REFUGEE CAMP SHELTER AND NEIGHBORHOOD PLANNING METHODOLOGY BASED ON ENVIRONMENTAL CRITERIA

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ABSTRACT

The purpose of this dissertation is the study of the refugee phenomenon and how it affects spatially each refugee settlement area, as well as the design proposal of a bioclimatic and low-energy consumption neighborhood typology and the individual shelters that make it up. It should be emphasized that, in fact, this research is not just a neighborhood typology that is proposed but the methodology based on which it could be adapted to any camp.

The methodology followed is as follows:

Initially, the refugee phenomenon was studied, existing camps in Greece and abroad and research was done on the characteristics that make a camp functional. In addition, various examples of refugee accommodation, the traditional architecture of refugee countries, as well as conventional bioclimatic buildings were studied.

That way resulted the design proposal of the typical neighborhood-community and the typologies of accommodation. At the same time, in terms of accommodation, two completely different materials are proposed, which serve different needs.

As a result, the present research is a guide that can in the future contribute to the creation of camps that offer better living conditions to their residents while meeting the criteria of environmental planning, after analyzing one by one the parameters that will be addressed on a case by case basis, combining and utilizing information and knowledge from different fields.

KEYWORDS

bioclimatic, sustainable architecture, refugee accommodation, emergency shelters, planning

1. INTRODUCTION

The purpose of this dissertation is the design proposal of a basic bioclimatic and with reduced energy needs neighborhood typology and the individual shelters that constitute it as well. Furthermore it regards the study of the refugee and immigration phenomenon and how it affects the space where refugee settlements exist.

Although the design of a functional and good refugee camp seems like a separate field of knowledge, in fact it is a simple synthesis of knowledge that already exists architects.

More specifically, it is necessary to synthesize knowledge concerning: urban planning, the design and implementation of emergency accommodation, the lifestyle characteristics of

the countries that refugees originate from, as well as the characteristics of their traditional architecture, the characteristics of bioclimatic architecture buildings and open spaces, the existing required specifications of UNHCR etc. That way, the research methodology was developed, based on which the design of a typical neighborhood-community and the individual shelters that make it up, occurred. The exact route that was followed is analysed below.

2. METHODOLOGY

Firstly, the refugee phenomenon was studied and the basic characteristics of the global refugee crisis were clarified, how it is reflected in Greece and the processes related to it, as well as numbers, origin, age, gender, length of stay and more data concerning refugees arriving in Greece seeking asylum.

It is referred that in recent years, the refugee phenomenon has intensified due to the many outbreaks of war that exist mainly in the Middle East and in some African countries too. Although this is a phenomenon that has not occured in recent years, but pre-existed, knowledge about the design of an adequate refugee camp is limited. It results in poor conditions in most refugees camps, with some exceptions of course.

Secondly, camps in Greece and abroad were studied and research was done on the characteristics that make a camp functional. Such are the operation, organization, type of accommodation and climatic conditions of the area and whether the existing shelters meets them. Successful and failed examples of refugee camps were studied as well as the basic specifications given by the UNHCR.

That way, the basic problems of the existing camps arose, the basic principles of designing a good refugee camp, as well as the features that should be avoided. More specifically, it is particularly important to have:

- Proper orientation (ensuring maximum solar gain and protection against the cold north winds in the winter, adequate sun protection and ventilation during the summer and adequate natural light during the whole year)
- Shelters with good construction materials (adequate insulation of accommodation, sufficient shell heat capacity, good exploitation and adaptation to temperature changes of the external environment)
- Proper design of shelters (transitional shelters that offer a decent type of living during the stay and not just a survival, ensure the residents' privacy, designed according to the lifestyle of the countries of origin of the inhabitants)
- Urban planning (Urban planning as in any city - there is the concept of neighborhood that favors the creation of communities between people, spatial hierarchy: shelter <neighborhood <building block)
- Environmental planning (good drainage system - water absorbing materials, good relationship with natural environment, rich planting)

At the same time, various examples of refugee accommodation were studied, which are divided into three categories: emergency shelters, transitional shelters, which are used to host people from a few weeks to a few months and permanent shelters.

The importance of other characteristics was also understood, such as assembly time, weight, cost and ease of transport, bioclimatic behavior of various materials, ideas for better bioclimatic behavior and durability, etc., characteristics that were taken into account for the two different material versions proposals, each of which has different advantages an ddisadvantages in terms of the above axes and are going to be presented later.

