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More Humane and Sustainable Engineering Ideas for the Design of Shelter Units (camps)

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ABSTRACT:

The meaning and plans of shelter are often reduced to a light fabric structure – a tent – that provides the minimum physical protection requirements, ignoring the most important and complex needs in terms of compensating forcibly displaced people who have been deprived of their homes and homelands, and in ridding them of the fears of a new life of displacement and a turbulent and ambiguous future.

The tent is the alternative to the dwelling that the displaced lost due to war or a natural disaster, and it means a lot to him - that is, the dwelling - is the mental memory, his personal identity in its different stages, the culture and the very common and familiar space, resembling the body, to the point that we forget it only to remember it suddenly in times of war and destruction.

In the concept of the physical tent based on the study situation of the three camps (Atmeh-Arsal - Zaatari), the meaning of housing disappears and disappears and is replaced by an emergency shelter unit - the tent - always gives the displaced a sense of loss, emergency, and exile from his home.

The research paper aims to propose a more civilized and humane shelter unit consisting of a more humane structure and construction materials (activating human engineering) in terms of

security, home space, basic functional and formal services, and sustainability, such as the idea of a tent that produces energy.

Keywords: Shelter – camp–Tent – displaced people – refugees – Atma camp – Zaatari camp–Arsal Camp – Renewable Energy – Sustainability – weaving a home

1 INTRODUCTION

The camps constitute the traditional solutions used to shelter refugees and forcibly displaced people as a result of wars and natural disasters, as the number of displaced people today exceeded 100 million people, according to the statistics of the United Nations High Commissioner for Refugees, after it was 89.3 million last year in 2021.¹

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In the area of the Syrian crisis, the Syrian war has left about 4 million refugees, a million living in fragile shelters - cloth camps - distributed spontaneously.²

More than 10 years have passed since the war and conflict in Syria without any political solutions, and the method of dealing with the forcibly displaced from their homes was reduced to providing a cloth tent as a shelter unit that lacks the simplest services and means of protection against external factors, and distributing shelter centers in border areas and sites that are not suitable as urban settlements, such as Atmeh camp in northern Syria, Zaatari camp in Jordan and Aرسال camp in Lebanon.

The meaning and plans of shelter are often reduced to a light fabric structure – a tent – that provides the minimum physical protection requirements, ignoring the most important and complex needs in terms of compensating forcibly displaced people who have been deprived of their homes and homelands, and in ridding them of the fears of a new life of displacement and a turbulent and ambiguous future.

The tent is the alternative to the dwelling that the displaced lost due to war or a natural disaster, and it means a lot to him - that is, the dwelling - is the mental memory, his personal identity in its different stages, the culture and the very common and familiar space, resembling the body, to the point that we

forget it only to remember it suddenly in times of war and destruction. Dwelling in the Heideggerian concept is equivalent to being on earth, which transcends crises, emergencies, constructions, cultures, and global trends, the dwelling is not a right to claim, it is the actual state of existence.³

In the concept of the physical tent based on the study situation of the three camps (Atmeh - Aarsal - Zaatari) the meaning of housing is absent and disappears and is replaced by an emergency shelter unit - the tent - always gives the displaced a sense of loss and emergency and exile from his home and therefore the tent cannot be called or likened to housing because the dwelling means tranquility and stability, but the tent is just a fabric structure to protect the body.

The research paper aims to propose a more civilized and humane shelter unit consisting of a more humane structure and construction materials (activating human engineering) in terms of security, home space, basic functional and formal services, and sustainability, such as the idea of a tent producing renewable energy and made of corrugated fabric and wrapped in a three-dimensional geometric shape, as it works to secure basic services such as electricity and water collected from rainwater, and then heated by solar panels and stored in batteries for reuse in lighting and benefit from the part Excess rainwater in hygiene.

The research paper also calls for finding innovative engineering and humanitarian solutions in design and planning characterized by spatial and social privacy, safety, and quality of life (sustainability) away from traditional tents and random distribution and ignoring the validity of the site and the basics of planning and urban requirements.

These solutions also aim to alleviate the psychological and health impacts on refugees and those fleeing death, whether from wars, floods, or earthquakes, and contribute to the reconstruction of displaced and forcibly displaced families to empower them and integrate them into the new place.

