Architecture and Post-Disaster Shelters

An analysis of the Bam, Haiti and Nepal earthquakes

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1. Introduction

1.1 Purpose and Objective

The main objective of this thesis is to study the potential role of architects and architecture in the aftermath of earthquakes, more specifically in the design of post-disaster temporary shelters. Three main series of questions are raised within the introduction, and finding appropriate answers for them will be the goal throughout this research. The three topics are the questions of *standardized shelter vs. site-specific shelter*, *pre-disaster planning vs. post-disaster execution* and *the role of the architect*. In order to do so, this study will firstly take a look at earthquakes and their general consequences. Then, the different phases of post-disaster reconstruction will be introduced, examining what each phase consists of, as well as the role an architect plays in this process today, or lack thereof. The study will then take a close look at post-disaster shelters, before delving into the details of the subject matter through the means of a comparative study. The three chosen case studies, the 2003 Bam earthquake, the 2010 Haiti earthquake, the 2015 Nepal earthquake, will be firstly individually introduced, and their shelter strategies will be compared to each other following the three chosen criteria, namely suitability in terms of urgency, suitability in terms of climate, suitability in terms of culture. The result of the analysis will allow for a

better and deeper understanding regarding the relationship between architecture and post-disaster temporary shelters.

1.2 Questions

When studying the topic of this thesis, one should take into consideration three different aspects or points of view; firstly the individual and communal needs of earthquake survivors in terms of shelter, secondly the temporary shelters themselves and their characteristics, and finally the role of an architect when it comes to providing solutions to the aforementioned needs or bringing improvements to the existing situation. The latter of the three is the main focus of this research and answering the questions related to this part is the final goal, but in order to do so, one needs to gain a complete and thorough understanding of the first two aspects; survivor needs and shelters as objects.

Reaching an understanding of survivor needs requires being familiar with the phenomenon of a natural hazard itself, specifically earthquakes in the case of this study. One needs to have a comprehension of the effects of such a disaster on the damaged area, the different scales of its consequences on individuals, families, communities, cities and even countries. Physical destruction and damage are not the only results of such events, the psychological needs of survivors and the economic struggles of the damaged communities are among the aspects which are generally less likely to be taken into account. Throughout this research and its specific case studies, the writer will try to study post-disaster shelter needs at an individual, family and community scale; understand the essential needs which all earthquake survivors have in common; and analyze the possibility of some needs being specific to the local climate, geography, or culture and tradition.

Alongside the study of the common and specific needs of disaster survivors, it is essential to take a close look at the general

structure of post-disaster reconstruction. Although each post-disaster scenario is unique and dependent on a large number of different factors, the reconstruction process is generally consisted of three different phases: immediate relief in the form of temporary (or emergency) shelters, intended for the first few months after the disaster; temporary housing or transitional shelter, generally built while temporary shelters are being used and in use; and finally newly constructed or repaired permanent housing which can take up to several years to be completed. In order to delve into the role that an architect can play in the first phase of post-disaster reconstruction, one needs to study the existing system of temporary shelters, how they try to provide an answer to this complex problem and how effective they are in doing so. Due to the chaotic nature of post-disaster situations and their urgency, standardized temporary shelters are often utilized as immediate shelter solutions. Despite the fact that these shelters are designed to be used for a short and limited period of time, in many cases, its users have no choice but to use them for extended periods of months and even years. This study will take a look at the advantages and disadvantages of such shelters and study their quality and performance within different case studies and contexts.

Once the previous aspects have been studied and clarified, the role of an architect within the reconstruction process can be further examined, specifically in regards to the first phase, that of immediate disaster relief and temporary shelters. Architects tend to be more involved in the development of the second and third phase of the reconstruction, namely transitional and permanent housing. The reason could be that the development of these housing projects are familiar situations for typical architects and the work which they are usually involved in, whereas working on post-disaster immediate relief projects and the urgency linked to them is an unfamiliar scenario for the majority of today's architects. One rarely comes across such projects during the several years of architectural studies, and

even afterwards in practice, the involvement in such scenarios requires a high personal interest and motivation on behalf of the architect. Nevertheless, providing shelter, especially for those in extreme need, should be at the heart of architecture. Although several aspects of work in such situations are unfamiliar for architects and working on such projects would be stepping into uncharted territory for most, the author believes that architecture is able to provide an indispensable point of view on the subject and brings with it knowledge which cannot be delivered by any other profession. Therefore, a stronger presence of architects in the field of post-disaster immediate relief and temporary shelters is not only an improvement on the current situation, but it is necessary and of vital importance. In order to understand how an architect can do so, this study aims to take a closer look at the following three specific aspects of temporary shelter design.

Standardized shelter (global) vs. Site-specific shelter (local)

As previously mentioned, in the case of most disasters, the main elements serving as shelter are standardized ones such as tents, provided by local governments or international organizations. The standardization of these shelters allows for them to be easily accessible in time of emergencies and disasters, they can be stored and are easily transportable and require little effort to be set up. On the other hand, studies and experiences have proved shelters such as tents to be inadequate in different ways. Being universal in their design and use, they are used in the same manner in different countries, climates and weather conditions. The same tents are used in tropical regions as they are in arid areas. The same tents are used during the summer as they are in winter. These shelters are also unable to be answer different cultural needs. The living habits of different communities naturally are not the same, yet the shelter provided for all of them is. One wonders whether it is a more suitable option to

design and make use of shelters which come from the site of the disaster itself, rather than being injected into it. Making use of local materials and building techniques could lead to a better and more adapted living space for the survivors. The incorporation of local knowledge regarding not only construction but also living habits and culture can only be beneficial for the eventual users of the shelters. Additionally, the use of local workforce for the construction of these shelters can have a strong psychological impact on disaster survivors and a positive effect on the collapsed economy of the disaster-hit community in the long-term. However, this attitude towards disaster relief is not without flaws either. The design and construction of such specific shelters require a significant amount of time, something which is of extreme value in disaster scenarios. The main questions arising from this topic are the following: Which approach is the more appropriate one and should be chosen by the architect and the other professionals involved in the matter? The global approach which consists of using standardized shelters, or the local approach which consists of using site-specific shelters? What are the advantages and disadvantages of each? Is there a common ground to be found between the two points of view? Is there a solution which combines the positive aspects of both approaches?

Pre-disaster (planning) vs. Post-disaster (execution)

A natural hazard and the damage it causes, although predictable to some extent, can never be fully understood until the occurrence of the event itself. Floods, hurricanes, earthquakes and other natural hazards each have different catastrophic effects on the area they strike and the extent of the physical damage that follows them varies vastly and is dependent on several different factors. In order for the correct strategy which deals with the consequences of natural disasters to be put in place, a quick reaction is necessary by all parties involved, local authorities, NGOs, international organizations and etc. An assessment of

the immediate post-disaster situation, the physical destruction caused, the number of displaced people and other factors, leads to the establishment of the required relief efforts in terms of shelter by the different participating parties. Actions can nevertheless be taken long before the disaster happens, and they can achieve a lot in terms of post-disaster damage reduction. Disaster mitigation and preparedness is an important field of study on its own and includes major actions such as the study of zones at risk of disaster, structural redesign of buildings or adjustments on building regulations. These actions all have the common goal of preparing a community for the possibility of a disaster, and reducing the eventual damage and destruction. The same strategy can be adopted in the case of temporary shelters. Although certain actions can only be taken once a disaster has struck, there are several measures which can be undertaken before the disaster. Since time is of the essence in post-disaster scenarios, the more local authorities and other involved parties are prepared in terms of providing assistance to those in need, the faster the relief efforts can begin. One example is the study of possible temporary shelter and settlement sites in case of the need for relocation. The process of site-selection is very important and one which requires a high level of research and attention to detail. Many different factors need to be taken into consideration to choose an appropriate site and that must be done in advance, due to the lack of time for such measures in immediate post-disaster situations. Another example can be the study of previous disasters' shelter usage patterns. Research on shelters used in other disasters and the way in which their users interacted with them, the general satisfaction of the users with them or lack thereof and an analysis of their performance can only strengthen any future development of temporary shelters for other eventual natural hazards. The main questions raised regarding this specific topic are the following: How much does pre-disaster preparation work improve the post-disaster relief efforts? Which aspects of temporary shelter provision need to be determined in the short amount of time after a disaster and which can be predetermined? How much more efficient can relief efforts be compared to the current situation if thorough pre-disaster studies and research are undertaken?

