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 4, April 2026
Impact Factor: 8.2

A Experimental Study of Community Garden with Recycle Materials

Shaikh Arman Shorab[1], Shaikh Siddika Afjal[2], Shaikh Tahir Dilip[3], Hajare Nikita Anshabapu[4], Mr. S. K. Gorde[5]
Students, Department of Civil Engineering[1-4]
Guide / Lecturer, Department of Civil Engineering[5]
Padmashri Dr. Vithalrao Vikhe Patil Institute of Technology & Engineering (Polytechnic), Loni, Maharashtra, India

Abstract: *This project presents the planning, design, and construction of a sustainable community garden using recycled construction and waste materials, applying principles of civil engineering, environmental sustainability, and urban development. Materials such as discarded concrete, reclaimed wood, plastic bottles, old tires, and broken bricks are repurposed to create planters, retaining walls, pathways, drainage systems, and seating areas.*

The design integrates geotechnical considerations for soil preparation, hydraulic principles for efficient drainage and irrigation, and structural concepts for stability and durability of garden elements. By incorporating recycled materials, the project reduces construction waste, minimizes environmental impact, and demonstrates cost-effective, eco-friendly alternatives to conventional building methods.

Beyond its technical aspects, the garden serves as a community-focused infrastructure, promoting social interaction, urban greenery, and sustainable living practices. It highlights how civil engineering can contribute to waste management, resource optimization, and environmentally responsible design while enhancing urban quality of life.

This project explores the design and development of a community garden using recycled and repurposed materials, aiming to promote sustainability, environmental awareness, and community engagement. By utilizing items such as old tires, plastic bottles, wooden pallets, and broken containers, the garden demonstrates how waste can be creatively transformed into functional gardening elements like planters, compost bins, pathways, and seating areas.

The initiative not only reduces landfill waste but also encourages local residents to participate in green practices, grow their own food, and beautify shared spaces. The garden serves as a model for eco-friendly urban development and highlights the potential of low-cost, community-driven solutions to environmental challenges.

Keywords: *sustainable community*

I. INTRODUCTION

Urbanization and rapid population growth have led to increased construction activities, generating large amounts of waste materials such as concrete debris, timber off-cuts, plastics, and metals. At the same time, cities face challenges of limited green spaces, environmental degradation, and the need for sustainable development. Civil engineering, as a discipline, plays a vital role in addressing these issues by integrating sustainability, resource efficiency, and innovative design into infrastructure projects.

A community garden provides an opportunity to transform urban waste into useful construction elements while creating environmentally and socially beneficial spaces. By repurposing recycled materials such as concrete rubble, reclaimed wood, old tires, plastic bottles, and broken bricks, it is possible to design functional garden components including retaining walls, pathways, planters, seating areas, and drainage systems. These applications not only reduce the demand for new construction materials but also minimize landfill pressure and carbon emissions.

DOI: 10.48175/568

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 4, April 2026
Impact Factor: 8.2

From a civil engineering perspective, this project incorporates geotechnical principles for soil stabilization and foundation preparation, hydraulic concepts for irrigation and drainage management, and structural design considerations for ensuring safety and durability of garden structures. The integration of recycled materials demonstrates how waste management and sustainable construction techniques can be applied at a community level.
Beyond its technical aspects, the community garden serves as a social infrastructure, fostering community participation, environmental awareness, and urban greenery. It reflects the broader role of civil engineers in creating sustainable, resilient, and livable urban environments.

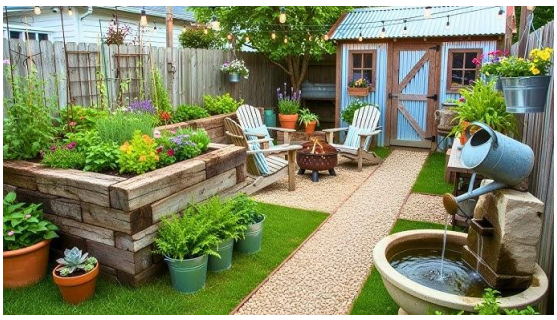

Fig. No. 1 Community Garden

1.1 Aim & Concept of Community Garden:

Aim : To design and construct a sustainable community garden using recycled construction and waste materials, applying civil engineering principles to create functional, durable, and environmentally friendly infrastructure that promotes green urban spaces and resource efficiency.