The study of the characteristics of the refugee phenomenon showed that the refugees usually stay for several months - or maybe in some cases for a few years - in the camp of Moria, which is the case study of the present research, but also in any similar camp. For this reason it was chosen to build transitional shelters, which provide to their users more comforts than an

emergency shelter that can be used for a few days and provides a simple survival and protection from severe weather conditions.

In addition to understanding the three categories of refugee accommodation, the study of examples of refugee housing revealed other individual characteristics and ideas that were applied to the design proposal. It is worth noting the example of Super Adobe, a refugee shelter built from earth under the supervision of the UNHCR in Iraq. At the same time, soil is the basic material in the traditional architecture of the Middle East. Through the study of many more types of accommodation of natural construction, the proposal of the 1st version of materials of the proposed typology, which almost entirely consists of natural materials, arised. Other accommodations that have inspired the typology of the accommodation and the neighborhood include the Transitional Community, a Sri Lankan system of 17 houses for families affected by the tsunami, and the Solar Cabin, a bioclimatic transitional accommodation for refugees in the Netherlands.

In addition, the Hub, which is a prefabricated unit with bathroom, kitchen, heating and Internet, for fast conversion of empty non-residential buildings into habitable with the idea of "box in a box", can be used in the proposal to standardize the construction of the bathroom and the kitchen and the simultaneous provision of additional facilities, such as heating, Internet, sockets, air conditioning, etc., to save time when assembling the construction. Finally, the influence of Y: Cube was remarkable with the logic of modular construction and height expansion according to the number of people who needed hosting.

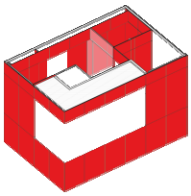


Figure 1. The Hub

Figure 2. Y: Cube

At the same time, data from the study of standard bioclimatic housing complexes were used for the design and selection of passive systems, the relationship of building volumes between them, the orientation, location and size of openings for natural ventilation and solar gain.

Finally, the study of the traditional architecture and architectural typologies of Syria, which is the main country of origin of the refugees, revealed something very important: the social characteristics and the characteristics of the culture and lifestyle that led to the formation of the basic housing typologies in Syria during the 19th century. These characteristics are very common in most Middle Eastern countries and are very important elements to consider when designing accommodation and refugee settlements. The correlation of the traditional architecture of the Middle East with the proposed accommodations will be presented in more detail below:

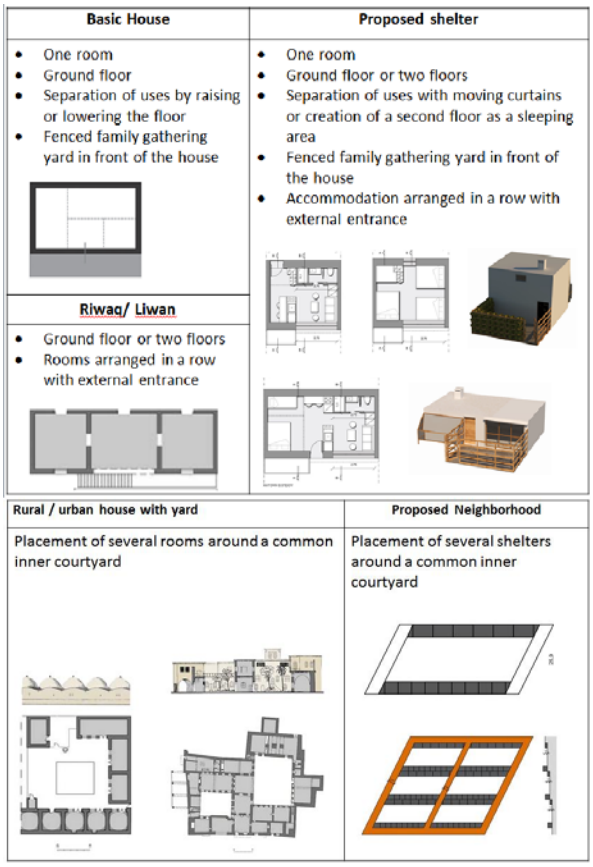


Table 1. Comparison of basic features of the traditional architecture of the countries of origin of refugees (Middle East) with the proposed accommodation

3. RESULTS AND DISCUSSION

As referred above, the research is related to the study of a design methodology of a neighborhood typology and the shelter typologies it consists of. This typology can be applied to any camp with modifications. In order to be accomplished, the research's chosen case study is the space that houses the existing refugee camp of Moria. As for the design methodology the following applies:

Regarding the location and separation of the residents of the camp according to their gender and age, it is emphasized that each group lives in a building block fenced by the other residents, where each building block consists of at least one neighborhood. In the neighborhood people can develop their social life and have their own personal space, since in their countries of origin it is common for a large part of a family's activities to take place outdoors.

