Original Article

Emergency Architecture Towards Temporary Educational Facilities for Children of Internally Displaced Persons (IDPs) in Northern Syria

Mohamed Ahmed F. Mahdy[*] [1,2]
Islam Hamdi Elghonaimy [3]
Dalia Hussein Eldardiry [4]
Ashar Abdulghany Habbab [5]

[1] Department of Architectural Engineering, College of Engineering and Design, Kingdom University, Bahrain

[2] Architecture Department, Faculty of Fine Arts, Alexandria University

[3] Department of Architecture and Interior Design, Collage of Engineering, University of Bahrain

[4] Department of Interior Design, Imam Abdulrahman Bin Faisal University, College of Design, Saudi Arabia

[5] LIF for Architectural Consultation & Urban Studies, Saudi Arabia

[*] Correspondence email: m.mahdy@ku.edu.bh; mfouadmahdy@hotmail.com, *ORCID ID*: https://orcid.org/0000-0002-1580-7056

Abstract

Internal displacement, often triggered by conflict or natural disasters, has left millions worldwide seeking refuge in temporary settlements. These camps, while providing essential necessities, face design challenges in balancing longevity and the freedom of movement for displaced individuals. Prolonged displacement, particularly for children, raises concerns about educational continuity and social cohesion. This paper explores the concept of fast-deployable shelters for IDPs using recycled maritime containers. The research stems from the observation of a large number of refugee children in all age groups requiring adequate spaces for learning, working, and social interaction. Inspired by the work of the Molham volunteer team, which aids disaster-affected communities, the study aims to propose an affordable and sustainable solution for IDP housing and social spaces. The research employs a mixed-methods approach, combining analysis of case studies and qualitative feedback from IDPs in northern Syria. This approach enables comprehensive insights into the design requirements and social needs of IDPs. The paper proposes a prototype boarding school unit constructed from recycled shipping containers. This design offers several advantages: Fast deployment allows for rapid construction, minimizing disruption to education. Provide an environmentally friendly and cost-effective solution. The modular design allows for flexibility in layout and expansion, catering to varying needs and site conditions. The design incorporates communal spaces to foster social cohesion and promote a sense of normalcy among IDPs. The proposed prototype demonstrates the potential of recycled maritime containers to provide fast-deployable, sustainable, and socially inclusive shelters for IDPs, particularly children.

Keywords: Sustainable Development; Refugees Shelters; Temporary Communities; Refugee

1. Preface

More people are displaced than ever before, many fleeing conflict or climate change. The New Humanitarian tells their stories and documents the world's evolving responses to refugees and migration. Education is a crucial stage in a child's life. The threats that children face during violence can deprive them of a very important period in their childhood, and children who are learning need fast solutions for building spaces that help them continue their education without interruption for a long time, so as not to heavily impact their academic progress. Our migration reporting has covered everything from the Rohingya refugee crisis in Bangladesh to corruption harming refugees in Sudan and Uganda. We've reported on the growing role of local aid workers and the troubling trend of criminalizing migrant assistance. We're on the ground covering the latest trends, including the Venezuelan exodus and climate-related displacement in Afghanistan[1]. Response plans in countries receiving migrants should include education, health, water, sanitation, and other interventions to help migrants meet the challenges of their difficult situation. Also, Natural hazards such as storms and floods uprooted nearly 25 million people in 2019. However, the exact number of displaced people is unclear due to scarce data on disasters, as reported by the Geneva-based Internal Displacement Monitoring Centre. This is a warning to the estimated 370 million Indigenous people worldwide, many of whom are exposed to rapidly changing climate problems. Geography, climate, and natural and artificial capabilities all play a role. The more robust, coherent, and prepared an environment is to respond to any sudden natural or industrial disaster, the less harmful the impact will be. Environmental disasters can have long-lasting effects, causing destruction and devastation of many facilities and leading to loss of human life. Disasters in general can result in devastation and destruction that affect the area to which they are exposed and disrupt regular life, in addition to causing physical and financial losses that can be difficult to treat[11].

2. Rationale for problem

Recently, the number of IDPs around the world has been increasing. Due to reasons of natural and hazardous human-made causes, these numbers are rising incredibly. The numbers of refugees are increasing, for example, in West Asia and North Africa: 2.653 million, Sub-Saharan Africa: 6.236 million, North/South Americas: 484,261, Europe and North Asia: 6.088 million,