2 RESEARCH PROBLEM:

Shelter plans are seen as a short-term solution as commonly believed, many camps have been around for decades, with an average shelter stay time of around 20 years. More than 20,000 IDPs die prematurely each year due to poor life in poorly built and overcrowded shelters.⁴

Solutions for sheltering refugees fleeing wars in general and in the Syrian war since 2011 to now have been limited to the establishment of border shelter centers that constitute the cloth tent as its basic unit

with a fragile structure in the face of natural factors such as rain, snow, and dust storms that lack the simplest basic services such as water, toilet, and kitchen, in addition to being structurally unsafe and not thermally or soundproofed, which makes it an inappropriate place humanly for those people who lost their original homes and the tent became their only refuge and shelter. The shelter plans followed today (the case of displaced Syrians and displaced persons) also inspect to achieve the meaning of shelter in its physical and temporal dimension, as it is temporary housing, but in fact, the study case camps (Atmeh, Aarsal and Zaatari) are poor places to live and have been established for more than ten years and are still continuing.⁵

3 RESEARCH OBEJCTIVES:

The research paper aims to propose a more civilized and humane shelter unit consisting of a structure and construction materials that are more sustainable, resistant, and isolated to climate fluctuations, such as the idea of a tent producing renewable energy and made of corrugated fabric and wrapped in a three-dimensional geometric shape, as it works to secure basic services such as electricity and water collected from rainwater and heated by solar panels and stored in batteries for reuse in lighting and taking advantage of the surplus part of rainwater in cleanliness.

4 RESEARCH METHODOLOGY:

The research methodology was based on an analytical study of the reality of the existing camps inside and outside Syria, and they are as follows: Atma camp in northern Syria - Zaatari camp in Jordan - Aarsal camp in Lebanon, in order to monitor the most important problems suffered by refugees, as they were diverse fields and the research here focused on the engineering and architectural aspect of the tent structure and its infrastructure (tarpaulin) being the basic shelter unit.

The research relied on monitoring the latest design of the shelter units and reached the tent unit producing energy consisting of corrugated fabric, bendable and heat-insulating, and equipped with some basic services such as energy and water saving, and that experience was evaluated from the pros and cons.

The results were developed based on the monitoring and analysis study, and then recommendations were formulated for the design of the shelters based on the basic needs and requirements of the study case.

5 RESEARCH FIELD (Case Study):

Field of research: Spatially includes the three camps - Atmeh, Aarsal, and Zaatari - located in Syria, Lebanon, and Jordan, while chronologically it includes the period from 2011 to 2022.

Case Study: Study of Syrian refugee camps inside Syria and in neighboring countries (Atmeh camp Syria - Aarsal camp Lebanon - Zaatari camp Jordan):

The following table shows the geographical location, spatial description, year of establishment, the number of displaced persons and refugees, family structure, and the most important problems and developments since inception until now in the three camps (Atma camp - Aarsal camp- Zaatari camp)

<ul style="list-style-type: none"> - Atmeh Camp (Syria) ¹⁰ - Year of Construction 2012 - It includes (450) tents inhabited by (510) families, - The number of displaced people (3925) displaced - Percentage of children (60%) - Lack of drinking water -The spread of diseases and epidemics due to wastewater and waste due to the lack of a sewage network 	<ul style="list-style-type: none"> - Aarsal Camp (Lebanon) ⁹ - Year of construction 2013 -Includes 177 camps - 9000 tents - Prolonged snowfall and rain area - An area of environmental pollution and the spread of diseases such as cholera and asthma due to the lack of a drainage network - Lack of drinking water 	<ul style="list-style-type: none"> - Zaatari Camp (Jordan) ⁶ - Year of construction on July 29, 2012 - 10 -km from the meeting point of the Syrian-Jordanian border. - 80,000 -refugees - %55 -of them are children⁷ - %42 -of families have at least one member with a chronic disease - In 2013, tents were replaced by prefabricated caravans⁸ - Lack of drinking water
		

		
<p>Tents crowded and present in large numbers in a land and mud housing thousands of displaced people (Atmeh camp in northern Syria border with Turkey)</p>	<p>Snow-soaked tents in Lebanon's Aarsal camp and border with Syria</p>	<p>Tents distributed in desert land in northern Jordan near the Syrian-Jordanian crossing</p>
		

Table prepared by the researcher

The three camps for internally displaced people and refugees to Lebanon and Jordan (Atmeh-Arsal and Zaatari) are similar as if they were disciplinary camps in terms of manifestations of misery in shelter units within compact tents and dirt roads where drinking water is scarce and the sewage network is absent despite the different geographical areas and without any consideration for social relations, culture, and identity.