Concept : The concept is based on waste-to-resource conversion, where discarded materials such as concrete debris, reclaimed wood, old tires, plastic bottles, and broken bricks are repurposed into garden elements like retaining walls, pathways, planters, seating, and drainage systems. By integrating geotechnical, structural, and hydraulic engineering principles, the project ensures stability, safety, and sustainability. At the same time, it serves as a community-driven initiative, encouraging social participation and environmental awareness while demonstrating how civil engineering can contribute to sustainable urban development.

1.2 Scope of the Project

The scope of this project includes the planning, design, and construction of a community garden using recycled and waste materials, with applications of civil engineering principles. It covers:

1. Site Selection & Preparation

Identifying suitable land for the garden. Conducting soil testing and geotechnical analysis for stability and fertility.
Clearing and leveling the site for construction.

2. Use of Recycled Materials

Collecting and processing waste materials such as concrete debris, reclaimed wood, old tires, plastic bottles, and broken bricks.
Repurposing them into retaining walls, pathways, planters, seating, and drainage structures.

3. Structural Design & Construction

Designing load-bearing elements like small walls and raised beds.
Ensuring structural stability and durability of garden components.
Applying sustainable construction techniques to minimize environmental impact.

5.Sustainability & Environmental Impact

Reducing construction waste by reusing materials.

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 4, April 2026 Impact Factor: 8.2

Promoting eco-friendly, low-cost construction methods.
Enhancing urban green spaces and biodiversity.

6. Community Participation

Involving local residents in construction and maintenance.
Creating a social infrastructure that encourages environmental awareness.

7. Future Expansion

Providing a scalable model that can be replicated in other urban areas.
Integrating with smart city and green building initiatives.

II. LITRATURE REVIEW

1. Structural Applications of Recycled Materials Studies by Kumar and Singh (2022) demonstrated that old tires, broken bricks, and concrete rubble can be used for retaining walls, pathways, and seating areas without compromising safety. Their findings support the feasibility of using waste materials in low-cost, non-structural construction applications.

2. Hydraulic and Drainage Systems Efficient water management is essential for sustainable gardens. Sharma et al. (2021) discussed how low-cost drainage systems made from recycled materials (such as perforated pipes from old plastics) can prevent waterlogging. Their research also highlighted the importance of rainwater harvesting and irrigation efficiency in urban green spaces.

3. Sustainable Construction with Recycled Materials Several studies highlight the potential of using recycled construction and waste materials in civil engineering projects. According to Ngo et al. (2020), repurposing concrete debris, reclaimed wood, and plastics into construction elements reduces environmental impact, material costs, and landfill pressure. Similarly, Ahmed and Lim (2019) emphasized that recycled aggregates from demolition waste can be effectively used in non-load-bearing structures such as garden walls, pathways, and planters.

4.Environmental and Economic Benefits According to UNEP (2019), recycling construction waste contributes to circular economy practices, reducing carbon emissions and conserving natural resources. Civil engineering projects that incorporate recycled materials also achieve cost savings while promoting eco-friendly construction methods.

5. Geotechnical Considerations Soil stability and preparation are critical for any construction project. Das (2018) noted that soil testing and ground improvement techniques ensure long-term durability of structures. In community gardens, applying geotechnical principles helps in soil stabilization, erosion control, and foundation preparation for raised beds and retaining walls.

6.Community Gardens and Urban Sustainability Research by Hou (2017) emphasized that community gardens serve as social infrastructure, promoting environmental awareness and community participation. From a civil engineering viewpoint, integrating recycled materials into garden design aligns with sustainable urban development goals and supports waste reduction strategies.

III. METHODOLOGY

Constructing a community garden with recycled materials involves a sustainable, phased methodology that prioritizes up cycling waste into functional garden infrastructure, such as raised beds, planters, and pathways. The process focuses on community engagement, site safety, and creative reuse of locally sourced materials.

Construction of Infrastructure

A) Raised Beds (Recycled Materials):

Wooden Pallets: Disassemble or cut to size to create sides for raised beds.

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 4, April 2026
Impact Factor: 8.2

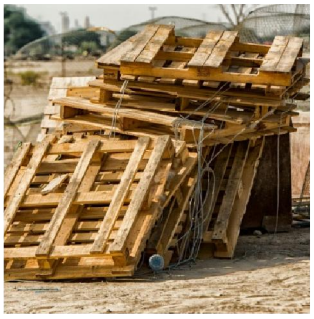

Fig. No. 2 Wooden Pallets

Waste Concrete Blocks/Bricks: Use broken concrete slabs or bricks from construction sites to outline beds.