and South/East Asia and Oceania: 4.153 million. According to UN statistics[12], in 2015, about 51% of refugee residents were children. A high percentage of them were separated from their parents. In 2015, about 86% of refugees under UNHCR's command were in low- and middle-income countries close to conflict. As a result of this problem, children need additional care at all levels while they see and live their lives. In the Arab region, Syria has the highest number of people at risk of displacement; see Figure 1. The war in Syria resulted in more than half of the displaced being children, see Figure 2. Furthermore, according to UNICEF[13], the accommodation of 19 million Syrian children was replaced in their country by conflict and violence in 2019,[14]. Despite closing the borders with the neighboring countries of Syria, thousands remained on the borders from all sides of the Syrian side, stuck and fleeing the war. They met in isolated areas between the two countries, especially in the northern part of Syria, as
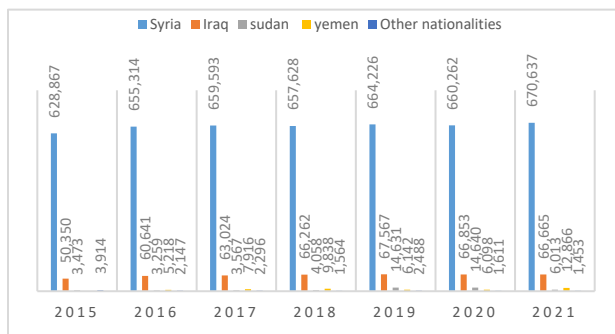
Figure 1. Refugees' nationality and numbers chart 2015- 2021, [3]
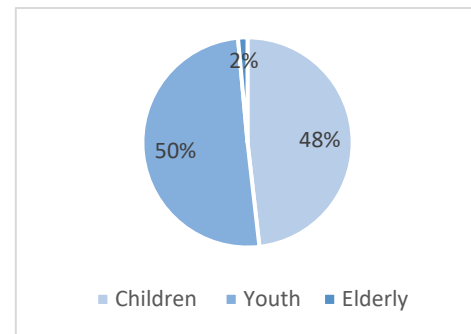
Figure 2. Refugee age pie graph, [5]

a large part of the northern region became a safe area[15]. The deteriorated living conditions of these refugees are below acceptable levels due to war circumstances and a shortage of necessities[16]. Living in dignity is one of the rights that these children lack. The conditions of the refugee camps in which they lived deprived children of the most fundamental rights at the beginning of their lives due to the conditions in which they lived.

3. Initiatives towards Solution

John Maynard Keynes, one of the remarkable and undisputed economists, authored the idea of total integration with disasters; he explained that rebuilding might take a long time. He suggested three stages to accelerate the service of refugees and help in disaster situations[17].

a) **Emergency***:* The first reaction depends on providing temporary shelters, medical assistance, and other similar services. This stage can last two to three weeks.

b) **Treatment***:* Short-term housing, health centers, and some services that may be provided at this stage may take a few weeks.

c) **Recovery***:* This stage is characterized by reconstruction with an emphasis on comprehensive long-term planning that will improve the region's urban fabric, which will take several years.

The agencies responsible for creating the refugee camp develop refugee camps impromptu to meet essential human needs for a short period[18]. The governments of the host country often prohibit facilities that make a camp look or feel more permanent[19]. According to UNHCR[20], in general, few refugees (about 25%) live in well-manageable refugee camps. At the end of 2015, it was found that about 56 % of the total refugee camps are in rural locations in managed areas.

The primarily responsible groups are the local government, the United Nations, NOGs, and international organizations (for example, the International Committee of the Red Cross). In some cases, unofficial refugee camps took the opportunity to do this job, where refugees are mainly left without the support of governments or international organizations, such as idomeni in Greece or the Calais jungle in France.

4. Research aim, Objective and add to knowledge

Only a few publications have focused on the reuse of recycled materials in the construction of shelters. The article scope suggests the tradeoffs that arise when designing and implementing a large-scale shelter solution: how to create quick and easy buildings that are more solid and dependable than simple tents while still providing adequate comfort conditions[5]. The research also was inspired by, the idea of cooperating with the Molham volunteer team [21] was born, which is a volunteer team that helps people affected by disasters around the world, since the team was looking for a proposed affordable design for a residential and social complex for the homeless children to start building it. In 2018, the land was bought to be a refugee camp on the Turkish-Syrian border, north of the city of Aazaz. The value of the land was about $ 200,000; see Figure 3. They registered under the name of the team. The research tried to meet its target of them by sharing the proposal at hand. The research aims to investigate how designing a refugee camp that addresses the missing dimension of humanity can restore dignity to displaced children,