3.1.Typical neighborhood design methodology

The design methodology is as follows:

1. The buildings are oriented to have a south orientation and to ensure solar gain during the winter months

2. The direction of the roads is based on the prevailing winds, in order to be parallel to them, so that there is good air circulation and adequate ventilation of all accommodation throughout the year, without facing the north sides of the accommodation during the winter months.

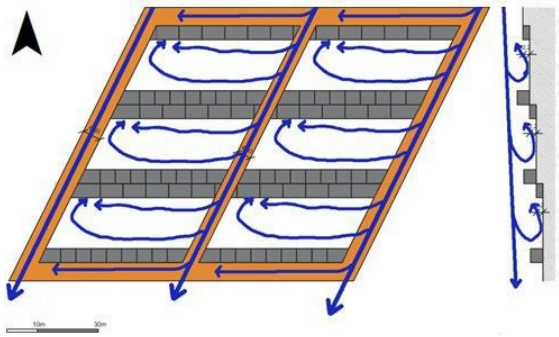


Figure 3. Ventilation diagram of a building block

3. The distance of the buildings and consequently the width of the streets and the dimensions of the yard, were decided on the basis that no shelter throws shadow on the others during the winter, in order to ensure the maximum solar gain while taking into account the ground's inclination as well.

4. The number of buildings that will exist in each neighborhood was decided based on the grid of 2.5 meters. Since there were two basic typologies of accommodation, (the ground floor and the two-storey),their width was made to be a multiple of one number, in the current phase of 2.5m. So, the ground floor buildings have an external dimension 3x2.5 = 7.5 meters while the two-storey 2X2.5 = 5 meters.

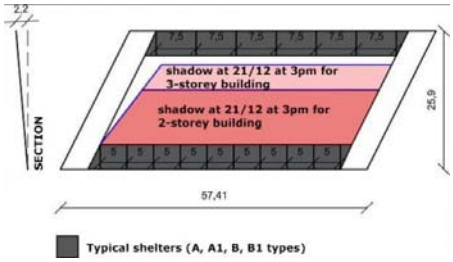


Figure 4. Typical plan of the neighborhood– Shadow at 21/12 at 3pm

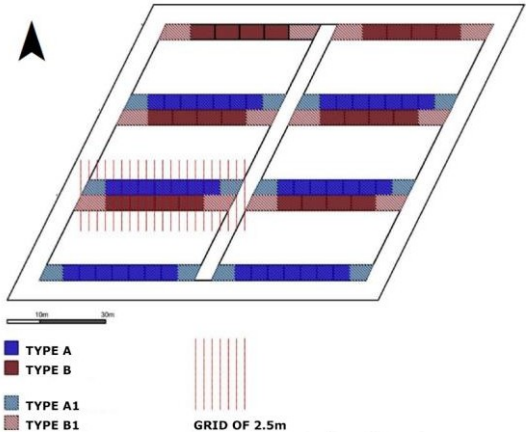


Figure 5. Diagram of basic building block typologies

Each neighborhood-community consists of 15 shelters for six inhabitants (90 inhabitants). However, if there is a need to accommodate a larger population, there is the possibility of growth, which can lead to up to 24 accommodations (144 inhabitants) per neighborhood.

The above typology is considered the best in terms of the combination of positive bioclimatic feature according to the weather conditions of Lesvos. However, with the same criteria, more typologies can emerge.

3.2.Typical shelters design methodology

As for accommodation (shelter) typologies, the two main ones are A, which is two-storey and B, which is ground floor. What needs to be understood is that as in the case of the neighborhood, in the case of shelters, the suggested typologies can have variations. More specifically, two versions of different materials are proposed, each with different wall thicknesses. What matters is that regardless of the thickness of the walls, the external dimensions of the shelters must be in accordance with the grid that was decided, in this case 5 and 7.5 meters, and the change of thickness must be done internally.

