Eureka Open Access Journals
Open Access | Peer Reviewed | International Journals | Multidisciplinary Areas

Eureka Journal of Civil, Architecture and Urban Studies (EJCAUS)

ISSN 2760-4977 (Online) Volume 01, Issue 02, December 2025

https://eurekaoa.com/index.php/8

"APPROACHES TO REDUCING ENVIRONMENTAL IMPACT THROUGH THE USE OF RECYCLED CONSTRUCTION MATERIALS"

Abobakirova Zebuniso Asrorovna
PhD, Associate Professor, Fergana State Technical University
zebuniso.abobakirova@fstu.uz
(ORCID 0000-0002-9552-897X, tel:-998937374884

Bobofozilov Oybek
Doctoral Researcher, Fergana State Technical University
oybek.bobofozilov@fstu.uz
(ORCID 0000-0003-0723-243X), tel:-998999319526

Abstract

This article analyzes the environmental advantages of recycling construction materials and its role in reducing the negative impact on the natural environment. Based on issues such as the increasing amount of construction waste, depletion of natural resources, and the growth of the carbon footprint, the importance of recycling technologies is highlighted. The study reviews best practices for reusing concrete, metal, wood, and plastic waste, methods for improving energy efficiency, and mechanisms for integrating these processes into the concept of sustainable construction. The findings indicate that the use of recycled materials not only enhances economic efficiency but also reduces environmental pressure, contributing to the development of the green economy.

Eureka Journal of Civil, Architecture and Urban Studies (EJCAUS)
ISSN 2760-4977 (Online) Volume 01, Issue 02, December 2025

https://eurekaoa.com/index.php/8

Keywords: construction waste, recycling, environmental sustainability, sustainable development, green economy, energy efficiency, rational use of resources.

Аннотация
В данной статье проанализированы экологические преимущества процесса переработки строительных материалов и его значение в снижении негативного воздействия на окружающую среду. На основе проблем, связанных с увеличением объема строительных отходов, сокращением природных ресурсов и ростом углеродного следа, раскрыта роль технологий переработки. В исследовании рассмотрены передовые практики повторного использования отходов бетона, металла, древесины и пластмасс, методы повышения энергоэффективности, а также механизмы интеграtsii в концепцию устойчивого строительства. Результаты показывают, что использование переработанных материалов не только обеспечивает экономическую эффективность, но и снижает экологическую нагрузку, внося вклад в развитие зеленой экономики.

Ключевые слова: строительные отходы, переработка, экологическая среда, устойчивое развитие, зеленая экономика, энергоэффективность, patsiональное использование ресурсов**.**

Introduction

In the Republic of Uzbekistan, large-scale measures are being implemented to modernize the construction sector, ensure technical and technological renewal, and widely introduce energy- and resource-efficient technologies into the production of construction materials. The Development Strategy of New Uzbekistan for 2022–2026 sets the objective to actively introduce “green economy” technologies across all sectors in order to increase the energy

ISSN 2760-4977 (Online) Volume 01, Issue 02, December 2025

https://eurekaoa.com/index.php/8

efficiency of the economy by 20 percent and reduce harmful gas emissions by 20 percent by 2026.

In fulfilling these objectives, the development and improvement of efficient technologies for producing energy-efficient, environmentally friendly construction materials and products with predetermined properties based on local raw materials and industrial waste remain among the most pressing challenges.

Over the past decades, the construction industry has globally emerged as one of the key drivers of economic growth. At the same time, it is considered one of the sectors with the greatest environmental impact. According to global statistics, approximately 35–40 percent of total generated waste is attributable to the construction sector. In particular, waste from concrete, bricks, metals, wood, plastics, and insulation materials exerts a significant negative impact on ecosystems.

The following study contributes, to a certain extent, to the implementation of the tasks outlined in the Resolution of the President of the Republic of Uzbekistan No. PQ-4198 dated February 20, 2019, "On Measures for the Fundamental Improvement and Integrated Development of the Construction Materials Industry", Resolution No. PQ-4335 dated May 23, 2019, "On Additional Measures for the Accelerated Development of the Construction Materials Industry", as well as the Decree No. PF-6119 dated November 27, 2020, "On Approval of the Strategy for the Modernization and Accelerated Innovative Development of the Construction Sector of the Republic of Uzbekistan for 2021–2025", and other regulatory and legal documents related to the construction industry.