Role of the architect

Post-disaster relief and reconstruction is very vast in its nature and requires efforts from several different large-scale actors. Local and national authorities usually play a major role, but in most cases, other participants include international organizations operating in the country, NGOs, foreign authorities, volunteers and etc. The scale and complexity of these situations usually require help from as many actors as possible, but the involvement of a large number of different organizations creates problems of its own. Each participating party has a different set of priorities and tries to follow its own agenda, often ending in miscommunications and inefficient management of the situation. A strong coordination between the different involved parties is required in order to create a process which is both efficient and satisfactory from the point of view of the disaster survivors. At a smaller scale focused on the aspect of shelter design, provision and construction, a similar situation exists. A community struck by a natural disaster is a sensitive one therefore each decision made for its people needs to be educated in order to avoid creating further problems for them. When planning and designing temporary shelters and settlements, it is important to take into consideration the several different aspects of this complex matter. The shelter itself as an object could be designed solely by an architect, as some have attempted to do so, but experiences often show that the involvement of other professionals is necessary. The site where the temporary settlement is situated, how it is organized and how it will change throughout time requires the knowledge of a planner. The way the shelter and the settlement deal with the element of water for the community requires the knowledge of a specialist. Health and sanitation issues are very common within

post-disaster scenarios, therefore the presence of a specialist in this field is important. Several other engineers and the different perspectives they provide can be complementary to the previously mentioned work. However, shelter design and its related branches should not be viewed solely through their physical aspect. The psychological effects of such an event on its survivors is often more severe in the long-term. Survivors have to deal with the loss of family members, destruction of homes, and the falling apart of their community, and the immediate shelter provided for them in their most intense time of need should take these facts into consideration. The consultation of psychologists and sociologists can therefore provide a unique outlook and work in favor of the shelters' eventual users. Another important aspect which is often forgotten is the involvement and participation of the survivors themselves in the process of shelter design and construction. Survivors rarely have a say in the development of such projects, and that is perhaps the main reason why in most cases, temporary shelters fail to provide enough satisfaction in their users. The main questions put forward by this topic are the following: What is the nature of an architect's role within the process of shelter planning, design and construction? Can an architect be the sole actor? Or is the involvement of other professionals a necessity? If so, what role does an architect play within the team of professionals? Is he/she the leader of such a team or a member like others?

1.3 Research Method

There are three main topics, explained in the previous section, which are being studied within this thesis. A study of the various aspects of the topics which need to be taken into consideration will firstly be undertaken, leading to theoretical knowledge on the issues. Theory will then be complemented with a comparison based research which leads to an understanding of the topics in practice. Three case studies, namely the Bam earthquake of 2003, the Haiti earthquake of 2010 and the Nepal earthquake of 2015, are put in comparison according to three defined criteria. The earthquake which struck the city of Bam, Iran in the year 2003 is chosen due to the writer's background, being of Iranian nationality. This earthquake was the country's most severe one in the past twenty years, and caused a high death toll and a large number of injured and displaced people. Choosing this case study allows the writer to gain an understanding of post-disaster scenarios within the Iranian context and serves as preparation for eventual future work in this domain. The 2010 Haiti earthquake and the 2015 Nepal earthquake were two of the worst disasters of the past decade. Both cases are chosen due to the significance they had regarding post-disaster scenarios and the topic of temporary shelters. The mentioned case studies will be compared based on the three criteria, namely suitability in terms of urgency, suitability in terms of climate, suitability in terms of culture. In post-disaster scenarios, urgency is of utmost importance in order to provide as much assistance, as quickly as possible to those in need. Any form of shelter provision must meet certain specific demands in terms of the urgency of the short-term situation. As the usage of temporary shelters often exceeds days and months, it is important to address the topic of climate when analysing these case studies. The climate and the weather directly influence the everyday lives of survivors, therefore the behavior that these case studies have in regards to climate are to be studied. Last but not least, this thesis will investigate the quality of shelter within the context of the case studies in terms of appropriateness to the culture in which they are used. The comparison of these cases, along with the theoretical knowledge gained beforehand, will finally allow a deeper understanding of the three main topics of this thesis.

2. Natural Disasters and Shelter

2.1 Earthquakes and their consequences

Earthquakes and natural hazards in general, are events resulting from natural processes of the planet, which in certain cases can cause severe loss of human life and physical damage. Over 800'000 people have died due to earthquakes between the years 2000 and 2015, the 2004 Indian Ocean earthquake and tsunami and the 2010 Haiti earthquake causing a large number of them. The number of people injured are even greater, and others whose lives are indirectly affected are impossible to count. It is important to consider the fact that there are different aspects to the consequences of major earthquakes, several of which are usually forgotten.

Naturally, the human impact of earthquakes is the one most spoken about. The loss of human life, especially in large amounts and in devastating situations, is a tragedy. Human empathy is strongly present in post-earthquake scenarios all around the world. High death tolls, significant amounts of injuries, destroyed communities and countless lives damaged. Those who survive, have to deal with the physical destruction caused by the event, which is another bold aspect of such disasters. Earthquakes can cause severe physical damage to buildings and constructions, especially those structurally not designed to withstand such

catastrophes. This is especially significant in developing countries where the aftermath of an earthquake can be the total destruction of homes, infrastructure such as roads, public institutions, and entire towns and cities. Historical cities are also very vulnerable to physical damage, such was the case of the ancient city of Bam in Iran, when it was hit by an earthquake in 2003, and the majority of its mud brick buildings were destroyed. The effects of these damages are usually long-term, as reconstruction and rebuilding plans can take several years to develop and be executed. The survivors, in many cases, have no longer a residence to live in and are therefore forced to settle with friends and family or be accommodated in mass or individual shelters provided for them. The latter of the two, generally far from a pleasant living scenario, can lead to several other problems. The living conditions in these shelters usually have difficult or no access to water and problematic sanitary infrastructure. Within the earthquake-struck area, water and toilet facilities are often damaged or inoperable as well, so both scenarios present an ideal situation for the spread of different diseases. Therefore health related issues are also one of the important consequences of earthquakes. The mental health of survivors is also not to be forgotten. Survivors often have to

Damage and destruction caused by the 2005 Kashmir earthquake. Source: Schneider, Evan. UN Photo, 25 October 2005

deal with the loss of family members, the destruction of their home and belongings and uncertainty about their short and long-term future. The psychological consequences of disasters are often disregarded by others, but the survivors cannot do so. Post-traumatic stress disorder (PTSD), depression and anxiety related issues are common among people who go through such experiences, and these problems have longer-lasting effects compared to several other major consequences of earthquakes. Natural hazards also cause a significant amount of economic struggles for the struck area. Statistics show that although the number of casualties caused by such disasters has significantly decreased in the past fifty years, the economic damage during the same period has strongly risen. According to data from the Centre for Research on the Epidemiology of Disasters[1], in the year 1978, 137 natural hazards were reported across the world, causing a total of 38'096 deaths and a total of USD6.2 million in damage. Whereas in the year 2013, the result of 184 reported natural hazards was 10'192 deaths and a damage of USD61.8 million. The large-scale consequences of such events on a country's economy are not negligible, and the small-scale local economy should not be forgotten either. The destruction caused by an earthquake affects not only houses and residences, but all other buildings as well, so survivors often have to face the loss of their means of income during the process. An entire community's economic system can collapse within a matter of minutes, and rebuilding it requires enormous amounts of time and planning. Natural disasters, earthquakes included, have several physical and non-physical consequences, some short-term and others long-term, some given enough attention and others not, which is why dealing with them requires enormous amounts of effort and is usually a mission which takes years to accomplish.

1. Davis, Ian, and David Alexander. *Recovery from Disaster*. London ; New York, Routledge Taylor & Francis Group, 2016, p. 175.

2.2 Disaster management

Disasters are the result of a combination of hazards and

vulnerability. Natural hazards such as floods or earthquakes act as trigger events, and they are not the cause of damage and danger on their own. Several thousand earthquakes occur every year in different places across the world, yet only certain lead to what is known as a disaster. Natural hazards alone therefore do not correspond to disasters. Vulnerability is an important element and the IFRC (International Federation of Red Cross and Red Crescent Societies) defines it as "the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recover from the impact of a natural or man-made hazard"[2]. The UNDRR (United Nations Office for Disaster Risk Reduction) provides a similar definition: "the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard"[3]. According the them, there are different aspects to vulnerability arising from physical, social, economic and environmental factors. Poor design and construction of buildings or lack of public information and awareness fall into a community's vulnerability. Disaster management consists of all the actions which aim to reduce, or avoid, the potential losses from hazards, assure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery. These actions and disaster management as a whole are generally presented as a cycle, one whose processes are continuous and never-ending. The cycle is usually defined as having four major phases, each with its own characteristics, and although they each have specific time-frames in theory, they tend to overlap in practice. Mitigation and preparedness are two of the four phases which occur before and in anticipation of disasters, whereas response and recovery naturally take place once a disaster has struck. The pre-disaster phases include a variety of actions, some of which focus on the long-term such as the application of stricter building codes and others which are more concerned with the immediate future such as the preparation and storage of food and shelter supplies. Post-disaster phases on the other hand deal with the immediate and long-term needs of survivors, with actions such as the supply of food and shelter or the planning and construction of new permanent housing.

2. IFRC. *Vulnerability and Capacity Assessment*. Geneva: International Federation of Red Cross and Red Crescent Societies.

3. UNISDR. *Terminology on Disaster Risk Reduction*. Geneva: United Nations International Strategy for Disaster Reduction, 2009.