Each accommodation can accommodate a family of six. The accommodation is either two-storey with a loft (types A, A1), which is used only for sleeping, or ground floor (types B, B1). In this case the beds are bunk beds and are isolated from the rest of the space with movable curtains. The same is true on the second floor, where the beds are also separated by curtains so that the parents can be separated from the children or the boys from the girls. Each accommodation has a kitchenette for preparing a small meal, a bathroom, a living room and a desk that can be used by family members.

The proposed shelters have bioclimatic characteristics which are as follows:

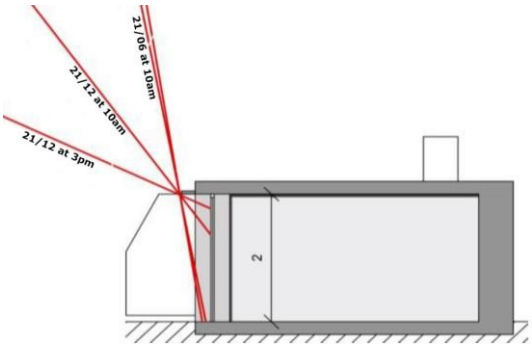


Figure 6. Type B- Solar diagram

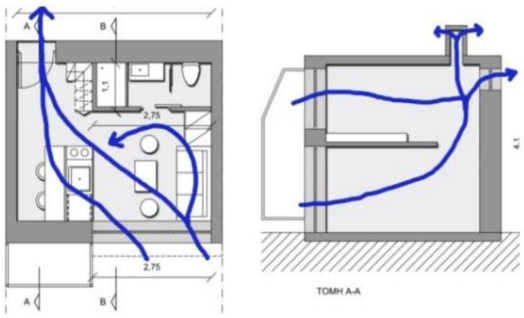


Figure 7. Type A- Ventilation diagram

- Solar greenhouse in the southern part, which opens - is removed in summer
- Large south opening / Small north
- Shallow depth for natural light
- Shades for external shading of the openings
- Solar water heaters on the roof for Hot Water
- Walls, floor and ceiling with high thermal resistance and heat capacity materials.
- Cross ventilation using a ventilation tower and window to the north of the attic
- Cover over the large south opening for sun protection in summer
- Planting with deciduous trees, about 7 meters high, that provide shade during the summer months while allowing the sun's rays to reach the openings in winter.

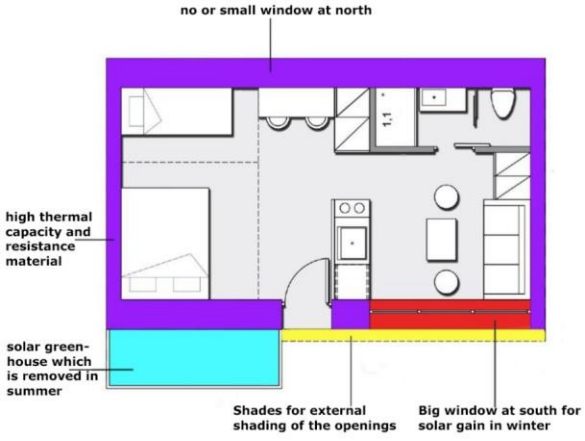
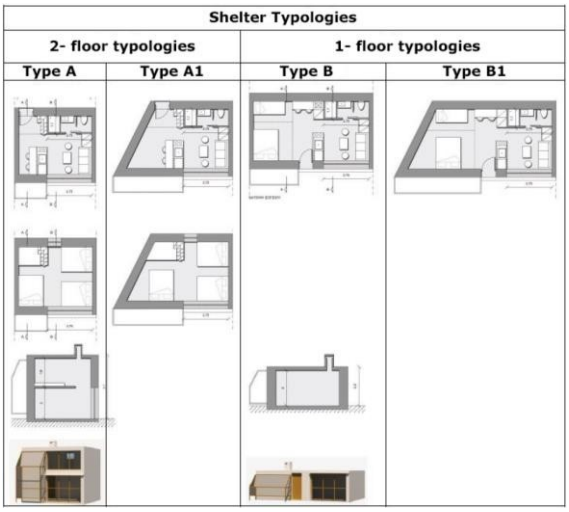


Figure 8. Type B- Bioclimatic characteristics

Table 2. Shelter Typologies



It is reported that such trees will be planted throughout the yard, creating angles under which people can sit during the summer months when the sun is not desirable. Due to the fact that they are deciduous they will not block the sun in the yard during the winter months when the sun is desirable in the open spaces.