providing collective social accommodation immediately and rapidly. These rapidly constructed temporary housing will help homeless children reintegrate into society and develop themselves and their surroundings rather than letting refugees languish, we should invest in their productive capacities. The research adopts a hovering approach to the solution of a resilient temporary fast-establishing shelter for refugee children. This approach has been investigated through previous research. This article focuses on the social/education aspect and how to fulfill the social needs of internally displaced persons (IDPs) in northern Syria.
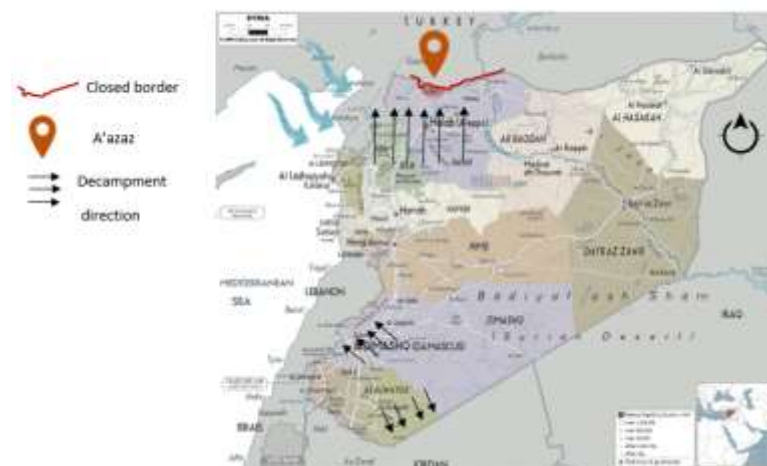
Figure 3. Location of the proposal, A'azaz
district, Aleppo city[5]

5. Research Methodology

This research used a mixed-methods approach to develop comprehensive knowledge for fast-deployable shelters for internally displaced persons (IDPs) using recycled maritime containers. The qualitative component of the research involved analyzing case studies of similar architectural solutions and reviewing previous research on fast-establishing shelters. This analysis helped to identify the key design requirements for the shelters. The qualitative component of the research involved visiting an IDP site to take feedback and record notes. This data was used to develop descriptive and demographic statistics of the IDP population, as well as to gain a deeper understanding of their needs and priorities.

5.1. Design alternatives

The design alternatives for the shelters were developed based on the research findings and the program requirements identified in the survey. The alternatives considered the following factors:

Modular design: The shelters were designed to be modular so that they could be quickly and easily assembled and disassembled. This would make them ideal for rapid deployment in emergency situations.

Use of recycled maritime containers: The shelters were designed to use recycled maritime containers as the primary building material. This would make them sustainable and cost-effective.

Flexibility and adaptability: The shelters were designed to be flexible and adaptable to meet the needs of a variety of IDP populations. This includes the ability to accommodate different family sizes and to be used for a variety of purposes, such as housing, education, and healthcare.

Durability and sustainability: The shelters were designed to be durable and sustainable in a variety of climates and environmental conditions.

The research evaluated the design alternatives based on a set of criteria that included cost, sustainability, durability, flexibility, and adaptability. The team also sought feedback from IDPs on the design alternatives. This feedback was used to refine the designs and ensure that they met the needs of the target users. Several scientific studies on emergency post-disaster shelters are available in the literature, dealing with the technological design, adaptability, and versatility of various solutions. The research proposes a method of using maritime containers, since the idea of reusing maritime containers for temporary structures is not new, but this research discusses its application specifically to the allocation of IDPs spaces for sleeping areas for orphan children. This is a significant contribution to the field of humanitarian architecture, as it addresses a specific and underserved need. The research provides insights into the design and implementation of maritime container shelters that could help to improve the lives of many vulnerable children in the future.

6. Literature review

Shelters for internally displaced people (IDPs) are often built in areas with limited resources and infrastructure. As a result, there is a growing need for sustainable and affordable shelter solutions that can be built by IDPs themselves using locally available materials[22]. In addition to using sustainable materials, it is important to design shelters for IDPs that are appropriate for the local climate and environment. For example, in hot, dry climates, shelters should be designed to provide shade and ventilation. In cold climates, shelters should be well-insulated to keep occupants warm[23]. By considering sustainability and local availability of materials, it is possible to build shelters for IDPs that are not only affordable but also environmentally friendly and resilient. These shelters can provide IDPs with much-needed shelter and protection from the elements, while also helping to reduce their reliance on external aid. The following are similar case studies for shelters for IDPs that can be built by their own considering sustainability and available materials.

6.1. The use of recycled materials

One of the most difficult issues to deal with in emergency and post-disaster situations is obtaining the necessary tools and materials to construct a temporary and livable shelter. A team of researchers from the University Joseph Fourier of Grenoble developed project the Ski Dome, a geodesic dome entirely constructed of skis[24], see Figure 4, the project investigated the feasibility of a lightweight shelter composed of recycled skis and covered by a textile multilayer envelope.


Figure 4. Construction stages of ski structures, [6]