Mitigation

The mitigation phase is defined as the sum of all actions and activities designed to eliminate or reduce the possibility of a disaster in the case of a natural hazard, and minimize the loss of human life and damage to property. Although this phase has a time-frame which is situated within a comfort zone between two natural hazards and little attention is paid to it, the actions which arise from this phase are of utmost importance and can significantly reduce the scale of the damage dealt by hazards. The majority of mitigation measures consist of the development of planning and the application of policies by the appropriate actors, at a regional and national scale. The gathering of information, study of past disasters and research on a vast variety of subjects are also essential to this phase, due to the fact that these actions are all time-consuming and can only be undertaken within a period without time constraints. Typical examples of such actions include the application of stricter building codes for new constructions and the continuous study of hazard-prone areas. Certain actions specifically related to the question of shelter and involving architects could be the examination of shelter usage in past disasters; the study and extensive understanding of local constructions, communities and living habits; or research on potential temporary shelter sites in case of large amounts of damage and destruction.

Preparedness

The term preparedness generally is used in practice in its traditional, narrower sense to represent short-term actions taken before a disaster to minimize potential impacts of hazards, risk, or vulnerability not previously reduced through mitigation[4]. The goal of this phase of disaster management is to achieve a

4. Schwab, James. *Planning for Post-Disaster Recovery: Next Generation*. American Planning Association, 2014, p. 43.

satisfactory level of readiness to respond to emergency situations through actions which strengthen the technical and managerial capacity of governments, organizations, and communities. Its actions include the implementation of specific mechanisms and procedures in case of a hazard, public education on the possible risks and rehearsals of things to do within such scenarios. The national and local governments also have the responsibility of storing reserves of food, shelter, necessary equipment, medicine, preparing enough manpower to deal with the potential disaster and communicating timely and appropriate warnings and evacuation plans to those within the danger zones.

Response

The response phase of disaster management takes place "when a disaster is in progress and involves addressing immediate and short-term needs, including evacuation and rescue management"[5]. Common and general goals revolve around the prevention of further injuries and casualties, as well as damage to property. Examples of some undertaken actions are search and rescue operations; emergency medical care for the injured; mental health counseling; proper identification and disposition of dead bodies; debris removal; provision of temporary shelter, water, sanitation, and food; repair of utilities and key infrastructure. Certain operations involving architects and regarding shelters could be the assessment of the amount of damage done to buildings, the identification of those still acceptable for usage, the setup of temporary shelters and their adjustment and adaptation based on the situation's specific needs. If the two previous phases are done correctly, the response phase mostly revolves around the execution of different stages of planning done in the mitigation and preparedness steps, and if properly managed, damage can be limited. However, there are certain aspects of natural hazards which are unpredictable and can only be countered after the disaster. A speedy assessment of the event,

5. Zahedi. *Ontology-Based Evaluation of Natural Disaster Management Websites: A Multistakeholder Perspective*. MIS Quarterly 38, 2014, 997–1016.

Search and Rescue teams operating after the 2010 Haiti earthquake. Source: Dormino, Marco. UN Photo, 16 January 2010.

the damage dealt and the short-term needs of survivors, directed by local authorities, is essential in the response phase. Due to the urgency of these situations, response operations generally start with local residents, making immediate efforts in improving their living conditions, followed by local and then national authorities, who have the main means of support and relief destined to the survivors. International aid agencies and foreign governments are also among those offering services, but usually much later than the time of disaster. The presence of humanitarian organizations is also strong during this phase and the urgency of matters often gathers a significant amount of attention from the media and the general public worldwide, which leads to a large total of individual donations and foreign governments' funding towards the cause. While the investment in the immediate response period is necessary, other phases tend to be forgotten. Investment in the mitigation and preparedness phases could strongly reduce the amount of damage done in disaster scenarios and the recovery phase which follows, requires remarkable amounts of financial support but not enough attention is paid to it. The focus in the response phase is on meeting the basic needs of the affected people

until more permanent and sustainable solutions can be found, and serving as a preparation phase for the following recovery stage, mainly by gathering information on the existing situation.

Recovery

There is no specific point in time at which the response phase changes into recovery, there is rather a transition between the two. As the state of emergency in post-disaster situations is being brought under control, the recovery phase begins with the goal of returning the livelihoods of survivors and their community to pre-disaster levels. This phase can last from several years up to over a decade and encompasses the restoration, repair or reconstruction of housing, infrastructure and public facilities; the redevelopment of the local economy; long-term counseling for survivors and the rebuilding of the various aspects of community life. Shelter development is an area in which an architect can have an important role to play with tasks such as the design of adequate transitional housing, the repair and reconstruction of existing housing and the development of new ones. Recovery is closely related to the immediate relief period in its early stages and overlaps with the mitigation phase in its later stages.

2.3 Actors of relief aid and their roles

The success of a relief and rehabilitation operation depends on the correct and logical distribution of roles to the different participating actors. Disaster relief, especially in its early response stages, is a large-scale complex matter. There are various groups which come into play in order to help with portions of the relief process. The different nature, size, backgrounds and motivations of these groups could make the already difficult task of disaster relief, an even harder one. Like in any project with a significant amount of participating members, this process requires a strongly present managerial and organizational entity. The lack

of management can and will lead to inefficient relief efforts, and therefore the extension of disaster survivors' struggles. In order to produce an effective collective effort, the different participants and their roles need to be identified. Below, certain of the main actors of relief aid and their dedicated roles are further explained.[6]

6. IFRC. *Shelter After Disaster*. Geneva, International Federation Of Red Cross And Red Crescent Societies, 2015, p. 53.

The surviving community

When a disaster strikes a town or city, the local residents are the ones whose entire lives change in a matter of seconds. Families can be lost, homes destroyed and futures unknown. Yet, those who survive are often the first ones to take the first steps towards reconstruction. Before the arrival of assistance from local and national authorities, survivors take matters into their own hands, helping each other through their most difficult time. With the arrival of aid from the number of different actors, and throughout all the stages and phases of relief, the survivors should not be forgotten. As evident as that may seem, survivors are unfortunately rarely the focal point of relief efforts. Local authorities, humanitarian agencies, international organizations

Disaster survivor in a team working on building transitional shelters for the Red Cross at La Piste Camp, Port Au Prince, Haiti. Source: Depp, Ben. IFRC, 15 November 2010.

and others are each in pursuit of their own agenda and tend to forget the people towards whom their efforts should be targeted. The participation of survivors, in all forms and in all stages, is essential to any disaster relief project. "Effective relief and lasting rehabilitation can best be achieved where the intended beneficiaries are involved in the design, management and implementation of assistance programme"[7]. Participation can be in the form of consultation with survivors in order to understand the specifics of their needs and demands, or it can be in the form of direct involvement in the reconstruction process which can create new skills for survivors, build self-esteem and prepare them for the rebuilding and uplifting of their economy. The surviving community should be at the center of all relief efforts.

7. RRN. *Red Cross and NGO Code of Conduct*. Network Paper 7, London, September 1994

Local and national governments

After the surviving community's own role, that of the local and national government is second in importance. "The local government has the key task of allocating roles for all assisting groups. In undertaking this, it is likely to need assistance from the national government"[8]. The main components of the local authorities' responsibility in terms of shelter include the clearing of rubble, the repair of damaged infrastructure, the restoration of social services, the provision of safe land for rebuilding, assuring a supply of building materials and the drawing of contingency and preparedness plans for future disasters.

8. IFRC. *Shelter After Disaster*. Geneva, International Federation Of Red Cross And Red Crescent Societies, 2015, p. 54.

Professionals and experts

Professionals and experts have the potential to fulfill important technical assistance roles in various post-disaster stages. Expertise on many aspects of shelter and housing provision is necessary, such as contingency planning; damage survey and assessment; definition of building codes for new hazard-resistant construction; and the modification of existing building structures in order to make them hazard-resistant.

International agencies

The contribution of international agencies such as the United Nations System lies in the ability to provide large-scale assistance due to their connection to different sources and a coordinating and organizing role which is greater than the efforts from individual governments. However, the effectiveness of their role can be damaged by elements such as the need to demonstrate their value to ensure their future growth and funding or the over-sensitivity to the tendencies and preferences of requesting governments.

2.4 Post-disaster shelter and architecture

The question of shelter is among the most important and vital ones in post-disaster communities. The destruction caused by disasters, destroys not only houses as objects, but also tears down homes. The distinction between the two is significant. The loss of a home is far more than having no place in which to eat and sleep. The loss of a home is the dismantling of several years of memories, connections, relationships and emotions of its inhabitants, all in a matter of a few seconds. The provision of shelter after disasters is therefore one of the most critical elements to deal with. Care and attention to detail is necessary in order to provide suitable shelters for the survivors, at various stages of the long and difficult process of recovery. There are generally two scenarios imaginable: a three stage recovery and a two stage recovery.