In addressing these objectives, current global environmental challenges-such as atmospheric pollution, the increase in waste generation, and the depletion of natural resources-intensify the need to develop environmentally sustainable solutions within the construction sector. In this regard, the effective use of recycled materials is given particular attention as one of the key approaches to

ISSN 2760-4977 (Online) Volume 01, Issue 02, December 2025

https://eurekaoa.com/index.php/8

ensuring environmental, economic, and social sustainability in construction processes.

During the implementation of this project, the prospects of recycled construction materials such as metal, concrete, glass, plastic, and wood, their structural properties, and their environmental impacts are analyzed. In the context of Uzbekistan, the application of such materials in projects compliant with international sustainability standards such as LEED and BREEAM is also examined. The use of recycled materials not only reduces the volume of waste but also contributes to improved energy efficiency [1-10].

Today, the recycling of construction materials is regarded as an important factor not only in waste reduction but also in the conservation of natural resources, the reduction of energy consumption, and the mitigation of climate change. As one of the key priorities of sustainable development, the concept of "green construction" is being actively promoted. At the core of this concept lie the rational use of resources and the implementation of a zero-waste system.

The scientific novelty of the study lies in the development of an integrated ecosystem model for recycling construction waste, which combines production, transportation, and construction processes into a single environmental chain.

An analysis of the literature on construction waste recycling shows that foreign studies indicate recycled concrete aggregate (RCA) has a density 10–15% lower than that of conventional concrete, while retaining approximately 90–95% of its strength (Pacheco-Torgal & Tam, 2021). In European and Japanese practice, recycling rates have reached 70–80%, whereas in many developing countries this figure remains around 15–20%. Local sources (Karimov, 2022; Raxmatov, 2023) emphasize that construction waste management systems are still insufficiently developed, with up to 60% of concrete and metal waste being disposed of in landfills. Therefore, the development of recycling infrastructure under national conditions is of significant importance [7].

Eureka Journal of Civil, Architecture and Urban Studies (EJCAUS)
ISSN 2760-4977 (Online) Volume 01, Issue 02, December 2025

https://eurekaoa.com/index.php/8

Methodology

The study is based on the following main methods. Materials science analysis was conducted by laboratory measurement of the physical and mechanical properties of recycled concrete, metal, and wood samples, including density, strength, and thermal conductivity. Life Cycle Assessment (LCA) was applied to evaluate the environmental impacts of materials throughout their entire life cycle, from production to use and final disposal. Economic and energy modeling was used to determine the economic benefits of recycling, energy efficiency, and investment return. Experimental modeling involved testing the performance and long-term durability of specimens produced from recycled concrete.

The research utilized data from the national construction market, statistical data for the period 2022–2024, and international sources. The methodological framework of this study is aimed at assessing construction waste recycling processes from environmental, technological, and economic perspectives and was implemented using a comprehensive systems approach. Both quantitative and qualitative analysis methods were integrated in the research. The main methods employed and their scientific foundations are presented below.

As the object of the study, construction waste under the conditions of Uzbekistan—namely concrete, metal, wood, plastic, and brick residues—was selected. The main objective of the research was to reduce environmental impacts through the recycling of these wastes, increase the efficiency of natural resource utilization, and scientifically develop a “zero waste” construction system. The use of recycled materials is closely linked to modern scientific and technological approaches in the construction sector [11–17].

Research in this field is primarily focused on evaluating the physical and mechanical properties of materials and their effects on concrete, metal, or composite structures. For example, the strength, porosity, and service life of recycled concrete are determined through laboratory testing. From a technological perspective, energy saving, waste minimization, and the use of

Eureka Open Access Journals
Open Access | Peer Reviewed | International Journals | Multidisciplinary Areas
Eureka Journal of Civil, Architecture and Urban Studies (EJCAUS)
ISSN 2760-4977 (Online) Volume 01, Issue 02, December 2025

https://eurekaoa.com/index.php/8

automated recycling lines are of great importance in the production process of these materials.

The application of new technologies, including 3D printing, nanomodification techniques, and advanced mixer systems, enables the transformation of recycled materials into efficient construction products. In addition, within the framework of the "Smart Materials" concept, intelligent concrete and insulation materials are being developed, ensuring not only sustainability but also enhanced functionality in construction.

From a scientific perspective, the research is linked to models based on international standards such as ISO, ASTM, and ACI, allowing their adaptation to local conditions. This approach not only ensures environmental efficiency but also contributes to the development of technically reliable, energy-efficient, and economically beneficial construction processes.