The project examines the potential (from a technological, thermal, and structural standpoint) of a lightweight shelter skin made of recycled skis, covered by a textile envelope and thermal reflective multilayer insulation capable of providing high-quality thermal comfort. This solution addresses several goals, including recycling high-tech materials, speed of construction, lightness, and low embodied energy. The project investigated the re-use of high-tech recycled materials to improve thermal comfort while lowering energy consumption and making installation simple. The presented work investigated the feasibility of a lightweight shelter composed of recycled skis and covered by a textile multilayer envelope. The skis are high-tech materials made up of steel plates, plastics, and resins to give them high toughness and flexibility. Each year, approximately 1 ton of skis are discarded in the Alpine Area. As a result, recycling these products is very difficult since their layers are not composed properly; therefore, their reuse is the best option. The Ski Shelter project, as Salvalai et al., [6]said, seeks to create a tent prototype that is easy to assemble, lightweight, and made from repurposed materials, and is capable of maintaining acceptable internal thermal comfort conditions. The basic design was based on the
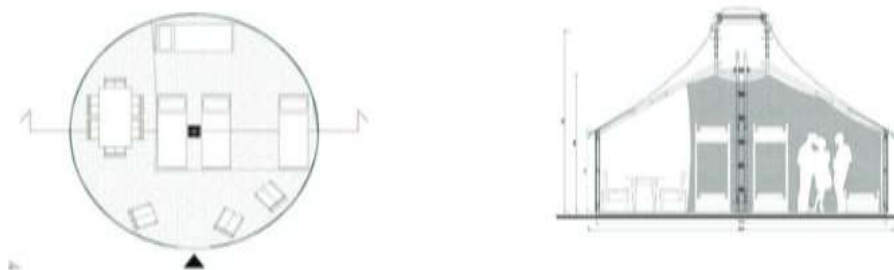
Figure 5. Section cut of a typical ski shelter, [6]

Diameter of the plan	6,00 m
Total floor area	28,26 m²
Minimum internal height	2,63 m
Maximum external height	2,97 m
External height	4,91 m
Total storage volume	62,36 m²
Skis used	260,00
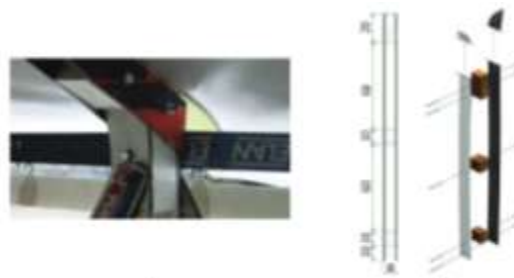
Figure 6. Standards of ski shelter module [6]

Figure 7. Assembly of the connection beam pillars [8]

Mongolian yurt archetype but was modified in some ways to optimize the use and connection of the specific materials: the skis and the multi-layer envelope. The architectural scheme is composed of a regular grid: The circular base is divided into 24 concentric axes, represented by

beams and pillars. A pillar made of reused standard steel elements for building scaffolding supports the openable 80,0 x 80,0 cm skylight in the center of the room; see Figures 5, 6 and 7. The beams and pillars are formed by the linear assembly of several skis, with the tips of each ski previously modified by the structural design. The skis have been joined together to form composite beams and pillars, increasing inertia and stability on a local and global scale. Wood spacer elements were used to reinforce the joints between the skis. The Sky Shelter project confirms the design of a habitable covered living space that is safe, comfortable, and healthy. The modularity and simple connection of different components ensure easy transport, assembly, and maintenance by locals without the use of special tools. Furthermore, these characteristics are consistent with the need to adapt shelters to different cultures, local traditions, functions, and achieve or support a long-term shelter solution in the future.

6.2. The use of local materials

Jarahieh School for Refugee Children in Lebanon; see Figure 8, 9 which was shortlisted for the 2017-2019 Aga Khan Prize, is an indication of the importance of the environment and architectural design in constructing a sense of belonging and is the result of a participatory design process led by Catalytic Action, which is a non-profit design firm that works on a global scale, concentrating on the Middle East's most vulnerable parts. Participatory design, sustainable architecture, and the active participation of social groups in the construction process are key features of their approach[6].

Figure 8. Jarahieh school for refugees between informal tented settlement [10]

Figure 9. Elevation of school [1]

The structure is made of a wooden-framed pavilion modified for the purpose, transforming it from an open, permeable structure into complicated indoor spaces arranged around a courtyard, forming a neighborhood within Jarahieh. It was constructed with OSB (Oriented Strand Board) panels and a fabric roughly comparable to that provided by the UNHCR to the refugees, as shown in Figure 10.

Figure 10. Wooden framed pavilion [1]

Materials used in building this structure were mostly utilizing sheep's cloth produced and processed by farmers in the Bega Valley for thermal and acoustic insulation. The use of simple, recognizable but suitable raw materials, such as wood and canvases, helped to forge a connection between the family members and the school, which is mainly a facility made up of separate classroom settings set up around a courtyard rather than a single large building with inbuilt subareas. The school is constructed on the very same scale as the housing, but it stands out as a visual landmark due to the single roofs emerging on the horizon, including the use of color. To personalize the building and give each class its personality, each classroom is designed differently than the others, with shortened pyramid roofs at varying heights and angles and adding skylights, as shown in figures 11, at the ridges of each building, is intended to solve the problem of indoor lighting, as the inclined walls help ensure that enough indirect light hits the classes.

Figure 11. Section cut of playing rooms [1]

The classroom walls that open onto the camp's internal walking paths or street corners are enclosed with educational and aesthetic murals created by the residents themselves, seeking to avoid the anonymized appearance of tent city streets and provide a symbol of community identity.

