

# The Sustainability and Efficiency of Refugee Camp Design

Safa A. Alhusban, Ahmad A. Alhusban, and Mohammadward A. Alhusban

**Abstract**—Refugee camps worldwide are temporary places planned and designed with immediate and well-managed actions to achieve shelter for refugees that meet their basic human needs. Successful refugee camps' architecture should be sustainable in providing the shelters with energy and electricity and efficiently meeting the shelters' stability and quality. In this area of research, there is a lack of knowledge regarding the design factors that may promote the sustainability and efficiency of refugee camps. This research aims to define the design factors that promote design sustainability and efficiency and to estimate the extent of applying those factors in the Azaatari refugee camp in Al Mafraq City, Jordan. This qualitative research collected the data regarding factors that may promote design sustainability and efficiency from archival records and literature review and analyzed through content analysis. Data regarding Azaatari refugee camp design were collected through maps, images, and plans by site visits, observations, and non-governmental organizations' reports and were analyzed through spatial and descriptive analysis. This research found that the design factors that may promote the sustainability of refugee camps are urban design principles and sustainability techniques, and the design factors that may facilitate the efficiency of refugee camps are humanitarian considerations and the construction system. Any shortage or weakness in the sustainability or efficiency of the camp design may cause chaos, social problems, diseases, and crimes, threatening community stability and safety. Additionally, this research found that the extent of applying the sustainability and efficiency factors in the Azaatari camp design is very low. This research recommends adding more services to the Azaatari camp to be more walkable, redesigning the interior spaces of the units to be more efficient, and reconsidering the integration between indoor and outdoor spaces. This research calls for further research that integrates sustainability and efficiency factors for post-disaster shelters to improve life quality.

**Keywords**—refugee camps' design, sustainability factors, design efficiency

## I. INTRODUCTION

The United Nations High Commissioner for Refugees (UNHCR) reported that refugees and forcibly displaced people

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Safa A. Alhusban works in the Department of Architectural Engineering, Faculty of Engineering, Al al-Bayt University, Jordan

Ahmad A. Alhusban works in the Department of Architectural Engineering, Faculty of Engineering, The Hashemite University, Jordan

Mohammadward A. Alhusban is Student at the Department of Architectural Engineering, Al al-Bayt University, Jordan

had increased to 80 million in 2018 [1], which is considered the highest level since World War II. Shelters are constructed to provide a secure place for people who have lost their houses due to disasters [2]. Currently, refugee camps are characterized by high economic impact, waste production, and low adaptability to location-based needs [3]. Post-disaster temporary shelters are the first construction needed for the affected population, and their design should be efficient in a way that serves and sustains them. Many typologies of shelters were found to move people from tents to occupants' places [4]. The location of the post-disaster shelters influences their effectiveness and sustainability in the short and long term [5]. Portable structures of shelters are the most popular and practical models as a temporary solution after any crisis because of the ease of availability and users' comfort [6]. Azaatari camp is the fifth largest refugee camp in the world, established for Syrian refugees in 2012 at Al Mafraq –Jordan. There are over 26000 prefabricated shelters, some accommodating persons with disabilities [7].

### A. Research Problem

Refugee camps' design should be efficient in a way that meet the short-term need for immediate shelter [6]. Successful post-disaster architecture should meet the need for sustainable energy resources and stability [5]. Currently, there is a lack of knowledge regarding the design factors that may promote the sustainability and efficiency of refugee camps.

### B. Research Objective

This research aims to define the factors that promote design sustainability and efficiency and to estimate the extent of applying those factors in the Azaatari refugee camp in Al Mafraq City, Jordan.

### C. Research Questions

- What are the factors that promote design sustainability and efficiency?
- To what extent does the Azaatari camp design apply the design factors that promote design sustainability and efficiency?

### D. Research Significant

Defining the factors of refugee camp design that may promote design sustainability and efficiency can help and improve the design of shelters worldwide, which promotes a

healthy lifestyle mentally, physically, and psychologically. Designers must support camp design by understanding the proper architectural solutions [8]. Developed countries need a strategic plan for refugee camp design because three of four refugees are hosted in developed countries [9].

## II. LITERATURE REVIEW

### A. *Refugee Camps*

Refugee camps are the first places where affected families begin their journey toward becoming "homed." Studies suggested that the shelters should have psychological qualities in design and materials [10]. Refugee camps are the first response to natural and artificial disasters; the design and construction of fast shelters require immediate decisions [3]. Planning, implementing, and controlling refugee camp design and sites are the most critical challenges of post-disasters [5].