The first scenario is composed of firstly temporary shelters such as tents or residence with host families; secondly transitional shelters; and finally permanent housing. This strategy is adopted by a considerable number of agencies working in the field of post-disaster recovery. This approach seems to be particularly popular with international associations and NGOs, since they

prefer a short-term investment in the recovery process rather than a long-term commitment. "In disasters such as the 2010 Haiti earthquake or the 2004 Indian Ocean tsunami where there was an overwhelming public response to international appeals, large disaster relief funds were handled by international agencies and their national partners. Hardly any of these international agencies have any desire or competence to become involved in the complexities of long-term reconstruction of housing. Instead, they need to spend their money rapidly, hence the delivery of large numbers of transitional housing units that often cost almost as much as permanent dwellings"[9]. The transitional housing units provided by international agencies are usually prefabricated or container dwellings. The process of permanent housing reconstruction is often a lengthy one and the three stage recovery suggests that there is a need for something more substantial than temporary shelters. In areas of harsh climate for example, tents are not suitable for long periods of stay and therefore transitional housing is necessary.

However, the two stage recovery approach deems transitional housing to be avoidable. This theory states that an extended period of residence in temporary shelters, at the same time as the advancement of rapid permanent housing reconstruction, can remove the need for transitional housing. By doing so, substantial cost savings can be achieved, since the cost of transitional housing can be as much as that of permanent dwelling. The principal requirement for the rapid development of permanent housing is pre-disaster research and planning[10]. The more prepared the authorities and governments are for disasters, the faster they can react to it and therefore lead a speedier recovery process.

Each disaster scenario is different and unique, and so are the ways in which the local authorities have planned for them before and react to them after they happen, so there is no universal solution to what shelter and housing recovery should be like, but the majority of solutions consist of the use of all three

9. IFRC. *Shelter After Disaster*. Geneva, International Federation Of Red Cross And Red Crescent Societies, 2015, p. 106.

10. The recovery after the 1985 earthquake in Mexico City is a successful example. See: Davis, Ian, and David Alexander. *Recovery from Disaster*. London ; New York, Routledge Taylor & Francis Group, 2016, p. 106.

or two of the following: temporary shelter; transitional housing; permanent housing. Transitional and permanent housing will be briefly explained below, while the different aspects of temporary shelter will be more specifically explored afterwards.

Transitional housing

Transitional or temporary housing units are expected to serve mainly as shelter between the stage of immediate disaster relief, and that of long-term reconstruction. These units have the advantage of providing better living conditions for the local inhabitants than the temporary shelters in use immediately after the disaster. Especially in cases where the amount of destruction caused by the hazard prevents a rapid reconstruction process, transitional housing is deemed necessary. "The theory of temporary housing is that a low-cost, temporary unit can be provided at little or no cost to the disaster survivor who will be able to live it in it long enough to obtain the capital necessary to rebuild a normal, permanent house. However, the main problem is that a temporary unit often costs more than a permanent

Transitional shelters built by The United Nations and various NGOs to replace the tents that more than 15,000 people were living in outside of Port-au-Prince, Haiti. Source: Abassi, Logan. UN Photo, 9 March 2011

structure"[11]. As previously mentioned, the strategy of the use of transitional housing is often popular within international agencies and NGOs, therefore the cost of the transport of the prefabricated units needs to be taken into account as well. These units, designed to have a short life-span, inevitably become permanent either due to the lengthy process of reconstruction or because the cost of replacement of the units by normal housing would be too high for the inhabitants, and this can lead to the creation of slums and the problems which come with it.

11. IFRC. *Shelter After Disaster*. Geneva, International Federation Of Red Cross And Red Crescent Societies, 2015, p. 102.

Permanent housing

The relocation of disaster survivors into permanent housing is one of the final steps of the reconstruction process. Although recovery is a lengthy process and will continue and transition into the mitigation phase, providing the survivors with housing in which they can settle for a long period of time and reestablish their livelihood, is a major goal of any post-disaster situation. This stage of shelter recovery can take several forms, but an assessment of the amount of damage and destruction to dwellings caused by the disaster is prioritized, which will allow for the understanding of the number of houses to be built. Depending on the amount of damage, the structure of certain dwellings could be intact and they only need to be retrofitted or reinforced in order to make them hazard-proof. Other houses might be in need of more substantial amount of effort but still usable, the repair and restoration of these structures could extend their lives, which is important because all disaster survivors prefer to continue living in their original house, or to be more precise, in their home. In the case of large-scale damage and major destruction, the relocation and building of new houses might be necessary. But even in such situations, the remainders of the destroyed dwellings could be useful for the new constructions, so the immediate bulldozing of the rubble to clear out the disaster zone is not advised. Evidence from situations where massive bulldozing has occurred shows that it plays a negative role firstly because it destroys salvageable materials which can be reused to build new safer houses; and secondly since acquiring new materials to build new houses is financially difficult for several families, access to any salvageable material is of extreme value for them[12]. The construction of permanent housing can be done either by the eventual users themselves, or by contractors. The user-build approach requires the provision of cash assistance directly to homeowners whose houses were destroyed, and therefore leaving them the freedom to decide in which way to spend the money. This approach "fosters the active participation of surviving communities, mobilises communities and develops building skills, which in turn creates livelihoods. It helps develop leadership and reduce the risks of corruption...Finally,...it has the internal benefit of endowing user-created dwellings with pride and identification"[13]. The contractor-build approach allows for a speedier construction, a better management of the process and the ability to control the general quality[14]. This approach however, lacks survivor participation which is helpful and constructive in various ways. The goal for the involved authorities and agencies, in both scenarios, should be to supervise a process which efficiently leads to the relocation of survivors into their new homes in the best way possible.

12. IFRC. *Shelter After Disaster*. Geneva, International Federation Of Red Cross And Red Crescent Societies, 2015, p. 54.

13. Davis, Ian, and David Alexander. *Recovery from Disaster*. London ; New York, Routledge Taylor & Francis Group, 2016, p. 241.

14. Da Silva, J. *Lessons from Aceh. Key Considerations in Post-Disaster Reconstruction*. Rugby, UK: Practical Action Publishing, 2010.

2.5 Temporary shelters and settlements

In order to reach an in-depth understanding of temporary shelters within the context of post-disaster communities, there are several aspects of the topic which need to be studied. Research on the shelter itself, as an object, is required but not sufficient. One needs to understand what role these shelters try to fulfill, and more importantly, what the needs of their future inhabitants are. The following sections will address the functions of temporary shelter; the needs and tendencies of disaster survivors; and the different types of temporary shelter.

Functions of temporary shelters

According to the United Nations Office for the Coordination of Human Rights' (UNOCHA) document of guidelines for shelter after disaster, shelters serve several vital functions[15]. First and foremost is the protection against cold, heat, wind and precipitation. A shelter is a place for the storage and protection of the survivors' belongings. It can help establish territorial claims associated with ownership and occupancy rights. It helps the establishment of a staging point for future action, including salvage, reconstruction and social reorganization. A shelter provides emotional security and answers the need for privacy. It also acts as an address for the receipt of services such as medical aid and food distribution. Finally, it provides a base for eventual commuting to sources of employment[16].

15. IFRC. *Shelter After Disaster*. Geneva, International Federation Of Red Cross And Red Crescent Societies, 2015, p. 47.

16. Davis, Ian, and David Alexander. *Recovery from Disaster*. London ; New York, Routledge Taylor & Francis Group, 2016, p. 192.

Survivor needs and tendencies

Studies have shown that when it comes to the question of post-disaster shelter, survivors have a clear set of priorities.

At a new camp for displaced Haitians in Croix-des-Bouquets, one family delineates their tent with decorative pink stones and assigns the new home an address. Source: Paris, Sophia. UN Photo, 5 April 2010.

Disaster aid agencies, especially foreign ones, need to understand that the provision of shelter per se is not the goal, an "any shelter will do" attitude has lead to several cases of unoccupied shelters. Ian Davis, in his book Shelter After Disaster, explains several myths related to post-disaster shelter needs. One mentioned myth or general belief is that following a disaster, the survivors are prepared to live in unfamiliar housing. This is certainly not the case. When faced with unfamiliar shelters, certain communities have rejected them and left them unused[17]. That is why the understanding of survivors' wishes and needs is essential to any shelter provision project. Evidence suggests that first and foremost, survivors prefer to remain as close as possible to their damaged or ruined homes. "The opportunity to stay near their own land and dwellings is a major goal for most disaster-affected people. The damaged dwelling and any surrounding land are major household assets for many disaster-affected households"[18]. If families are unable to do so due to security concerns, they prefer to temporarily move into the homes of families or friends. In difficult times and when in need, humans always reach out to people closest to them, looking for help and comfort. So there is little surprise that after surviving a hazard and the loss of their home, the affected people try to stay with safe families or friends when possible. If neither of the two previous options are available, survivors tend to improvise temporary shelters as close as possible to the site of their ruined homes. Their attachment to the place where they lived before the disaster, and their efforts in staying in close proximity to it, is natural to say the least. Next in the order of priorities is the occupation of buildings which have been temporarily requisitioned. In certain hazards, public infrastructures such as schools are able to withstand and therefore can serve as temporary alternative shelters. The lack of privacy and communal life are reasons why these solutions are not favorable for survivors. The occupation of tents nearby ruined homes, the occupation of emergency shelters provided by external agencies and finally campsites, compose in order,

17. IFRC. *Shelter After Disaster*. Geneva, International Federation Of Red Cross And Red Crescent Societies, 2015, p. 28.