We note from the previous photos of the locations and distribution of the three camps¹¹: Atma camp - Zaatari camp - Aarsal camp that they are located in arid border areas far from urban centers, where the tent constitutes its basic and typical unit.

Until now, these refugees still live¹² in primitive settlements of overcrowded tents that flood the winter with rainwater and mud in the absence of paved roads and sewage networks, which increases the suffering

of the fleeing population in the face of a more difficult life and greater challenges in living within spaces limited in space (tent) and devoid of basic services and protecting its residents from the cold of winter and the heat of summer, especially since the majority of the camps' residents are children, women and the war disabled.

Here I quote some of the people in charge of managing the camps:

- Patrick Columbello, general manager of the Emergency Engineering Foundation, said: "I have never met a happy person in camps, and these camps often turn into shantytowns".¹³



**Figure 1 Uninhabitable tents for Syrian refugees in Lebanon (Bekaa region)
Most of them are children and women after being displaced as a result of the war**

Source: www.Google.com

- Kilian Kleichmid, a former UNHCR official who ran the Zaatari camp for Syrian refugees in Jordan, describes the camps as storage facilities for people and a person can live in them for many years and camps can become part of the city, such as the Shatila camp for Palestinian refugees in Lebanon.(1949)

The shelter unit, consisting of a weakly constructed and protected cloth tent, does not protect its fleeing residents from any slightest protection from strangers or intruders, and is unable to face storms, not even the cold of winter or the heat and dust of summer, it is made of cloth and does not contain the lowest basic

services of a bathroom or kitchen and is not supplied with water, so it is difficult to call it humanitarian shelter units. Figure (1) and Figure(2)



Zaatari Camp in Jordan in the summer of 2019



Arsal Camp in Lebanon Winter 2019

Figure (2) Pictures from the reality of refugee tents in Lebanon and Jordan

Source: www.Google.com

The most important engineering ideas in designing the shelter unit instead of the traditional tent:

The idea of a tent producing renewable energy (weaving a home)¹⁴:It is designed by Engineer Abeer Al-Sqaili Figure No. (3). The design idea originated in 2013 as the first model of the tent and won the Award (Lex us Design). It is a flexible fabric structure that allows ventilation control and is easily detachable and transportable, Figure (4) & (5)