### B. *Refugee Camps` Design*

Refugee Camps` architectural design depends on the architectural style and design standards. Those aspects define the quality of the camp and create a gap between camps` designs worldwide.

The style may adopt traditional or modern typologies of design; most designers follow humanitarian agency shelters (HAS) or historical vernacular dwellings (HDS) in which each style has a different level of comfort, energy consumption, and sustainability [11]. The differentiation between them is in the energy demand and the stability of comfort level.

Design Standards or guidance for refugee shelters are multiple; firstly, the International Organization for Migration clarified the Transitional Shelter Guidance in 2012 [2]. Secondly is the Strategic Planning for Post-Disaster Temporary Housing [12]. Generally, a shelter requires more than just a roof for a space to be habitable. People living in a shelter must have enough clothing, blankets, mattresses, stoves, fuel, and access to services such as water and sanitation [2]. The shelter should be secure, stable, livable, and aesthetically pleasing [13]. The shelter should include human and social dimensions with individuals` proximity to services and livelihood.

### C. *Sustainability in Refugee Camps` Design*

Sustainability in refugee camp design depends on two factors: urban design principles and sustainability techniques,

- Urban design principles: Urban design elements and principles emphasize the importance of walkability, connectivity, proximity, accessibility, sustainability, and safety [14]. Walkability is positively associated with perceptions of attractiveness, aesthetics, or greenery [15]. Urban connectivity is the physical connection between two urban spaces and is related to urban space integration [16]. Accessibility is easy access to the place from surrounding areas [14]. The accessibility of any urban setting enhances social interaction [15]. Safety is the secure feeling in any urban setting. It is critical for users, especially the elderly and women [17]. The indications of

urban design principles are walkability and accessibility to community services.

- Sustainability Techniques: The materials of shelters should be easy to recycle, upgrade, reuse, resell, and relocate after a shelter is disassembled [13]. The shelter should be environmentally friendly and provide different functions with direct access to services. Shelters can even positively affect the environment if they are designed with a dual purpose in mind [2]. UNHCR achieved the coordinating role of providing the shelters with the required assistance such as infrastructure, maintenance, and energy-saving sustainable energy supply [7]. The electricity in the camp is provided through a solar power plant that increases safety and security [7]. The indicators of sustainability techniques are energy-saving systems, daylighting processes, and mechanical heating and cooling systems.

### D. *Efficiency in Refugee Camps` Design*

Efficiency in refugee camp design depends on humanitarian considerations and the construction system.

- Humanitarian Considerations: individuals whose homes have been damaged will have serious stress issues; being a refugee suddenly has a considerable psychological impact and can cause physical stress symptoms. Therefore, it is important to consider design elements to reduce the stress of affected people, such as adding nice colors, soft materials, kind furniture, sloped roofs, and large windows [18]. UNHCR achieved equitable and gender-appropriate access to the shelters and basic facilities in the Azaatari camp [7]. The indicators of humanitarian considerations are indoor comfort quality, services, indoor and outdoor integration, merging people with nature, child-friendly spaces, and aesthetics.
- Construction system: some designs for shelters develop a method for layering local soil with a specific construction system. The goal is to create durable structures that can be easily deconstructed once they serve their purpose. Some trends used locally sourced materials in combination with additive manufacturing to reduce the financial cost, resources, and human labor [3]. Material: Material that can be used in refugee camp architecture varies from one country to another. For example, bamboo was used in Afghanistan, concrete was used in Haiti, brick was used in Pakistan, steel was used in Vietnam and Indonesia, and timber was used in the Philippines, Peru, Pakistan, Indonesia, and Haiti [4]. Sun-dried brick [11]. The material should be as strong and efficient as possible to avoid damage and flexible to adapt to environmental challenges. Some shelters` designs focused on new construction methods that allow for time, cost efficiency, and flexibility to adapt to different contexts. The indicators of the construction system are the stable structure, flexibility of use, and the material quality of caravans.

### E. *Area of Study*

Azaatari camp is the fifth largest refugee camp in the world. It was established in 2012. It is located in Al Mafraq city, 15

kilometers from the Jordan-Syria border. The Azaatari camp comprises 8.75 square kilometers of land, home to 80,000 people within a 5-mile radius [19]. The relief organizations were given 19 days to prepare the camp to accommodate 15,000 people, but there was no master plan, and the design was weak [20]. The Azaatari camp was constructed with no pre-defined plan for population growth or long-term residency. The average life of a refugee tent is 4 years, while the tents are used for twelve [21].