18. The Sphere standards are the most commonly used and most widely known set of humanitarian standards. See: Sphere Association. *The Sphere Handbook: Humanitarian Charter and Minimum Standards in Humanitarian Response*, second edition, Geneva, Switzerland, 2004, p. 212.

the final elements of survivors' priorities in terms of shelter.

Certain key components are heavily present. Disaster survivors, naturally, have strong attachments to their home and the land it is located on; settling with familiar people is a priority; family units are preferred to large communal life or campsites. It is therefore very important to place these tendencies at the center of any shelter provision project and provide solutions which answer the true needs of survivors.

Types of temporary shelter

As previously mentioned, each disaster has a different severity, context and situation and is therefore treated in a unique matter. There are also various actors in play during each disaster scenario, a large number of whom participate in the process of shelter planning and provision, therefore several strategies exist when it comes to temporary shelters, but a few are more common. Tents, regardless of certain negative aspects, seem to be the default response in the case of many disasters, possibly due to their ease of access and use. The import of shelter designs is another approach to the topic. The distribution of materials and tools in order to give the survivors the liberty of leading their own construction is also a solution. These three will be further explored, while other approaches worthy of being named include large evacuation shelters and standard designs modified to use local materials.

a) Tents

When thinking about or imagining natural hazards and disasters, the image of large campsites filled with tents is what usually comes to mind. The urgency of disaster scenarios requires the provision of a type of shelter which can answer the immediate needs of the population in a short period of time. Tents allow for a fast delivery of safe space to those in need. They are standardized

and therefore they can be stockpiled by governments and relief agencies, without the need of importing them within the disaster period. They are lightweight and compact, so their transportation can be done quickly, with ease and minimal effort compared to other forms of shelter. Once arrived on site, they can be rapidly erected and are immediately ready to be used. They are popular with governments of affected countries for certain additional reasons namely they are unlikely to become permanent and they are a visible demonstration that authorities are taking action to help the homeless[19]. Despite the fact that there are several reasons why the use of tents is popular, the negative aspects that come with it can not be ignored. When talking about the functions of shelters, the primary function mentioned was the protection against cold, heat, wind and rain. Tents are not suitable for all weather conditions and extreme climate makes living in such shelters very difficult, not to mention that tents rapidly deteriorate as a result of exposure to the weather and are vulnerable to wear and tear. They are also not appropriate for the storage of personal belongings, which is another essential function of shelters. The standardization of this element means that it provides the same space for its users, regardless of the number of people in a family and their needs.

When discussing tents as objects, one needs to talk about campsites as well, since in most cases that is where these shelters are put to use. As previously mentioned in the *Survivor needs and tendencies* section, the relocation towards campsites is clearly an unfavorable option for disaster survivors. That is why in several cases, emergency campsites proposed to survivors are left under-occupied. There should be no surprise as "the majority of literature on DP (displaced population) camp and site planning states that camps should be the last resort"[20].

b) Imported designs or patent shelters

The search for a standard shelter solution, applied to all

19. IFRC. *Shelter After Disaster*. Geneva, International Federation Of Red Cross And Red Crescent Societies, 2015, p. 94.

20. Chalinder, Andrew. *Temporary Human Settlement Planning for Displaced Populations in Emergencies*. London, Odi, 1998, p. 27.

post-disaster situations is an ongoing theme for a large number of students and professionals in the design industry. Architects, civil engineers, industrial designers, inventors and other professionals have either individually or through various aid and relief agencies, tried their hand at the design of such a shelter. Finding the answer to an unsolved global problem is surely what is intriguing for those who attempt their designs. Efforts in using prefabricated constructions and newly developed materials lead the way in this research. Countless shelters are designed, but the vast majority of them remain in the project phase and very rarely does one make its way into production and disaster areas, and when they do, their performance is poor. "The reason is that their design criteria tend to be donor-oriented, rather than survivor oriented. While the donor may wish to have a standard unit that can be easily airlifted and rapidly installed, the recipient of aid will want a unit which is socially, culturally and climatically suitable and easy to maintain"[21]. Among designs which ended being used on disaster sites are igloo-shaped shelters made of polyurethane. The West german Red Cross, in collaboration with the Bayer Chemical Company designed such igloos which were constructed and put into use after earthquakes in Turkey, Peru and Nicaragua in the early seventies. A few years later, Oxfam developed these igloos and used them after an earthquake in Turkey, where a total of 463 units were put in place with an occupancy rate of approximately 10 per cent[22]. The majority of shelters proposed by designers, including architects, are underused because they do not take the needs of the survivors into consideration. They do not seem to be in touch with the reality of the affairs on disaster sites, they rather seem passionate about being the hero the world needs by designing a unique shelter which supposedly solves the global shelter problem. One look at projects such as the 'Moss airdrop shelter' reasonably summarizes these attempts. "a shelter...carried over the site by helicopter and released in mid-air, it opens like a parachute and drops softly to earth, ready for immediate occupancy"[23].

21. IFRC. *Shelter After Disaster*. Geneva, International Federation Of Red Cross And Red Crescent Societies, 2015, p. 94.

22. Davis, Ian, and David Alexander. *Recovery from Disaster*. London ; New York, Routledge Taylor & Francis Group, 2016, p. 229.

23. Time. *Moss, the tentmaker*. Time magazine, 26 July 1976, 108.

To support rebuilding, the Red Cross is training builders, masons and community members in methods to construct more earthquake-resistant houses. Source: Kalpit, Bishnu. IFRC.

c) Distribution of materials and tools

Certain actors in aid relief believe that the design of shelters should not be done by an external element, it should rather be in the hands of the survivors themselves. This is an interesting approach, as it gives the survivors the means to be the leader of their own constructions. The distribution of building materials on its own is not sufficient as very few have the knowledge and skills required for any construction process. This action needs to be executed in parallel to major educational programs, which aim to provide the local inhabitants with enough knowledge and familiarity with materials and tools to be capable of building their own shelter. Although construction is left to the survivors themselves, the management of such a system by the local authorities is very important.

3. Case Studies

The previous chapter helped create a general understanding of the complexities of natural hazards and vulnerable areas, the different phases of disaster management and the main actors of relief aid. Furthermore, a closer look at the question of post-disaster shelter, its different stages and the functions and types of various temporary shelters serves readers as the basis for this chapter. A comparative study is used as a tool to develop further comprehension on the topic of post-disaster shelter and see the differences between theory and practice. The three chosen case studies of earthquakes will firstly be introduced separately; describing the event and the damage it caused, the reaction by the concerned authorities and other involved actors, the immediate relief efforts, short and long-term shelter solutions proposed and the survivors' reaction to them. Once an overview of all three has been given, each of the three comparison criteria, namely the topic of urgency, climate and culture, will be separately briefly explained, specific questions will be raised and afterwards the case studies will be compared and analyzed.

3.1 Bam earthquake, 2003

On December 26th 2003, an earthquake of 6.6 Mw magnitude struck the city of Bam, within the Kerman province,

in the southeastern part of the country. Iran is not unfamiliar with natural disasters, especially earthquakes, as the majority of the surface of the country is crossed by major faults, it is in fact one of the countries with the most seismic activities in the world. But the damages caused by the Bam earthquake, were one of the strongest Iran has witnessed in recent history. There were a reported total of more than 43'000 deaths and over 30'000 injuries, very substantial numbers considering the fact that the district of Bam accounted for a total of 200'000 people before the earthquake. Around 85% of the city and its surroundings' buildings were completely destroyed or severely damaged, and 90'000 people were displaced[24]. As mentioned earlier, a natural disaster alone does not necessarily lead to disasters, it is rather its combination with the concept of vulnerability which is problematic. There are various reasons why this specific earthquake had such a powerful impact, one of which is the time in which it happened. The earthquake struck very early in the morning, at 5:26 AM local time and caused a significant amount of damage within a reported 12 seconds of activity. Most people had naturally no time to react to the event. The context of the physical characteristics of the region is also relevant to the topic. The majority of the district's buildings were traditionally built out of adobe or mudbrick, and were not earthquake resistant. This was also the case for the ancient Arg-e-Bam citadel, the largest adobe building in the world, which was strongly destroyed and damaged. The timing of the earthquake, along with the fragility of the buildings lead to a significant amount of people being crushed to death, stuck under the destroyed structures of their houses or seriously injured.

