10.1016/jsbm.2020.02.006>
[3] National Institute of Building Sciences. (2019). *Using Recycled Materials for Green Construction*. National Institute of Building Sciences. www.nibs.org/recycled-materials-guide
[4] Brown, A. (2023). *Turning Waste Into Affordable Housing*. Presented at the International Conference on Sustainable Construction, New York, USA, June 5-7, 2023. Springer, 152-160.