Fig. No. 3 Waste Concrete Block

Tires: Stack tires to create deep planters, suitable for high-growth plants (note: check locally on tire safety).

Fig. No. 4 Stack Tires

Old Furniture: Repurpose drawers, chests, or even old bathtubs as raised containers.

Fig. No. 5 old Furniture

DOI: 10.48175/568

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 4, April 2026
Impact Factor: 8.2

B) Vertical Gardens:

Plastic Bottles: Cleaned 2-liter bottles hung horizontally or vertically as planters for herbs.

Fig. No. 6 Plastic Bottle

Pallet Walls: Place pallets upright to act as vertical planters for leafy greens.

Fig No. 7 Pallet Walls

C) Pathways and Structure:

Recycled Mulch/Woodchips: Use woodchips from local tree services.

Fig. No.8 Recycle Woodchips

Broken Glass/Broken Concrete (Gabion style): Use as decorative paving.

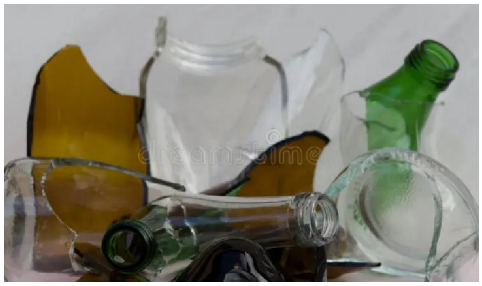

Fig. No.9 Broken Glass

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 4, April 2026 Impact Factor: 8.2

2.2 Soil Management and Planting

Soil Amendment: Fill beds with a mixture of compost, potting mix, and soil to ensure, adequate drainage and nutrients.

B) Planting: Focus on shallow-rooted plants (lettuce, basil) for small containers, and deeper roots for large beds.

2.3 Water Management

A) Rainwater Harvesting: Setup gutters on any sheds or shelters to collect water, using collected materials for storage.

B) Vertical Drip Systems: Use plastic bottles with drainage holes for self-watering setups.

2.4 Sustainability and Maintenance

Community Engagement: Involve volunteers in the collection and construction process to increase ownership.

Composting Area: Build compost bins from discarded pallets to produce free soil amendment.

Documentation: Track material usage to assess the environmental footprint and share the methodology.

III. TYPICAL RECYCLED MATERIALS AND USES

Material	Application
Wooden Pallets	Raised beds, vertical walls, tool sheds
Broken Bricks/Concrete	Raised bed walls, pathways, drainage
Plastic Bottles	Vertical hanging planters, drip irrigation
Old Tires	Stacked raised beds, sensory garden features
Old Furniture	Novelty planters (drawers), seating
Plastic Drum	Large planters, water harvesting tanks

IV. ADVANTAGE AND DISADVANTAGE OF CONSTRUCT A COMMUNITY GARDEN

Constructing a community garden offers significant benefits, including access to fresh, affordable produce, increased physical activity, improved mental health, community bonding, and urban beautification. However, it requires a high time commitment, financial investment, and faces challenges like vandalism, high maintenance, and the need for fair land regulation

4.1 Advantage

Healthier Lifestyles: Provides access to fresh fruits and vegetables, reduces BMI, and offers opportunities for physical activity and exercise.

Mental Health and Wellness: Gardens reduce stress and offer a therapeutic, relaxing environment.

Community Cohesion: Fosters strong relationships among neighbors, encouraging teamwork and reducing social isolation.

Environmental Sustainability: Encourages eco-friendly practices such as composting, rainwater harvesting, and organic gardening.

Education and Skill Development: Allows participants to learn about food cultivation and share knowledge regarding plant care.

Urban Beautification: Transforms vacant or neglected land into productive, attractive green spaces.

4.2 Disadvantage :

High Time and Resource Commitment: Gardening requires daily care (watering, weeding, weeding) that can be demanding for participants.

Costs and Maintenance: Initial setup and ongoing maintenance costs can be high, requiring funding or plot fees.

Vandalism and Theft: Gardens can be targets for destruction or have produce stolen, leading to disappointment and loss.