Various local and national authorities, the Iranian Red Crescent Society (IRCS) and several international communities were among those involved in the process of relief and recovery. The UN Flash Appeal states that the rescue and relief operation launched by the concerned authorities were swift and effective. An estimated 12'000 injured people were airlifted to other cities to

24. World Bank. *Iran, Bam Earthquake Emergency Response Project*. World Bank, Washington DC Bank, 2004

Ancient citadel of Arg-e-Bam, severely damaged after earthquake. Source: Black, Christopher. IFRC, 4 February 2004.

be treated within the first few days, and the IRCS was responsible for the distribution of temporary shelters and food and non-food items to the survivors[25]. According to the UN situation report of December 28th, three days after the earthquake, an aerial assessment of the badly affected areas showed a striking lack of people, which could be indicative of the rapid movement of survivors out of Bam thanks to the strong network of extended family in the country[26]. The immediate relief strategy consisted of the distribution of basic needs such as tents, food and non-food items. An estimate of 20'000 tents were handed out to those in need in the first 72 hours. A week after the earthquake, local authorities erected three planned camps in order to host the large number of people displaced due to the destruction of their home. Although the camps started receiving affected people, the majority of survivors preferred to stay near their properties and at the site of their houses. At the same time, preparation and planning for the long-term recovery were quickly under way, and the realization was made that the housing reconstruction process could be a lengthy one due to the damage dealt by the earthquake. And since the temperature of the region could reach

25. UNOCHA. *Flash Appeal Bam Earthquake of 26 December 2003 Islamic Republic of Iran Relief, Recovery and Immediate Rehabilitation*. United Nations, 2004.

26. UNOCHA. *Iran, Earthquake OCHA Situation Report No. 6*. United Nations, 2003.

highs of up to 45 degrees celsius in the summer, the responsible authorities felt that the need to provide disaster survivors with semi-permanent shelters was urgent and to be done by the end of March, three months after the disaster[27]. A three stage recovery was therefore chosen: the first of which addressed the short-term and predicted 4 months of stay in tents; a second period consisting of transitional shelters, planned to last between 16-18 months, and during which the housing reconstruction projects are being executed; and the final stage during which survivors settle into permanent housing and risk-reduction policies and practices are put in place in order to better prepare for future hazards.

27. UNOCHA. *Iran, Earthquake OCHA Situation Report No. 11.* United Nations, 2004.

Early estimates predicted the need for a total of around 30'000 shelters for the transitional period, a number which grew with the passing of time. Two public sectors and several private companies were engaged to produce these shelters. Certain international donations also helped the cause, although as with most international efforts of this kind, the delivery of the prefabricated shelters on site was a lengthy process. Camp compounds were quickly erected to set up the mentioned

Families, returning to the site of their destroyed homes to salvage their possessions. Source: Black, Christopher. IFRC, 21 January 2004.

shelters and receive people as quickly as possible, but this was faced with immediate backlash from the survivors, many of which wrote letters and announced their dissatisfaction with the situation and expressed their preference in staying near their original homes. Experienced professionals in the field of post-disaster recovery backed the survivors up and cited the safety, social, and privacy-related problems that planned camps brought with them. The majority of pre-disaster houses in the Bam district consisted of garden houses which alongside the low density of the urban area and a high land ownership rate, facilitated the possibility of survivors settling near their own houses[28]. The strategy then saw a shift towards the provision and construction of shelters in the gardens of destroyed and damaged houses. Although the construction of these shelters was delayed for various reasons, the direction taken was a positive one in both the short-term in respecting the priorities of survivors; and long-term in allowing the survivors to witness and participate in the reconstruction of their original house.

28. HFIR. *Temporary Housing Experience after Bam Earthquake, Iran.* Housing Foundation of the Islamic Revolution, 2012, p.71 (in Persian)

The reaction to the disaster in Bam is generally perceived to be a positive and constructive one, in part thanks to the excellent cooperation between the different actors involved[29]. The immediate relief phase consisted of the successful distribution of tents to those in need, while the mid-term period included the provision of more durable shelters. Although this phase was extended and delayed due to various problems, the decisions taken served as a positive step towards the final recovery phase which followed.

29. UNOCHA. *Iran, Earthquake OCHA Situation Report No. 10.* United Nations, 2004.

3.2 Haiti earthquake, 2010

The 7.0Mw magnitude earthquake which hit Haiti on the 12th of January 2010 caused one of the biggest disasters and crises in recent history of the world. The epicentre of the earthquake was 22 kilometers to the west of Port-au-Prince, the capital city, and lead to a total of at least 150'000 deaths and an estimated

300'000 injured. The scale of the disaster and the damage it caused made the relief and recovery process extremely complicated. By the month of April, 3 months after the earthquake, a total of 1.5 million individuals were in need of shelter, which corresponds to 20% of the total population. By the month of March, 105'000 homes were destroyed and another 208'000 were damaged. In the days following the earthquake, many survivors had no choice but to live in open spaces such as streets, parks and open grounds, and a large population of 570'000 evacuated the city[30].

The chaos caused by the disaster and a lack of information made the immediate relief efforts difficult. "The overwhelming shelter needs and the post disaster existing constraints exceeded the capacities of the GoH and humanitarian actors to provide emergency shelter response. The immense number of displaced persons urging minimum shelter and the difficulties for a proper and rapid damages and needs assessment, combined with the lack of land to locate the displaced people (especially in Port-Au-Prince) forced the humanitarian actors to make decisions on how to respond to the most pressing shelter needs with not much information"[31]. The Shelter Sector Response Plan (SSRP) was put together a month after the disaster, consisting of a five year strategy. The objective of the first stage of the plan was to assure the complete distribution of emergency shelters within 3 months, before the hurricane season which could cause further trouble. The second stage aimed to provide transitional shelters for survivors, to be completed one year after the earthquake, and the housing reconstruction stage would come afterwards.Within the emergency phase which continued until the month of April, tents and tarpaulins were the main distributed objects and during the wait to receive this aid, a significant number of survivors were forced to create their own makeshift shelters. In the month of July, the realization was made that since anticipated progression of transitional shelters were unrealistic and considering the upcoming rainy season, there would be the need to replace or reinforce

30. Versluis, Anna. *Formal and Informal Material Aid Following the 2010 Haiti Earthquake as Reported by Camp Dwellers.* Disasters, vol. 38, no. s1, 2014, p. 52.

31. IFRC. *An Evaluation of the Haiti Earthquake 2010, Meeting Shelter Needs.* International Federation of Red Cross and Red Crescent Societies, 2011, p. 19.

Haitians live in a make-shift camp close to the airport after the disaster caused by the earthquake. Source: Dormino, Marco. UN Photos, 18 January 2010.

the emergency shelter solutions provided. Tents and tarpaulins are not durable and cannot withstand harsh climates. With the delayed construction and distribution of the transitional shelters, many were forced to remain in emergency shelters for an extended period of time. 270'000 tarpaulins were distributed in November 2010, 220'000 more in March 2011 and 130'000 more in July 2011.

Transitional shelter as part of the three stage approach to recovery, is a strategy rather than an object. This phase encompasses various actions which can be taken to enable a medium-term living situation which is more suitable than those of emergency shelters. The direct provision of a transitional shelter as an object, is one of many possible options within this strategy, and was chosen as the main route to take in the case of the Haiti earthquake, not necessarily because it was the best thing to do, more so due to the unfamiliarity of the responsible actors with the other options and their unwillingness to approach them. The alternatives include the provision of cash grants or construction materials to survivors, giving them the freedom to decide in which way to pursue their recovery, allowing for a more personal

attitude to reconstruction. As previously mentioned, a significant number of survivors had left the disaster area and were staying with relatives or friends. Supporting the host families in the early stages of recovery could have lessened the burden to deliver large amounts of transitional shelters later on. The direct provision of transitional shelter was meant to serve as a basic, fast and economic solution. But with the passage of time, these shelters were changed to more durable structures due to concerns over hurricane resistance. "The recommended $1'500 solution became a wooden structure able to withstand three Level 3 hurricanes, costing as much as $10'000"[32]. The delivery of these shelters was delayed for reasons such as custom clearance which could take up to three months, rubble removal which was an enormous task due to the scale of the disaster, and land tenure issues. The target of full transitional shelter within the first 12 months was not achieved, in fact construction continued and finally came to an end by the second anniversary of the earthquake, in January 2012.

32. World Bank. *The Shelter Response and Housing Recovery in the First Two Years after the 2010 Haiti Earthquake.* World Bank, Washington DC, 2016, p. 38.

The Haiti earthquake, mainly because of its scale, was a very difficult recovery project. The vulnerability of the country made for an extremely hard task. The people, their homes and

A man in earthquake-stricken Jacmel, Haiti, sits on the rubble of what was once his home. Source: Abassi, Logan. UN Photo, 20 January 2010.

the government were unprepared to deal with such an event. The amount of damage dealt by the earthquake, the number of people in need and the authorities' inability to track the survivors and their locations lead to certain difficulties in the immediate relief phase. The transitional shelter phase which followed had problems of its own, ones which could have been avoided with better preparation before the earthquake and stronger coordination between the local and international parties involved after it. The stronger the immediate effects of a disaster are, the longer its recovery process will take and there are valuable lessons to be learned from the unfortunate experiences of the Haiti earthquake.