Regarding the floor materials of the outdoor areas, it is stated that most of the common yard will be covered with compacted soil, while the private courtyards of the accommodations and some traffic corridors are paved with cobblestones, which have soil underneath. These are water-permeable materials that can absorb large amounts of water, preventing floods during periods of heavy rainfall. At the same time, thanks to the evaporation of water, it helps to drop the temperature during the summer months during a period of rainfall. The existence of two fountains, which release jets of water through a floor grate, contributes to this as well.

3.3.Material selection methodology

Regarding the materials, two different materials are proposed, which serve completely different needs, but in both cases the buildings will be bioclimatic and will have low energy needs. The first version will be made with natural construction. More specifically, the walls will be made of unbaked mud with the appropriate clay content while the windows, doors, bathroom, roof and floor of the mezzanine will be standardized and will be based on a frame that will be repeated . This version, although more time consuming, is more environmentally friendly, as mud which is the material with the least possible energy content and which leaves the smallest possible environmental footprint, will be used for the exterior walls of the accommodation. This is also the lowest cost option, which is especially important in the case of refugee accommodation, as it is often not possible to have the right resources. The downside is that due to the non-standardization of the external load-bearing walls, it is more time consuming to implement.

The second version is more standard, less time consuming but with more cost and energy content of materials, but at the same time, it has the flexibility to be implemented in more types of soils and lead to a wider application of the above neighborhood typology around the world. In this version, the key is to choose materials that will ensure sufficient thermal resistance in the building shell, while at the same time they will have a high heat capacity, so that it can store energy in its mass and deliver it to the interior with a time delay. In order to increase the heat capacity of the light construction, water containers will be placed, which will have the ability to empty and refill every few months through a notch accessible from the outside so that bacteria will not be collected in the water. It is emphasized that the floor of the house will not be in contact with the ground to avoid moisture and will be a few centimeters away, based on four above-ground bedrocks. This allows the shelters to be set up anywhere without the need of large excavations as in the first version of materials.

Table 3. Shelter construction materials

Shelter construction materials (external walls)			
1st version		**2nd version**	
1.Lime-cement mortar (1 cm.) 2. Unbaced clay mud (48 cm) 3. Lime mortar (1 cm)		1.Cement board (1.2 cm) 2. Extruded polystyrene (6 cm) 3. Polycarbonate with water (25.8 cm) 4.Cement board (1.2 cm)	
Wall thickness	50 cm (up to 2 floors) 75 cm (3 floors)	Wall thickness	34 cm.
U value	0.081 W / (m · K) (wall 50 cm thickness)	U value	0.446 W / (m · K)

Figure 9. Typical neighborhood with minimum height

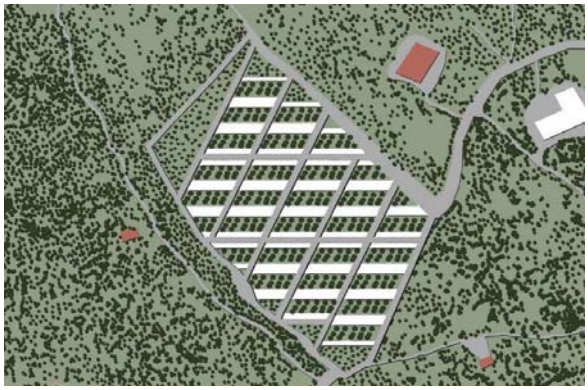


Figure 10. Moria refugee camp - Indicative Proposal

4. CONCLUSIONS

In conclusion, from the above it becomes clear that thanks to the detailed presentation of the methodology, the proposed typologies can have variations per case in order to better adapt to environmental conditions. Also, depending on whether in each case, the time, construction cost, environmental footprint, or other parameters are the most important factor, construction materials will be decided on a case by case basis.

It is worth noting that this guide can in the future contribute to the creation of refugee camps that offer better living conditions to their residents while meeting the criteria of environmental planning. The parameters are analysed one by one in the order that will be addressed in each case, combining utilizing information and knowledge from different fields, such as the refugee issue, how to organize a refugee camp, the necessary specifications, environmental planning principles, types of shelters and more.

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