Another example by Emergency Architecture and Human Rights architects [1] who are located in Jordan, just outside the Za'atari refugee camp and 10 kilometers from the Syrian border, have constructed one hundred sand-bag schools on an area of 28 m² for Syrian and Jordanian children due to the vast majority of Syrian refugees that are now living informally within the host community, and as a result, they frequently lack access to social protection, hygiene, and educational institutions.

Figure 12. Zaatari camp top view [2]

Figure 13. Location of Zaatari camp in Jordan [31]

The beehive-style classroom was built using the superadobe technique, inspired by Mali's Great Mosque of Djenné, Syrian beehive houses, and the refugees' hometowns of Aleppo and Homs, see Figures 14 & 15. This design was chosen due to the harsh environment, limited building materials, and need for a quick and easy construction process. Superadobe is a cost-effective and sustainable building method that uses low-skilled workers and local materials, such as earth and sand. The beehive shape provides excellent thermal insulation, making it ideal for hot summers and mild winters. The classroom achieved better results than tents, cement blocks, and corrugated steel plates, while costing half as much to build as a comparable cement block structure.

Figure 14. Super adobe classrooms plans and sections,[6]

Figure 15. Great Mosque of Djenné,[3]

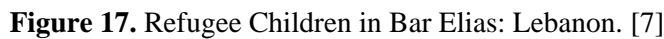Interior ceiling of classroom

Exterior of classroom

Indoor playing ideas

Figure 16. Construction techniques and inspiration, [3]

6.3. The use of modular design

Catalytic Action architecture: design firm in Lebanon [3] designed and built a playground in one of Beirut's schools with the help of the children, who were involved throughout the process. The structure is easily disassembled, transported, and reassembled, or repurposed. The designers believe that children have the right to be educated, to feel safe, to play, and to grow in self-esteem. They aim to challenge the notion that only basic necessities are necessary in an emergency, and to expand the scope of what is considered essential. The designers advocate for a design that allows children to design their own playground, rather than simply providing them with standard play equipment. This results in playgrounds that are unique to their location, time, and people. In Beirut, the playground was designed with the input of the children, who completed exercises that allowed them to express their ideas. The playground is a haven for these children to play, rest, and feel secure in a dangerous environment. This is an important, timely, and necessary project that will benefit a generation of children who would otherwise suffer from psychological trauma and developmental issues.

Playground   Temporary playing ground

Unit modular plan   Section cut of playground

Figure 17. Refugee Children in Bar Elias: Lebanon. [7]

6.4. Refugee camps programming (site visit: Azraq refugee camp)

The authors visited Azraq refugee camp, a camp that utilizes shipping containers to create spaces in a very basic and design neglectful way, see Figure 18. The camp is a stark example of the harsh conditions that refugees face, with little sense of place or comfort. The shipping containers are cramped and poorly insulated, offering little protection from the weather conditions and others. The camp is also located in a remote area, far from essential services and amenities. Despite the challenges, the author found that the refugees at Azraq are resilient and resourceful.

Figure 18. Azraq Refugee camp in Jordon. [5]

They have created a community within the camp, supporting each other through difficult times. The authors also found that the camp is home to a number of talented and creative individuals. They were particularly impressed by the work of a group of refugees who have created a small

art gallery in one of the shipping containers. The authors' visit to Azraq refugee camp was a sobering experience, but it also left the authors with a sense of hope. The researchers saw firsthand the resilience of the human spirit in the face of adversity. Also, the authors saw the importance of community and creativity in helping people to cope with difficult circumstances. After visiting Azraq refugee camp in Jordan, the authors found that every refugee has a compelling story. Each one represents an intellectual asset, and a talent that has the potential to foster socio-economic development. Based on observation and literature review, it was evident that refugees have high coping capabilities and show high resilience and agility. Moreover, policymakers should rethink viewing refugees as a burden to be shared and instead view them as an opportunity to be harnessed. The authors have the opportunity to go through the camps and record functional spaces and facilities on site. Based on this observation and received feedback from the site visit, Table 1 shows that refugee camps can have the following facilities:

Table 1. Extracted facilities from Azraq refugee camp refugee camp.

Refugee camps Areas	• Recommended area is a minimum of 3.5 sqm per person. • A span of at least 2 m should be between shelter zones. • Average-sized camp is home to about 11,400 p • According to UNHCR, areas of about (e.g. 10 m x 12 m) for a family, which are variable from 4 to 7 people as family members[7].
Administrative facilities	• A transit center where refugees initially arrive and register
Accommodations	• Distance from the shelter to the latter should not exceed 50 m, and not be less than 6 m
The Greenery Zone	• 15 sqm per person.
Infrastructure	• One shower for 50 persons. • One communal bath is for 20. • 20 liters of water per person. • One tap stands per 80 persons, not to be more than 200m away from households. • Disposal area (one 100-liter rubbish container) for 50 people and a garbage pit for 500 people. • Place for worship. • One marketplace per 20,000 persons.
Health care	• Clinics and immunization for 20,000 people. • Referral hospital per 200,000 persons.
Communication services	• Camp's radio stations. • Food distribution and therapeutic feeding centers per 5,000 people and one feeding center per 20,000 people. • GIS monitoring network to understand an emergency over time and to track the camp by the authority 24/7 via GIS.[25].
The Control section	• Form of police stations located in/out of the refugee camp.
Education facilities	• One school per 5,000 persons and training centers: (UNHCR).