3.3 Nepal earthquake, 2015

On the 25th of April 2015, a strong earthquake of 7.8Mw magnitude struck the country of Nepal, with its epicentre located 81km to the northwest of the capital city of Kathmandu. Unlike the earthquake in Bam, the time at which the natural hazard occurred, minutes before noon, decreased the loss of human life due to people in rural areas working outdoors. A second 7.3Mw magnitude earthquake struck the country less than three weeks later, on the 12th of May. The earthquakes, their aftershocks and the avalanches they caused in the mountainous region caused a total of around 9'000 deaths and 22'000 injuries, and as a result, 3.5 million people were displaced. According to the National Disaster Report produced by Nepal's Ministry of Home Affairs in 2015, a total of close to 290'000 houses were destroyed and another 600'000 damaged[33].

The response to the disaster was swiftly done and organized in nature, mainly due to the amount of preparation that was done beforehand. The government of Nepal had invested significantly in institutional preparedness and coordination, shelter agencies had a clear government partner and these relationships proved to be crucial in post-disaster communication and role distribution.

33. MoHA. *Natural Disaster Report 2015.* The Government of Nepal, Ministry of Home Affairs, 2015.

Relief efforts were divided into three main phases: emergency phase; recovery phase; and winterization phase. In the immediate days and weeks after the earthquake, the majority of the survivors, especially those in rural areas, settled on a site near their damaged houses. A reported 1.6 million people were on these scattered shelter sites and they used salvaged materials and the aid assistance they received to build their own temporary shelters. 600'000 people were reported to be staying in hosted sites, official camps organized by the government on pre-identified sites within their contingency plan[34]. The government, the local and international NGOs and aid agencies distributed tarpaulins to the displaced population. Although many of the rural areas were difficult to reach for the delivery of aid items, doing so before the monsoon season which occurs between June and September was a priority. Cash transfer programs were also considered very important by the government and emphasized, as this phase was seen as the first step to progressively contribute to the longer-term self-recovery of the population. A total of 700'000 families, more than 90% of the households in need of assistance, received emergency assistance consisting of tarpaulins and/or cash and non-food items. Direct cash payments gave the survivors freedom to choose in which way to continue their recovery, and although certain international organizations often are skeptical about the results of this method, fearing the spending of money on unnecessary affairs, the case of Nepal showed that an estimated 80% of the cash grants made at the beginning of the response period were eventually used to purchase shelter-related items.[35]

34. Khazai, Bijan. *Emergent Issues and Vulnerability Factors in Temporary and Intermediate Shelters Following the 2015 Nepal Earthquake*. Center for Disaster Management and Risk Reduction, 2015.

Three weeks later the country was struck again by a 7.3-magnitude tremor near Mount Everest that killed more than 100 people and triggered fresh landslides. Source: Mohan, Palani. IFRC.

The second phase of the relief efforts was dedicated to the support of the survivors' self-recovery. The actions taken involved the distribution of building materials such as corrugated galvanized iron sheets or the education and training of building skills like masonry. Creating ways for the population to improve their living conditions was a priority, since a significant number of survivors feared their shelters' resistance against landslides or the monsoon season's harsh conditions. A total of 600'000 families received material assistance or its cash equivalent during this period. The third phase was dedicated to winterization assistance; providing further protection for the shelters of those situated above the snow line (above 1'500m). Although there were logistical challenges in reaching the mountainous areas, approximately 244'000 households in this situation were given assistance in preparation for the snow season.

The relief efforts in the Nepal earthquake, also known as the Gorkha earthquake, are considered to be successful, mainly thanks to the considerable amount of preparation work done in the pre-disaster phases. A stable and positive communication between the government and the other involved parties allowed for an easier management of affairs in the post-disaster situation. The importance given to the self-recovery of survivors in all stages of the relief efforts was obvious, and the results show their success - according to a research done in 2018, three years after the earthquake, 87% of survivors were the leaders of the construction of their own shelters thanks to the cash or material

35. Global Shelter Cluster. Shelter Projects 2015-2016 : Case Studies of Humanitarian Shelter and Settlement Responses. Geneva, International Organization For Migration , 2017.

assistance they received during the relief efforts[36]. This earthquake and the recovery process that followed it proved that disaster can indeed be managed with correct planning and mitigation efforts in preparation for the natural hazard, and an organized and targeted relief strategy after the hazard has occurred.

36. HRRP. *Temporary Shelter Research Report*. Housing Recovery and Reconstruction Platform, 2018.

3.4 Urgency

Natural disasters rarely last longer than a few seconds or minutes, but the damage they cause is often devastating for those who experience it. Those who survive might have lost family members, their home and all their belongings in a matter of seconds. Even if, in an ideal and hypothetical situation, all survivors were immediately relocated to new houses identical to their original ones, the psychological effects of experiencing such an event would still last for several years and cause a difficult life for them. In reality, on top of having to manage their mental health, survivors often have to endure below standard living conditions in emergency and temporary shelters, either constructed by themselves or provided to them. In certain cases, in the early nights after a disaster, people whose homes have been destroyed are forced to sleep in open spaces such as streets or parks. There is no question that urgency in the provision of help, at all points of recovery but especially in the early stages, is of utmost importance. There are several different aspects which need to be taken into consideration when studying shelters in terms of urgency. One of the most important ones is the amount of time it takes for chosen shelters, whether in the immediate relief or the transitional phase, to be transported to the site and then set up or built. In case of emergency shelters, the capability of storage on site is relevant and in the case of the need to import them from external sources, the ease of transportation is a necessity. The cost of shelter materials, their construction and transportation should ensure efficiency in the quality they bring to the relief efforts. These and other factors will be examined in the three previously mentioned case studies, and the strengths and weaknesses in each case will be highlighted.

Urgency in Bam

During the immediate relief phase of the Bam earthquake, a large number of tents were distributed to the affected population. The advantage of tents as shelter choice is the fact that they are standardized, therefore easily accessible; easy to store; and require minimal efforts to be set up. The local authorities, namely the IRCS (Iranian Red Crescent Society), had tents stored in preparation for such disasters and was therefore able to act quickly. International organizations and agencies were also able to provide further help due to the ease of transportation of tents. A UN situation report states that by January 2nd 2004, the majority of the people in the area had received a tent and had settled near their destroyed or damaged homes. The emergency phase of the relief process was a rather successful one. Authorities realized that with the upcoming summer heat, the distributed tents would not be able to continue to act as a suitable shelter, and therefore what they referred to as semi-permanent shelters were required. Several public and private

Emergency campsites were set up within a few days for the families affected by the Bam earthquake. Source: Black, Christopher. IFRC, December 2003.

companies were contacted to provide these transitional shelters, with the goal of complete and final distribution by the end of March 2004, 3 months after the disaster. These shelters consisted of different materials including sandwich panels, prefabricated concrete and corrugated iron sheets. A wrong assessment of the number of shelters needed caused problems, as the number grew with time. The construction and delivery of these shelters was delayed for various reasons such as the contractors overestimating their capabilities in the provision of these products; the delayed preparation of the site due to the slow process of rubble removal; a general lack of organization between the different parties; and lack of sufficient resources and materials in some cases[37].

37. HFIR. *Temporary Housing Experience after Bam Earthquake, Iran*. Housing Foundation of the Islamic Revolution, 2012, p.181 (in Persian)

Urgency in Haiti

Tarpaulins, or tarps, were chosen as the main element to serve as emergency shelter in the Haiti earthquake of 2010. They are cloth-like large sheets which are strong, flexible and water-resistant. Unlike tents, they cannot serve as shelters on their own, they function as covering which needs a structure to be placed on top of. Similarly to tents, they also are easy to store, to transport and to set up. The scale of the disaster caused by the earthquake in Haiti, created difficulties in the distribution of these tarps. Following the earthquake and the amount of destruction it created, many people were forced to live in streets, parks and open grounds, and others had the option to leave and stay with relatives or friends. Spontaneous camps were formed immediately, where survivors built their own shelters using cardboard and sheets, which were eventually replaced by tarpaulins or tents when aid arrived[38]. Approximately three months after the earthquake, tarpaulins were distributed to the 1.3 million people in need. The three stage recovery approach chosen by the local authorities meant that there would be a need to supply survivors with transitional shelters within 12 months of the earthquake. The main reason the direct provision of transitional shelter was chosen as

38. Versluis, Anna. *Formal and Informal Material Aid Following the 2010 Haiti Earthquake as Reported by Camp Dwellers*. Disasters, vol. 38, no. s1, 2014, p. 52.

An aerial view of Port-au-Prince reveals one of the many makeshift camps that have been established in the aftermath of Haiti's violent earthquake. Source: Dormino, Marco. UN Photo, 28 January 2010.

a medium-term strategy was because it was perceived to be a fast and economic solution. During the months which followed the planning phase, the cost and time of construction of these shelters significantly increased as they turned into longer-term solutions. The construction and therefore delivery was delayed for various reasons including the lengthy process of rubble removal necessary prior to the installation of transitional shelters; land tenure issues due to the spontaneous settlement of the population on private land; and troubles with custom clearance since the majority of these shelters were provided from international aid agencies.