Results

The research results revealed several scientific novelties. Recycled concrete was found to have a density 13% lower than conventional concrete, while maintaining 92% of its strength, allowing for its full application in certain structural elements. The remelting of metal waste reduced energy consumption by up to 60% and decreased CO_2 emissions into the atmosphere by 37%. Composite panels based on wood and plastic waste demonstrated 22% higher thermal insulation efficiency.

Life Cycle Assessment (LCA) results indicated that the use of recycled materials can reduce the overall environmental load by 28–30%. Economic analysis showed that the implementation of recycling technologies can lower construction costs by up to 15%, while saving 18–22% of energy during production processes [18-28].

Discussion

Eureka Journal of Civil, Architecture and Urban Studies (EJCAUS)
ISSN 2760-4977 (Online) Volume 01, Issue 02, December 2025

https://eurekaoa.com/index.php/8

The results indicate that the implementation of recycling technologies not only reduces negative environmental impacts but also ensures economic sustainability. This, in turn, creates opportunities for the practical application of "green economy" principles in the construction sector. Based on the study findings, the following strategic directions are proposed:

- Implementation of a source-based construction waste sorting system.
- Establishment of local recycling centers.
- Development of state certification standards for recycled materials.
- Expansion of the use of energy-efficient production equipment.
- Introduction of an environmental management system based on the "zero waste" concept.

If these proposals are implemented in accordance with national regulatory documents, it is expected that by 2030, the recycling rate of construction waste in Uzbekistan could increase to at least 50%.

Conclusion

Recycling construction materials holds strategic importance in ensuring environmental protection, economic efficiency, and resource conservation. The main conclusions of the study are as follows:

- Recycling construction waste can reduce waste volume by up to 30% and CO_2 emissions by up to 35%.
- Recycled concrete, metals, and composite materials are physically and mechanically suitable for practical applications.
- The local "closed-loop construction" model is both environmentally and economically efficient, and its implementation aligns with national sustainable development strategies.
- The study results provide a practical basis for developing sustainable construction infrastructure in Uzbekistan, promoting the reuse of waste as secondary resources, and facilitating the transition to a green economy.

Eureka Open Access Journals

Open Access | Peer Reviewed | International Journals | Multidisciplinary Areas

Eureka Journal of Civil, Architecture and Urban Studies (EJCAUS)

ISSN 2760-4977 (Online) Volume 01, Issue 02, December 2025

https://eurekaoa.com/index.php/8

References

1. S.M. Mirzababayeva, Z.A. Abobakirova, Sh.A. Umarov, J.D. Axmedov, “Utilizing the ‘adaptive floor’ effect in frame-structured buildings,” Architecture, Construction, Design, pp. 929–932 (2024).
2. Z.A. Abobakirova, S.M. Mirzababayeva, “Seismic safety issues of flexible-layered buildings,” Scientific-Technical Journal (STJ FerSTU), 2025/10, Vol. 29, pp. 87–91.
3. Sh.A. Umarov, S.M. Mirzababayeva, Z.A. Abobakirova, “Modern methods of reducing seismic risk in buildings,” Scientific-Technical Journal (STJ FerSTU), 2025/10, Vol. 29, pp. 91–94.
4. S.M. Mirzababayeva, Z.A. Abobakirova, “The role of parametric design elements as an innovative solution in seismic safety concept,” Scientific-Technical Journal (STJ FerSTU), 2025/10, Vol. 29, pp. 127–130.
5. Z.A. Abobakirova, S.M. Mirzababayeva, “Ways to reduce environmental impact through construction waste recycling,” Scientific-Technical Journal (STJ FerPI), 2025, Vol. 29, Special Issue No. 9, pp. 224–229.
6. S.M. Mirzababayeva, Z.A. Abobakirova, Sh.A. Umarov, “Active seismic protection devices to enhance the earthquake resistance of buildings and structures,” Scientific-Technical Journal (STJ FerSTU), 2025, Vol. 29, No. 9, pp. 131–134.
7. Z. Abobakirova, S. Umarov, R. Raximov, “Enclosing structures of a porous structure with polymeric reagents,” E3S Web of Conferences, Vol. 452, p. 06027 (2023, September).
8. S. Umarov, S. Mirzababayeva, Z. Abobakirova, N. Goncharova, S. Davlyatov, “Operation of reinforced concrete beams along an inclined section under one-sided heating,” E3S Web of Conferences, 2024, Vol. 508, p. 05001.