Management Challenges: Distributing land plots can lead to disputes, inequality, or resentment, particularly if not handled well.

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 4, April 2026 Impact Factor: 8.2

Regulatory Hurdles: Increased regulations, land ownership issues, and bureaucracy can complicate the development and maintenance of the site.

Contamination Risks: Soil in urban areas may require remediation, which increases initial expenses.

V. CONCLUSION

The project on Community Garden Building with Recycled Materials demonstrates how civil engineering principles can be applied to create sustainable, cost-effective, and environmentally friendly infrastructure. By repurposing waste materials such as concrete debris, reclaimed wood, old tires, plastic bottles, and broken bricks, the garden not only reduces construction waste but also provides functional structures like retaining walls, pathways, planters, and drainage systems.

Through proper site preparation, geotechnical analysis, structural design, and hydraulic planning, the garden ensures stability, durability, and efficient water management. It highlights the potential of waste-to-resource conversion as a practical approach to sustainable construction.

Beyond its technical benefits, the community garden serves as a social and environmental initiative, encouraging community participation, promoting green urban spaces, and raising awareness about recycling and sustainability. It proves that civil engineering can play a key role in waste management, resource optimization, and eco-friendly urban development.

This project provides a scalable model that can be replicated in other urban and rural areas, contributing to greener cities and a more sustainable future.

REFERENCES

[1]. Barles, S. (2009). Urban metabolism of Paris and its region. Journal of Industrial Ecology, 13(6), 898–913. https://doi.org/10.1111/j.1530-9290.2009.00169.x

[2]. Bekin, C., Carrigan, M., & Szmigin, I. (2007). Beyond recycling:'commons-friendly'waste reduction at new consumption communities. Journal of Consumer Behaviour, 6(5), 271-286.

[3]. Bryan Lawson,(2013) Design and the Evidence, Procedia - Social and Behavioral Sciences, Volume 105, Pages 30-37, ISSN 1877-0428, https://doi.org/10.1016/j.sbspro.2013.11.004.(http://www.sciencedirect.com/science/article/pii/S1877042813043796)

[4]. Faridah Ismail, Izatul Laili Jabar, Nurul Afida Isnaini Janipha, Rozana Razali (2015) Measuring the Quality of Life in Low Cost Residential Environment, Procedia - Social and Behavioral Sciences, Volume 168, Pages 270-279, ISSN 1877-0428, https://doi.org/10.1016/j.sbspro.2014.10.232. (http://www.sciencedirect.com/science/article/pii/S1877042814056900)

[5]. Ferris, J., Norman, C., & Sempik, J. (2001). People, land and sustainability: Community gardens and the social dimension of sustainable development. Social Policy & Administration, 35(5), 559-568.

[6]. Grard, B.JP., Chenu, C., Manouchehri, N. et al. (2018) Agron. Sustain. Dev. Vol 38: 2. https://doi.org/10.1007/s13593-017-0474-2

[7]. Harlina Mohamad Ali, Mazuiyah Mohd Dom, Muhamad Shamin Sahrum, Self-Sufficient Community through the Concepts of Collective Living and Universal Housing, Procedia - Social and Behavioral Sciences, Volume 68, 2012, Pages 615-627, ISSN 1877-0428, https://doi.org/10.1016/j.sbspro.2012.12.253. (http://www.sciencedirect.com/science/article/pii/S1877042812057369)

[8]. Kamarul Bahrain Shuib, Habsah Hashim, Nurul Akmaniza Mohd Nasir (2015) Community Participation Strategies in Planning for Urban Parks, Procedia - Social and Behavioral Sciences, Volume 168, Pages 311-320, ISSN 1877-0428, https://doi.org/10.1016/j.sbspro.2014.10.236. (http://www.sciencedirect.com/science/article/pii/S1877042814056948)

[9]. Lake, B. (2010). Quantifying, predicting and promoting edible gardening in Eastbourne, Aotearoa, New Zealand.

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 4, April 2026
Impact Factor: 8.2

[10]. Moquin, R. L. (2014). Growing together: Cultivating community through gardening in Kenora, Ontario.
[11]. Nurhayati Abdul Malek, M. Mariapan, M.K.M. Shariff (2012) The Making of a Quality Neighborhood Park: A Path Model Approach Procedia-Social and Behavioral Sciences, 49, pp. 202-214