### III. METHODOLOGY

This qualitative research collected data regarding factors that may promote design sustainability and efficiency through archival records and literature review and analyzed through content analysis. Data regarding Azaatari refugee camp design and typologies were collected through maps, images, and plans by site visits, observations, and non-governmental organizations` reports and were analyzed through spatial and descriptive analysis. This research estimated the extent of applying those factors in the Azaatari refugee camp in Al Mafraq City, Jordan, by evaluating the availability of the indicators. If the indicator is available, it will be coded as (2), if the indicator is available with low quality, it will be coded as (1), and if the indicator is not available, it will be coded as (0).

### IV. RESULTS

This research found that the factors that may promote sustainability are urban design principles and sustainability techniques, and the factors that may promote the efficiency of refugee camps` design are humanitarian considerations and the construction system. Additionally, this research found that the extent of applying sustainability and efficiency factors in the Azaatari camp is very low; the sustainability ratio is 40%, and the efficiency ratio is 25%. The results of evaluating the availability of the indicators and the coding are clarified in Table I.

### V. CONCLUSION AND RECOMMENDATIONS

Refugee camp is the first response to natural and artificial disasters worldwide. Architects are responsible for designing and constructing the first place that will host the refugees, which is the shelter. Successful design of refugee camps should be sustainable and efficient.

TABLE I: THE RESULTS OF EVALUATING THE AVAILABILITY OF THE INDICATORS AND THE CODING

The factors	The indicators	Azzatari Refugee Camp	coding	Sum	
Sustainability of refugee camps` design	Urban design principles	• Walkability and pedestrians	Not available	0/2	4/10 = 40%
		• Accessibility and easy access to services	Poor	1/2	
	The sustainability techniques	• Using Energy Saving Systems	Available	2/2	
		• Using daylighting process	Poor	1/2	
		• Mechanical heating and cooling	Not Available	0/2	
		• Indoor comfort quality	Poor	1/2	
Efficiency of refugee camps` design	Humanitarian considerations	• Services such as schools and health centers	poor	½	4/16 =25%
		• Indoor and outdoor integration and merging people with nature	Not Available	0/2	
		• child-friendly spaces	Not Available	0/2	
	construction system	• Aesthetically pleased	Not Available	0/2	
		• Stable structure	Poor	½	
		• Flexibility of using	Not Available	0/2	
	• The material quality of caravans	Poor	½		

This research defined the factors that promote sustainability and efficiency of refugee camp design and estimated the extent of applying these factors to Azaatari refugee camp in Al Mafraq, Jordan. This research found that the design factors that may promote the sustainability of refugee camps are urban design principles and sustainability techniques, and the design factors that may facilitate the efficiency of refugee camps are humanitarian considerations and the construction system. This research recommends promoting the adequate consideration of shelters` design standards, sustainability techniques, and humanitarian concepts.

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**Safa Al Husban** is an associate professor in architectural engineering department, Engineering Faculty at Al al-Bayt University, Al Mafraq-Jordan. Specialized in architectural design, Dr. Al Husban got her Ph.D, DDes program (Doctor of Architectural Design) from the Interdisciplinary design institute at Washington State University in the USA in 2012 with a GPA (3.95). She got her Master degree in

Architectural studies in 2007 from Jordan University of Science and Technology (Very Good) grade; and her Bachelor's degree in Architectural engineering from Jordan University of Science and Technology in 1994 (Good).

She worked for 12 years as a Faculty Member at the architectural engineering department. worked as Dean Assistant (2019-2021), Dean Assistant for quality assurance and quality control (QA and QC) at the Engineering Faculty at Al Al-Bayt University (2015-2019) has 18th publications in international journals ISI and Scopus in architectural design, urban design, interdisciplinary research that integrates design, health, and sustainable development, and refugee camps' design.

Dr. Al Husban got an excellence award (Literati Awards 2020) and a scientific prize from Emerald Publishing for the paper "Assessing the impact of urban Syrian refugees on the urban fabric of Al Mafraq city architecturally and socially" which was published in the International Journal of Disaster Resilience in the Built Environment, 10(2/3),99-129. doi: <https://doi.org/10.1108/IJDRBE-09-2018-0039>. (Scopus, IF: 1.13, Q1)