7. Modelling

7.1. Introduction

In 2015, the United Nations introduced the 2030 Agenda for Sustainable Development, which focuses on social, economic, and environmental sustainability. These three aspects serve as the foundation for developing alternative solutions.[26]. Reusing waste materials, such as shipping containers, is a viable option for providing social housing for children and rehabilitating those affected. It is environmentally friendly, saves resources, is resilient, and can be reused in other refugee camps. It is also economically advantageous due to its time-saving, cost-effectiveness, ease of transportation, durability, stackability, security, and ease of loading and access. Socially, there is a need to consider intelligent design that utilizes available tools and materials to improve the lives of refugees. Reusing shipping containers serves as a "design placeholder" for the interior and exterior of refugee housing. It allows refugee camps to conceptualize both interior space and building massing simultaneously. Containers should be made of flexible materials and components that are easy to construct, transport, and reinstall, such as wooden panels or steel caravans. Once their use is complete, they can be preserved and reused in various areas, playing a significant role in problem-solving[27].

7.2. Programing

The point of recycling shipping containers in refugee camps seems to be practical as a fast and safe idea to implement refugee camps specially for education purposes. Recycling the shipping container to prepare and manufacture the components in a refugee camp is different from a conventional building in many details. However, despite a strong showing of positive container projects, construction with shipping containers is still in its primary stages as mentioned in the case of visiting Azraq refugee camp in Jordan.[20]. Recycling shipping containers in refugee camps should be considered a significant part of the design process. Table 2. shows geometry dimensions of the containers that will be used in a proposal for a refugee camp in northern Syria. Figure 17 illustrates 3D graphic for the primary elements of space extracted from containers' structure elements.

Table 2. Dimensions of the containers[4]

Interior Dimensions	Door Opening	Tare Weight	Cubic Capacity	Payload
40ft (12m) High Cube L: 12,032m W: 2,352m H: 2,698m	W: 2,340m H: 2,585m	3,790kg 8,355lbs	76.4cbm 2,698cu ft	26,690kg 58,845lbs
40ft (12m) GP Container L: 12,032m W: 2,352m H: 2,393m	W: 2,343m H: 2,280m	3,640kg 8,025lbs	67.8cbm 2,394cu ft	26,640kg 59,175lbs
20ft (6m) GP Container L: 5,898m W: 2,352m H: 2,393m	W: 2,343m H: 2,280m	2,185kg 4,820lbs	33.2cbm 1,173cu ft	28,295kg 62,380lbs
10ft (3m) GP Container L: 2,831m W: 2,350m H: 2,390m	W: 2,342m H: 2,280m	1,300kg 2,866lbs	15.9cbm 561cu ft	8,860kg 19,532lbs

Figure 19. Analyzing the structure of the shipping container

8. Output & Discussion

8.1. Design Configuration

When allocating containers within a campsite, it is essential to consider factors such as site layout, accessibility, waste management, and environmental impact. Containers should be positioned strategically to minimize disruption to camp activities and ensure efficient waste collection. Additionally, the type and size of containers should be appropriate for the expected waste volume and composition. The following elements should be considered when allocating containers within camp site:

a. Physical problems

- Site study, soil carrying capacity, and site maintenance requirements.

- Determine the required professional services.
- Check for zoning constraints.

b. *Costs*

- Formulate the refugee camp budget and determine the maximum budget.
- Locate local or regional shipping container resellers and stores capable of performing interior modifications and updates.

c. *Regulation*

- Define the binding code and review.
- The capacity of the camp, according to the responsible organization note.

d. *Program*

- Detail all requirements -number of bedrooms, baths, home office, etc.
- Decide each rough square footage.
- Prepare schematic architecture and structure design, including container massing configuration.

e. *Technical considerations for recycling the shipping containers*

- The exterior walls, floors, roofs, and glazing make up the fundamental envelope of a container.
- Making an allowance for the energy code compliance, the refugee campsite location, and climate (thermal, sound, humidity, etc.) will strongly determine the insulation requirements.
- According to environmental factors, keeping the shipping container warm in winter and cool in summer with a low level of mechanical system will help improve the performance of the accommodation and reduce monthly utility costs.
- The architecture design section stores data on passive vs. active heating and cooling strategies, which should be reviewed before developing/detailing the shipping container envelope.

f. *Interior Design*

- Temporary furniture design within refugee camp sites is a critical aspect of providing basic necessities and improving the quality of life for displaced people.