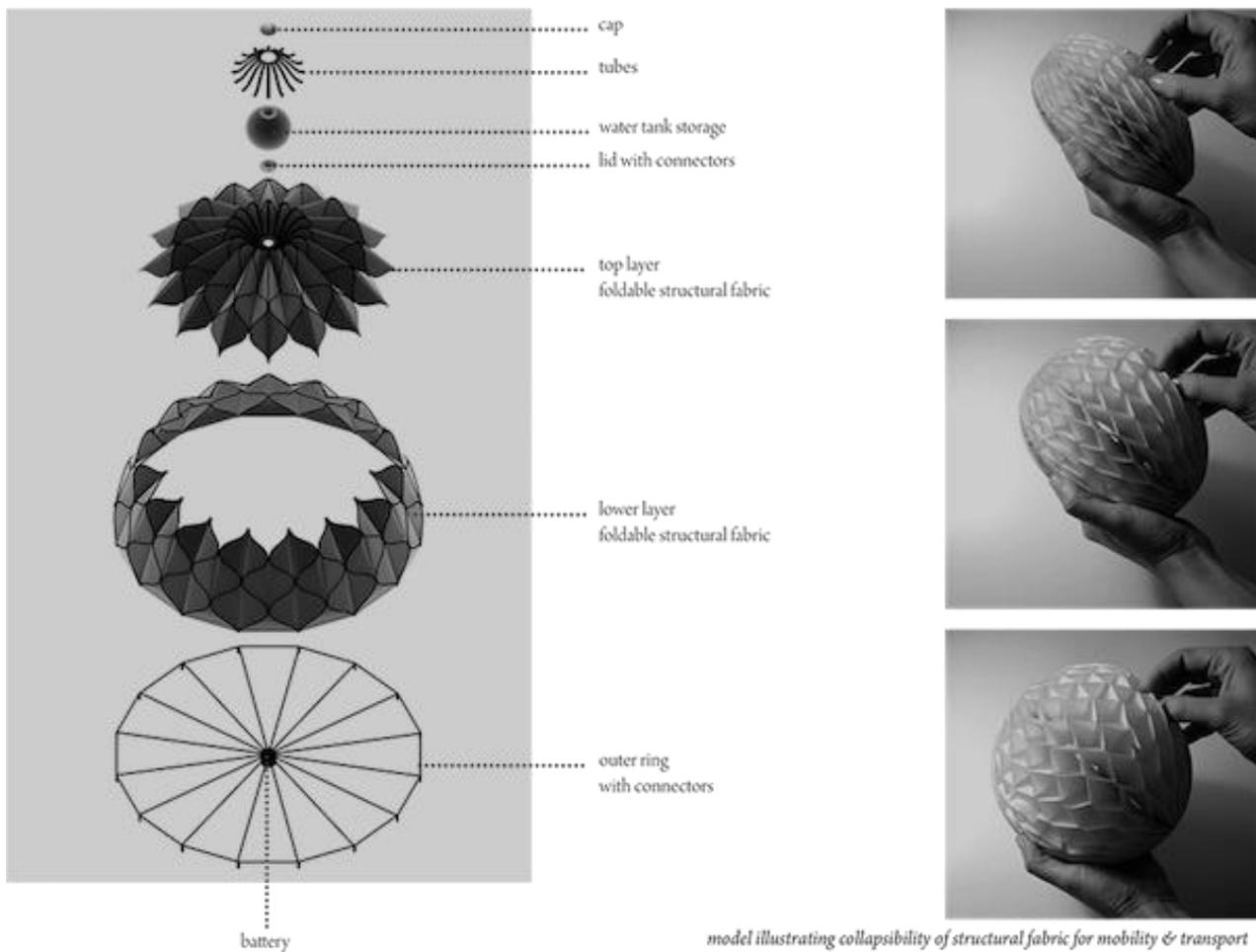


Figure (3) Stages of development of the idea of the energy-producing tent by Engineer Abeer Al-Skalli (Weaving a home)



