

Sustainable Design in Building and Urban Environment

Farshid Aram 

Faculty of Architecture and Urbanism, Urmia University, Urmia 5756151818, Iran; f.aram@urmia.ac.ir

The basic objectives of sustainability are to reduce the consumption of non-renewable resources, minimize waste, and create healthy, productive environments. Sustainable design in construction seeks to reduce adverse impacts on the environment and the health and comfort of people in buildings and urban areas, thereby improving the performance of buildings and urban spaces.

Sustainable design principles include the ability to optimize site potential, minimize non-renewable energy consumption, use environmentally preferable products, protect and conserve water, protect and enhance green resources, enhance the indoor and outdoor environmental quality, and optimize operational and maintenance practices.

Utilizing sustainable design principles encourages decisions at each phase of the design process, aiming to reduce adverse impacts on the environment and people's health without compromising the bottom line. It is the integrated, holistic approach that encourages compromise and tradeoffs, with such an integrated approach positively impacting all phases of an urban environment's life cycle, including design, construction, operation, and decommissioning.

As the editor of this Special Issue "Sustainable Design in Building and Urban Environment", I was pleased to receive several interesting research papers and review articles. This collection consists of a wide range of studies from different parts of the world, from South American to European and Asian cities, all accomplished in the fields of civil engineering, architecture, and urban planning. These studies introduced different methods regarding sustainable design from new techniques using computer simulation and artificial intelligence to studies on the traditional method of historical sites. In this Editorial paper, we present an overview of the main findings and conclusions of the included articles.

da Costa et al. [1] highlighted the issue of the large number of retired containers stacked in ports worldwide and the need for sustainable strategies for their use. Repurposing these containers into permanent structures, such as container houses, has become a popular trend. However, due to the urgency in disaster situations, container houses are often built quickly without considering energy efficiency principles. This can lead to performance issues, including overheating, corrosion, and rust, which further impact the vulnerable populations they serve. The objective of this study was to compare the performance of two thermal insulators applied to a temporary shelter container designed to promptly serve vulnerable populations. The researchers used Building Information Modeling (BIM) software and Building Energy Simulation (BES) software to simulate and analyze the technical and economic viability of the model. The results indicate that thermal insulators, particularly mineral wool, can significantly reduce energy consumption and improve long-term performance [1].

In a similar study regarding containers and tiny houses, Nezzi et al. [2] examined the relationship between the perceived knowledge and sustainability in the evaluation of a sustainable product, specifically a tiny house prototype. The study utilized a questionnaire to assess the quality, creativity, appropriateness, and sustainability of the tiny house. Unlike previous research that focused on direct sustainability-related information, this study provided sustainability information in an indirect and diffuse form. The majority



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of evaluators were ordinary people, with a limited number of experts in the field, making the sample representative of the general population. The findings indicated that prior knowledge and background did not significantly influence evaluations. However, gender and age had an impact, with women and younger participants rating the tiny house higher in terms of sustainability and other factors. The evaluation criteria were found to be significantly correlated, particularly in terms of perceived sustainability, preference, and creativity [2].

Cabeza-Lainez et al. [3] introduced a system called DianaX for architectural simulations that considers volumetric and three-dimensional properties, as well as energy sources involved in energy exchanges within and around buildings and urban spaces. The system is based on advances in optics theory, building upon assumptions of different studies in this field. The system utilizes complex integral equations to solve for radiated energy and offers advantages in terms of clearer visualization and analysis of building performance. The software can be considered a Design Tool, enabling the assessment of heritage building paradigms and the potential of new projects with unconventional lighting approaches. The main finding of this research was the feasibility and appropriateness of this method for addressing the problems at hand. The authors express their intention to expand the catalog of designs that can benefit from the use of their tool for scientific design in the future [3].