These designs must be functional, durable, and easy to assemble and disassemble, considering the transient nature of refugee camps. Key considerations for temporary furniture design include:

*Material selection:* Utilize readily available and sustainable materials like bamboo, plywood, or recycled plastic.

Modular design: Create modular pieces that can be easily interlocked or stacked to form various furniture items.

*Knocked-down packaging:* Design furniture that can be flat-packed for efficient transportation and storage.

Cultural sensitivity: Consider the cultural preferences and needs of the refugee population.

Community involvement: Engage refugees in the design process to ensure their needs are met.

- Effective temporary furniture design can significantly enhance the well-being of refugees, fostering a sense of normalcy and improving their living conditions. See figure 18 for elements of study furniture that can be used for shipping containers in refugee camps.
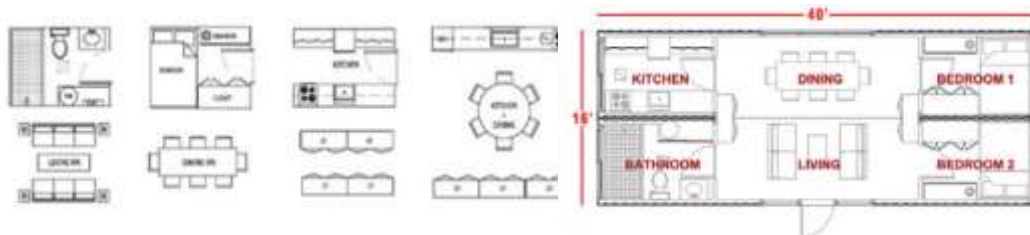
Figure 20. Furniture from shipping containers in refugee camps
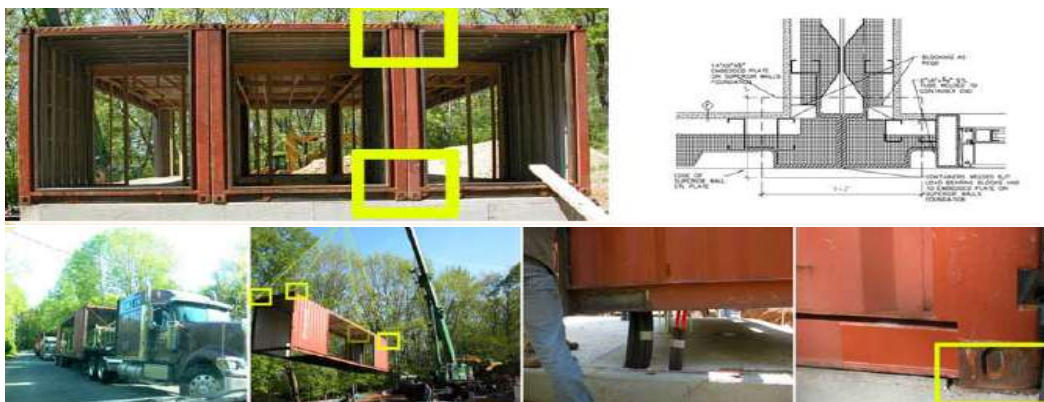
Figure 21. Installing the shipping containers in the specific plot in the refugee camp [9]

8.2. Output proposal

This study presents a proposal aimed at addressing the most prevalent impacts of crises: child displacement, destruction or damage to infrastructure, and disruptions to urban facilities. It emphasizes that addressing the needs of children affected by these disasters is one of the most critical architectural challenges facing the world today. The research proposes recycling shipping containers as temporary spaces for educational purposes, recognizing this as a necessary and significant step in the recovery process for these children as well as they need for immediate response to not stop a significant time for their growth which is their education. Internally displaced children (IDPs) lack permanent homes. Additionally, their physical needs necessitate dedicated sleeping areas that safeguard them from weather conditions harsher than those tolerated by adults. Consequently, combining educational spaces with residential units to create boarding schools is a key consideration.