Figure 4: Modern shape of the tent, which produces energy

Source: Eng Abeer Skalli

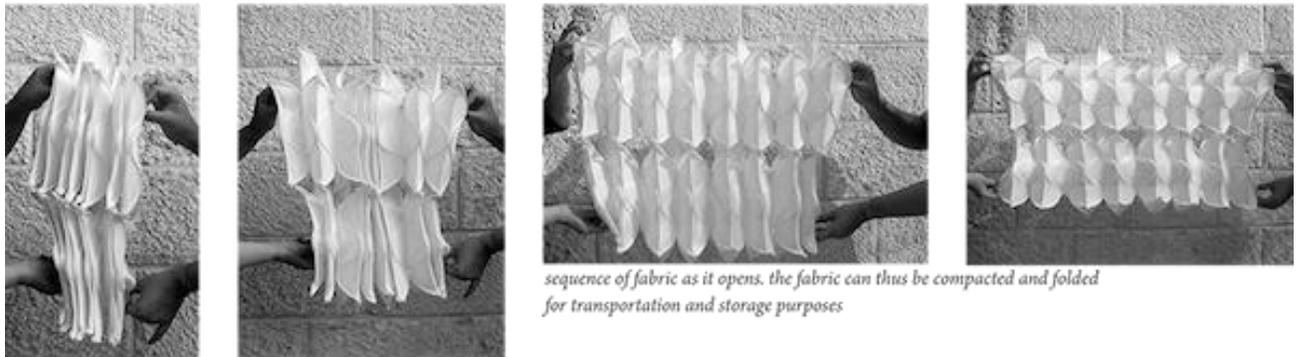


Figure (5) Foldable fabric forms the main material for tent design

source: www.wamda.com

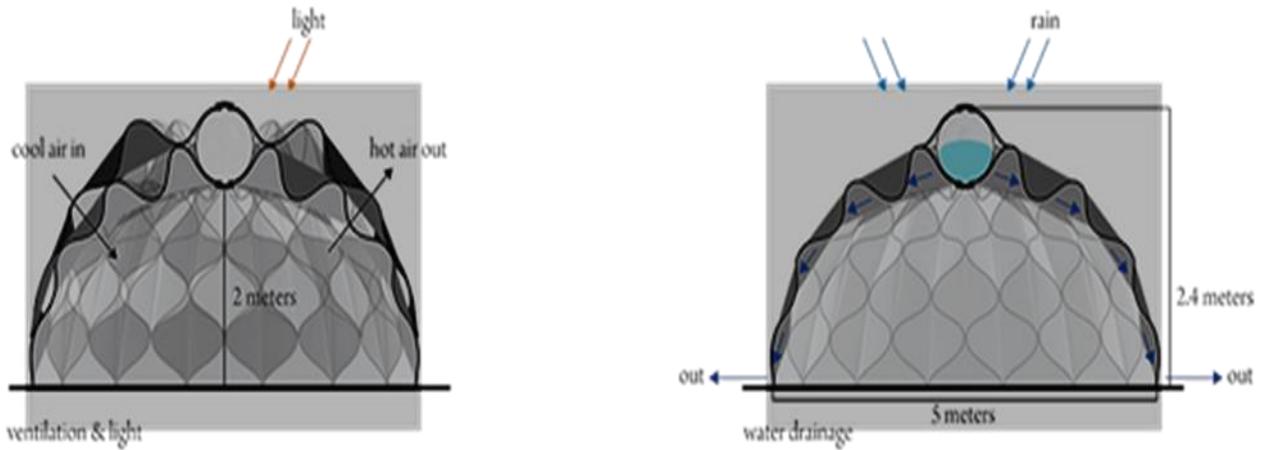


Figure (6) the structure of the tent shows, its dimensions and the design produced for energy

Inspired by snakeskin and influenced by the handmade pattern of the Arab world region and consisting of fabric, the tent takes the form of a dome almost similar to the traditional tent but with new standards as follows:

1. The tent consists of a lightweight, flexible, and waterproof structure Figure (7)
2. The curved design with cavities and layers allows the work of balanced lighting openings and ventilation Figure (8) can be closed (in winter) (openable in summer)
3. It contains a store above the tent to collect rainwater and then it is filtered and then stored in dedicated pockets Figure (8)
4. The tent Contains basic sanitation services such as bathroom
5. It provides a solar heating system (thermosiphon) that uses the heat of the sun that hits the tent to draw water upward from the storage pockets, then the tent turns into a place to bathe.¹⁵
6. The solar energy itself can be utilized and stored in a battery for later use, providing a clean energy source (Figure 9).



Figure (7) the space of the tent shows the inside and the ventilation and lighting openings

Source: www.wamda.com

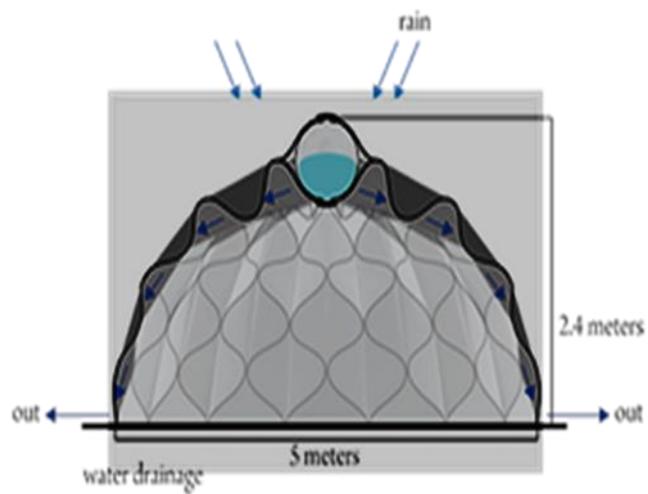


Figure 8: The top of the oval tent is a storage room
To collect rainwater and filter it for reuse