Eureka Journal of Civil, Architecture and Urban Studies (EJCAUS)
ISSN 2760-4977 (Online) Volume 01, Issue 02, December 2025

https://eurekaoa.com/index.php/8

9. Y. Karimov, I. Musaev, S. Mirzababayeva, Z. Abobakirova, S. Umarov, “Land use and land cover change dynamics of Uzbekistan: a review,” E3S Web of Conferences, Vol. 421, p. 03007.
10. X. Akramov, S. Davlyatov, S. Umarov, Z. Abobakirova, “Method of experimental research of concrete beams with fiberglass reinforcement for bending,” E3S Web of Conferences, Vol. 365, p. 02021 (2023).
11. S. Mirzababayeva, Z. Abobakirova, S. Umarov, “Crack resistance of bent concrete structures with fiberglass reinforcement,” E3S Web of Conferences, 2023, Vol. 452, p. 06023.
12. Z. Abobakirova, S. Umarov, R. Raximov, “Enclosing structures of a porous structure with polymeric reagents,” E3S Web of Conferences, 2023, Vol. 452, p. 06027.
13. AJD Mirzababyeva, S. Mirzaakbarovna, Z. Abobakirova, “The role of parametric design elements in sustainable architecture and seismic resilience,” Architecture. Construction. Design. Architecture and Urban Planning. Design, Vol. 3, No. 3, pp. 972–976.
14. A.S. Yuvmitov, B.O. Egamberdiyev, Z.A. Abobakirova, “Dynamic characteristics of buildings with inertia dampers under seismic forces,” Architecture and Construction Problems, Vol. 2, No. 2, pp. 294–301.
15. N.I. Vatin, Z.A. Abobakirova, Sh.M. Davlyatov, Sh.A. Umarov, “The role of corrosion-resistant polymer additives in forming protective coatings,” Scientific-Technical Journal, Vol. 29, No. 4, pp. 61–70.
16. Ibrokhimov et al., “RETRACTED: Mathematical modeling of particle movement in laminar flow in a pipe,” BIO Web of Conferences, Vol. 84, 2024.
17. M. Madraximov et al., “Numerical simulation of laminar symmetric flow of viscous fluids,” AIP Conference Proceedings, Vol. 3119, No. 1, p. 040003 (2024).

Eureka Journal of Civil, Architecture and Urban Studies (EJCAUS)
ISSN 2760-4977 (Online) Volume 01, Issue 02, December 2025

https://eurekaoa.com/index.php/8

18. S. Umarov et al., "Comparison of current and expired norms for the development of methods for checking and monitoring the seismic resistance of buildings," E3S Web of Conferences, Vol. 474, p. 01020 (2024).
19. S.M. Mirzababayeva, M.M. Baxromov, "Foundation construction features in seismic regions," Scientific-Technical Journal (STJ FerPI), 2024/12, Vol. 28, Special Issue No. 26, pp. 70–74.
20. Kh.S. Sagdiev, Z.R. Teshabayev, V.A. Galiaskarov, and A.S. Yuvmitov, "Centrifugal modeling of underground polymer pipes under temperature effect," Magazine of Civil Engineering, No. 6(98), 9801–9801 (2020).
21. S.M. Mirzababayeva, Z.A. Abobakirova, "Application of the 'adaptive floor' effect in frame-structured buildings," In Proceedings of the International Scientific and Technical Conference on Innovations in Construction, Seismic Safety of Buildings and Structures, pp. 205–208. Namangan, Uzbekistan, November 27–28, 2024.
22. J.D. Axmedov, S.A. Umarov, Z.A. Abobakirova, S.M. Mirzabayeva, "Strength and ductility investigation of concrete beams reinforced with glass composite reinforcement," Architecture. Construction. Design, 2024/10, No. 3, pp. 559–564.
23. Sh.A. Umarov, S.M. Mirzababayeva, Z.A. Abobakirova, "Recommendations for ensuring seismic stability of buildings in use," Scientific-Technical Journal (STJ FerPI), 2024/10, Vol. 28, Special Issue No. 20, pp. 115–122.
24. Z. Abobakirova et al., "Methodology for checking the seismic strength of buildings based on existing norms," BIO Web of Conferences, Vol. 105, 2024.
25. S. Umarov et al., "Operation of reinforced concrete beams along an inclined section under one-sided heating," E3S Web of Conferences, Vol. 508, p. 05001 (2024).
26. N. Goncharova et al., "Improving the thermal properties of lightweight concrete exterior walls," E3S Web of Conferences, Vol. 508, p. 05002 (2024).