Given the new techniques of sustainable design, Yu et al. [4] provided a comprehensive review of recent research on the use of immersive virtual environments (ImVE) in architectural design collaboration. The study identified, screened, and reviewed 29 journal articles published since 2010, focusing on three aspects: ImVE in the architecture, engineering, and construction (AEC) industry, ImVE for supporting virtual collaboration, and applications of ImVE in design collaboration. The review highlighted the need for future research and technological development in areas such as ImVE support for design collaboration at the early design stage, cognitive research on design collaboration in ImVE, and enhancements to ImVE technologies to incorporate advanced design features.

In this regard, through using artificial intelligence techniques, the study conducted by Jayabalan et al. [5] discussed the use of steel plates in various engineering fields and the importance of considering buckling as a failure mode. It focused on rectangular steel plates with centrally placed circular openings and different support conditions. The study utilized artificial intelligence techniques, including Gene Expression Programming (GEP), Artificial Neural Network (ANN), and Evolutionary Polynomial Regression (EPR), to predict the critical buckling loads of these plates. Datasets from the literature were compiled and used to develop the models [5].

Another study [6] assessed the use of in-filled tubes, specifically steel shell tubes filled with concrete, as a successful configuration for axially loaded members like columns and struts. This configuration offers advantages such as eliminating the need for shuttering, reinforcement bars, and ties, while increasing flexural and axial capacities and enhancing ductility. However, a main disadvantage is the potential for local buckling and decomposition. Previous studies have explored solutions using intermediate stiffeners or shear connectors. This research proposed a different approach using double cold-formed sigma sections as steel shell tubes. Sixteen specimens with varying lengths, cross-section dimensions, and shell thicknesses were tested under concentric and eccentric compression loads. The results recorded ultimate capacities, lateral deformations, and normal strains. Theoretical capacities were calculated using different standards and software, with deviations from experimental results ranging from 13% to 24% [6].

According to the necessity for the development of appropriate standard projects for providing highways with roadside service facilities and increasing efficiency, Samoilov et al. [7] suggested interconnecting space-planning solutions based on a triangular module instead of a square or rectangular one. According to the results of this research, the use of this modular system can help reduce the harmful impact on the environment and effectively utilize renewable energy sources [7].

The research conducted by Mangeli et al. [8] focused on rock-cut architecture, a lesser-known type of vernacular architecture that differs from conventional architectural practices. The study aimed to explore the techniques, designs, and excavation procedures employed in this type of architecture. The research compares and contrasts the techniques, types, and settlement context materials, recognizing three general excavation techniques. The main case study was the Meymand residential complex, the largest rock-cut complex in Iran. The study examined 50 residential units in the oldest part of the village, analyzing techniques and design styles and comparing them [8].

Regarding the importance of public spaces and green areas on the mental and physical health of individuals, with a focus on thermal comfort as a key indicator, Baquero Larriva and Higuera García [9] examined the outdoor thermal comfort of older adults in Madrid, Spain, and Newcastle upon Tyne, United Kingdom, during the autumn season. The study utilized a mixed methodology involving environmental measurements and surveys conducted on-site. The findings of this research highlighted the need for the design of more comfortable and healthy public spaces that enhance the quality of life for all citizens, aligning with the principles of active aging and healthy cities [9].

In the study conducted by Abouelela [10], the focus was on investigating the relationship between the work environment and job happiness at King Faisal University. The researcher aimed to understand the opinions of faculty and staff members regarding their environmental and functional needs at work, with a specific focus on improving the interior design of workspaces to create happiness in the work environment. Overall, this research emphasized the importance of the work environment in shaping individuals' happiness and quality of life. It provided insights into the factors that contribute to job satisfaction and highlighted the role of organizations in creating a conducive work environment that fosters happiness and encourages innovation and creativity [10]. In a similar study [11], the importance of interior design in academic libraries, specifically in the context of college and university libraries, was discussed. This research indicated the need for academic libraries to evolve from being mere repositories of books to becoming spaces for research and communication [11].

Conflicts of Interest: The author declares no conflict of interest.

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