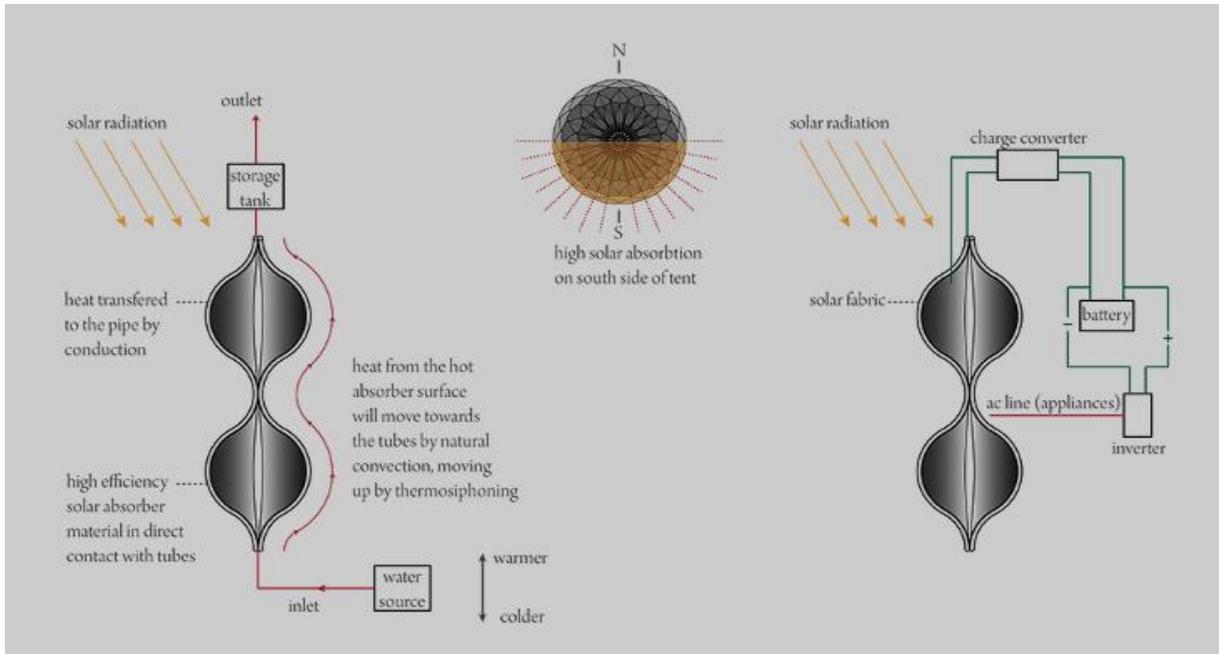


Figure (9) shows the mechanism of water storage and heating and conversion into electrical energy within a battery

7- The final design is similar to the initial design, but it needs to be developed and simplified in the composite shape.

8- The tent is lightweight, foldable, and also easy to disassemble and install.

9- The idea of the project achieves great development compared to the traditional fragile and modular tent, Figures (10) & (11)



Figure (11): Imaginary image of the use of energy-producing tents. www.wamda.com



Figure (10) A picture of one of the refugee camps in the state of Lebanon. Source: Google

6 PROJECT CHALLENGES:

- There is no firm plan to bring the tent to vulnerable communities such as refugee camps
- The emergence of many technical problems in terms of rain collection and solar energy storage.

7 PROJECT EVALUATION:

It can be said that the project (Weaving a House) is an innovative engineering design in architecture, as it offers an alternative social technology to the austerity tent that alleviates the suffering and misery of a large group of vulnerable communities, especially refugees, whose number exceeds 70 million people.

The importance of the project also lies in the integration between man and the surrounding environment, which is considered a good design and behavioral solution

This type of project is considered important and is in great need of society today, especially in light of the increasing volume of conflicts and wars.

And also face the natural disasters that afflict humanity today and force people to keep away from their homes, which makes these innovative and civilized design solutions that alleviate the pain of the displaced and the suffering of vulnerable communities, as children and women constitute the largest percentage of refugees and give them a healthy and somewhat decent life.

8 RESULTS:

The traditional tent is a poor shelter unit for housing displaced persons or refugees and is not suitable for temporary housing.

- The tent lacks the most basic services for shelters, namely water, toilet and kitchen.
- The tent lacks the simplest structural safety requirements for shelters, which is the structural structure that is safe against external factors.
- The tent lacks health and privacy as a result of the fact that many tents contain high densities of individuals and families, creating great physical and psychological crises, especially for women and children.
- Among the most frequent problems in the study sample - the three camps - are the following:
 - 1) Lack of drinking water and electrical energy
 - 2) Lack of sewage network and treatment plants
 - 3) The spread of epidemics and respiratory diseases such as cholera and asthma due to the high densities inside the camp in addition to the lack of drainage network.