The architecture of shipping containers has gained enormous popularity in recent years for its simplicity, affordability, and flexibility as an approach of green architecture[28]. The idea of using and designing shipping containers in refugee camp projects was raised to complete the task as quickly as possible. Shipping containers have the characteristic of limitless design: they are flexible and can adapt and join different designs. It helps in variable plans due to varying sizes as mentioned previously. It could be other plans, from cheap to small, to substantial and extravagant, that all shipping container structures have cost savings and high strength. The final products do not look like shipping containers using various finishing materials that cover the surface, wood, stucco, vinyl siding, or anything. It could be any look when it is finished. Designers can do a little ingenuity, paneling, flooring, and siding. It would never look like a recycled shipping container. In addition, the look of shipping containers is also becoming fashionable as they have been used in building 'Stadium 974' for FIFA world cup 2022 in Qatar.
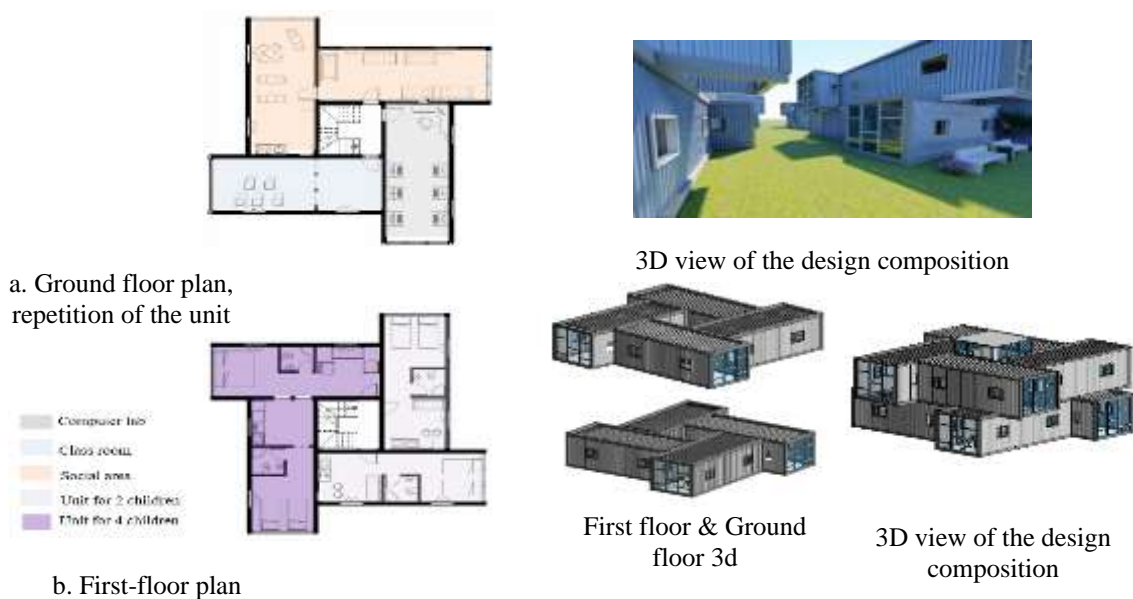
8.3. Modular Proposal

Recycled expired shipping containers offer a rapid and inexpensive solution to emergency refugee camp needs and, when stacked high, make for intriguing dormitory complexes. A proposal for the idea of recycling shipping containers explores how it has varied in its applications in refugee camps and presents diverse samples of how dignity has been realized in

movement contexts to draw out key lessons from the proposal. The proposal presents a prototype of boarding school unit built of recycling shipping container composition consists of two floors, see Table 3.

Level	The number of containers	Space
Ground Floor	Consists of 4 containers (8 m x 3.6 m x 2.4 m) *4	• Classrooms • Computer Lab • Meeting Space • Dining area
First Floor	Consists of 4 containers (8 m x 3.6 m x 2.4 m) *4	• Sleeping area (three wards) – maximum 24 children • common living space

It was considered that the design should be attractive, inspire optimism for children, encourage them to continue the educational process, and give them hope for the future. The design is shown in Figure 22 (a, b, c &d). Also, interior spaces shipping containers, can be multifunctional furniture where suitable for spaces where furniture pieces can be used for different functions. So, it can be folded or changed in a certain way to apply for more than one job, and it is the result of practical and innovative solutions in the interior design field to the problem of small spaces, as it fits into the project's industrial areas.

a. Ground floor plan, repetition of the unit

3D view of the design composition

b. First-floor plan

First floor & Ground floor 3d

3D view of the design composition

Figure 22. Recycling architecture of the shipping container

9. Conclusion

The ever-increasing number of displaced people, driven by conflicts and climate change, has brought to light the pressing need for innovative and sustainable solutions to address their immediate and long-term needs. The New Humanitarian's work in documenting the stories of displaced individuals and the evolving responses to refugee and migration crises provides valuable insights into the complexities of these issues. Education is a critical component in the lives of displaced children, particularly in the aftermath of conflict or disaster. The Syrian war, for instance, resulted in a staggering displacement of children, emphasizing the importance of education as a tool for resilience and recovery. Publications focusing on the reuse of recycled materials in shelter construction offer promising alternatives to traditional methods, highlighting the potential for sustainable and cost-effective solutions. This study presents a proposal to address the prevalent impacts of crises, including child displacement, infrastructure damage, and disruptions to urban facilities. The recycling of shipping containers as temporary educational spaces emerges as a necessary and significant step in the recovery process for displaced children, ensuring continuity of their education and fostering a sense of normalcy amidst challenging circumstances. In addition, this approach can be integrated with other methods to enhance thermal comfort and social integration like proving containers roofs and walls with green walls and roofs[29, 30]. The research underscores the urgency of addressing the needs of children affected by crises, recognizing it as one of the most critical architectural challenges facing the world today. By providing immediate and effective educational solutions, we can mitigate the negative impacts of displacement and empower children to rebuild their lives and contribute to their communities.

Acknowledgement

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