- 4) Fires occur in the camps largely due to the structure of the flammable fabric tent and the lack of civil defense means (fire units).
- 5) The presence of at least one member of the family with special needs.
- 6) Lack of health and educational services due to the border location and urban isolation and because of the state of extreme poverty and their dependence on humanitarian and charitable organizations .
- 7) The absence of a growth factor in the three camps studied due to the absence of empowerment policies and dependence on material and food assistance.
- 8) Host country policy plays a key role in the efficiency of asylum units that are directly affected by security concerns as well as the behavior of host communities.

CONCLUSION:

We must ethically and professionally work in the field of engineering in all its specialties, especially architects at the academic and professional level, to find innovative engineering and humanitarian solutions in design and planning that are flexible and fast in implementation and take into account the basic needs of the displaced or refugee from wars or disasters.

The following are the most important basic needs and requirements in the design of contemporary shelter units:

First: Strategic, Social, and Economic Recommendations:

- 1) Shelter cannot be seen as an isolated element; any solution or approach to this problem should take into account housing, place, family structure or the context of sheltering families, especially as they constitute the most vulnerable groups.
- 2) A shelter strategy should offer emergency shelter solutions that are initially flexible (immediately after displacement) and solutions that are scalable, adaptable and enabling over time.
- 3) Participation of host communities and affected populations at an early stage.
- 4) Support shelter strategies that promote employment and integration opportunities and benefit the local economy.
- 5) Finding a strategy aimed at paying attention to the physical health of refugees and those fleeing death, whether from wars, floods, or earthquakes.

Second: Environmental and technical design recommendations related to sustainability and safety standards:

1) Designing a safe shelter unit that takes into account the functional and formal quality such as the weaving a home model as an alternative to fragile and inhuman traditional tents.

2) Supporting and encouraging the idea of local construction and the use of natural materials as well as industrial materials.

3) The use of modern construction techniques lightweight and easy to transport and construction in the design and construction of shelter units and that this unit is fireproof and heat-insulating.

4) The shelter unit contains basic services such as water, energy, internet, sewage network and small treatment plants to achieve adaptation and spatial comfort.

5) Employing remote sensing systems and providing them to camp residents to take precautions and avoid disasters by installing fire alarms and weather fluctuations in shelter centers

6) Installation of road signs and safe exits in the event of a fire.

Third: Planning Recommendations:

1) Oblige host governments and the humanitarian community in the initial planning process of camps to organize them and avoid spontaneous and random forms that occur today as in the case of study camps.

2) The appropriate choice of place in terms of the suitability of the site for the establishment of the shelter center, the availability of water, health and sanitation, and the avoidance of remote border sites isolated from urban centers.

3) Choose the topographically elevated place and avoid low places and torrential reservoirs to avoid drowning and rainwater.

4) Follow sustainable urban planning methods in terms of street planning, distribution of basic services and the possibility of future expansion.

5) Choose arable places in order to avoid wind, dust and sand storms.

6) Allocating open yards and green places in and around shelters.

7) The possibility of linking the shelter center with municipal and urban centers in order to communicate socially and give them the impression that they are part of the host community and not intrusive or intrusive communities.

Fourth: Administrative and Legal Recommendations:

1) Issuing regulations, laws, and legislations related to the importance of planning and managing shelters, and working on continuous cooperation and coordination during the period of managing shelters between all competent authorities and institutions.

2) Providing pre-equipped shelters to receive those affected so that they meet the planning and design standards for the distribution and design of shelters.

3) Develop media strategies to increase community participation in shelter planning and maintenance.

4) Identify natural hazards (such as floods, landslides, and strong winds). If there are any earthquake-related hazards, seek specialist technical advice, even if only to design a simple shelter.

RESEARCH CONCLUSION:

Accommodation unit design standards should address hazards and health and psychological safety requirements, provision of basic spaces and services, user considerations and their life, occupational and social context, time span, size and shape, privacy, security and cultural suitability, ventilation, and thermal comfort; environmental and cost considerations, planning standards and building codes.

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