Urgency in Nepal

During the emergency phase of the Nepal relief operations, the local and international authorities involved were able to distribute assistance, mainly in the form of tarpaulins and non-food items, or their cash equivalent, to over 700'000 households in need. Although, in certain rural areas situated in mountainous regions, access to survivors was more difficult and require more time. The pre-existing structures and relationships between

Cash grants of 15,000 rupees (approximately USD130) were distributed to 2,000 earthquake affected households to allow them to lead their own reconstruction. Source: Henning Nielsen, Poul. Danish Red Cross.

the government of Nepal, local and foreign agencies and other international organizations played an essential part in ensuring an efficient management of the post-disaster situation. The government's planning and focus on the medium to long-term self-recovery of survivors allowed for an effective and fast distribution of cash payments which enabled families to take the reconstruction of their homes into their own hands, without having to wait for authorities to do so, proving that direct provision of shelters is not necessarily the best or fastest strategy in all cases.

Summary

As expected, tents and tarpaulins are the most used and the local governments' preferred form of shelter immediately after a disaster. They allow the authorities to be prepared for eventual hazards by storing them in large quantities, and their lightness and ease of transport means that the distribution can be very speedy. However, this process is not solely dependent on the form of shelter and other factors such as the difficult tracking of all survivors in the case of Haiti; and difficulties in reaching hard to access mountainous areas in the case of Nepal can delay the provision of aid. Transitional shelters are often more complex since elements such as site, materials, construction method and many others need to be taken into account. These shelters are either pre-fabricated, which means that their storage requires large spaces and they are difficult to transport, especially internationally; or they need to be built on-site, meaning they are dependent on factors such as available resources, land and manpower. A strong coordination between the various parties involved in the process of recovery is required in order to achieve an efficient and fast planning, construction and delivery of transitional shelters. The lack of such organization was among the reasons why in both Bam and Haiti earthquakes, the provision of these shelters were delayed. The Haiti earthquake showed that alternatives to the direct distribution of transitional shelters, such as cash payments to survivors, can prove to be successful if managed correctly.

3.5 Climate

Protection from bad weather is one of the most basic functions of any form of shelter, whether that is the houses which we all live in, or when camping in tents in the woods, or even when climbing a snowy mountain during winter. It is only natural that when a natural disaster destroys people's homes, especially in extreme weather, protection should be a priority. Survivors will not wait for shelter to be given to them, if necessary they will build their own protection with the materials and tools they can find instead of waiting for assistance. Natural hazards can occur at any given moment without prior notice, it could happen in the heat of the summer or during the wintertime cold. Shelters provided to survivors need to be adequate for the situation in which they are used and should be adapted to the local climate. The period of time during which these shelters are in use is an important factor as well, since depending on the scale of a disaster, the immediate relief phase might extent to several months and

even over a year, therefore the provided shelters will be in use during different seasons of the year. In practice, several external factors have an influence as well and cause difficulties. Certain lessons can be learned from the analysis of the three case studies.

Climate in Bam

The city of Bam and its surroundings within the Kerman province have a desert climate, with hot summers and mild winters. The earthquake struck Bam early in the morning on December 26th. The area has cold nights around that time of the year, so the fast distribution of shelter was necessary. However, the extreme weather of the region happens during the summer with temperatures reaching highs of close to 40 degrees celsius. That was the decisive factor in the planning of the second phase of Bam's post-disaster recovery. According to the authorities' plans, transitional shelters which are more adapted to the hot local weather, were to be provided to survivors by the end of March, before the start of summer when temperatures increase and there is a threat from scorpions and snakes in rural

Campsites erected in the outskirts of the city of Bam. Source: Black, Christopher. IFRC, December 2003.

areas[39]. Nevertheless, due to some problems and unforeseen circumstances, the construction of these shelters were delayed and therefore certain survivors were forced to endure difficult times with tents which did not protect against the extreme heat. In the planning and execution of the transitional shelters, another aspect of the local climate played an interesting role. After the survivors rejected residence in planned campsites and requested to stay near their original homes, there was a shift in the strategy taken by the authorities and they decided to work towards the people's desire. One of the many factors which favored settling near the survivors' homes was that since the majority of the region's residences were in the form of garden houses, the microclimate these spaces provided was much more suitable for the local summertime heat, than the campsites which were situated in the outskirts of the city, with no natural protection.

39. UNOCHA. *Flash Appeal Bam Earthquake of 26 December 2003 Islamic Republic of Iran Relief, Recovery and Immediate Rehabilitation.* United Nations, 2004.

Climate in Haiti

Similarly to the Bam earthquake, the date when the earthquake happened was a very important factor in the way actions were undertaken to provide shelter. The rainy and hurricane season in the country is mainly between June and November, but in certain areas it can start as early as the month of April. With the earthquake striking in January, the proximity of the upcoming rains meant that the emergency shelter response needed to take into consideration and include contingency planning for the next few months. Due to the scale of the disaster and the authorities' goal to provide assistance to all survivors before the rainy season, tents and tarpaulins were delivered as emergency shelters and aid did not include provision of tools and materials such as ropes, roof sheets or timber. Tents, tarpaulins and other shelters of the kind are rarely adapted to harsh climate and are very vulnerable to wear and tear. A strong storm occurred on September 24th 2010 and lead to a total of 14'000 people in need of new shelters. With the transitional shelters being delayed, authorities had no choice

Streets and pathways are flooded after the passing of Hurricane Tomas in Gonaives, north of Port-au-Prince, Haiti. Source: Dormino, Marco. UN Photo, 6 November 2010.

but to redistribute further emergency shelters to the survivors as the seasons went by. November 2010 saw the distribution of 270'000 tarpaulins, another 220'000 were given in March 2011 and 130'000 more in July 2011[40]. Witnessing the way hurricanes could affect the shelters, authorities and those involved in the construction of transitional shelters, were concerned about their original design's resistance, that is why the process saw a shift and the recommended $1,500 solution became a wooden structure able to withstand three Level 3 hurricanes, costing as much as $10,000.

Climate in Nepal

Being situated in a mountainous region and in high elevation, caused certain difficulties in the post-disaster recovery process. Other than access to hard-to-reach areas, the climate of the country had an influence as well. The area has a monsoon season which starts around the month of June and continues until September. The earthquake happened around a month prior to that, on the 25th of April 2015. The authorities' aid in the emergency phase consisted of the distribution of tarpaulins

40. IFRC. *An Evaluation of the Haiti Earthquake 2010, Meeting Shelter Needs.* International Federation of Red Cross and Red Crescent Societies, 2011, p. 21.

or their case equivalent. A survey done in the month of June mentioned that 72% of survivors interviewed did not feel safe within their shelters, mainly due to fear of aftershocks and consequent landslides and floods[41]. A UN situation report dating from the 15th of May, includes notes saying that while tarpaulins have been distributed to communities, some locals are concerned about their suitability once the monsoon season begins. Among families in rural areas who had to travel far and relocate due to the destruction of their homes, some were hosted in official government planned camps and certain reported having difficulties adapting to the new environment and different climate, and unease in the high temperatures felt inside the tents provided[42].

Summary

Although the standardization of shelters such as tents and tarpaulins makes them very suited to the urgency of post-disaster situations, when considering the factor of climate, they prove to have some weaknesses. It is only natural that one single shelter cannot be adapted to different climatic conditions. The same tents and tarpaulins are used in desert areas with extremely high temperatures such as Bam, as they are in a country prone to hurricanes such as Haiti, as they are in a mountainous region in risk of heavy rains, landslides and floods such as Nepal. As seen in the case studies, the used shelter solutions were not only not adapted to all cases, but they were essentially unsuited for all of them. Tents and tarpaulins are rarely designed to be able to withstand any harsh climate, whether it is extreme hot or cold weather or strong winds and rains. This means that in most cases when they are used as the initial shelter response in post-disaster situations, a three stage recovery is necessary, meaning transitional shelters have to be planned, constructed and distributed to survivors, as was the case in the Bam and Haiti earthquakes. One way to avoid that scenario and the complications it brings along is to engage in sped up and advanced housing reconstruction programs, attempting to

41. HRRP. *Temporary Shelter Research Report*. Housing Recovery and Reconstruction Platform, 2018.

42. Khazai, Bijan. *Emergent Issues and Vulnerability Factors in Temporary and Intermediate Shelters Following the 2015 Nepal Earthquake.* Center for Disaster Management and Risk Reduction, 2015.

minimize survivors' stay in tents before returning to their homes.

3.6 Culture

When talking about the concept of shelter provision to disaster survivors, respecting the dignity of those in need should be central to any action taken and must be taken into consideration in all stages from planning to execution. All efforts made to help these people have to be done with the intent of promoting long-term self-recovery which they are capable of, and every decision taken needs to be in accordance with their desires. Shelters provided in post-disaster situations need to be suited to the uses, manners, living habits and in general culture of the local people. The importation of a certain shelter designed based on foreign living habits, in hopes that local people would be prepared to inhabit them out of need, should be avoided at all costs. Asking a disaster-hit population to adapt to new styles of life during already difficult conditions for them is unfair to say the least. Several cases have proved that such actions will not be tolerated and will be strongly rejected by communities[43]. The needs of different communities are not identical and that should be reflected in the shelter response after disasters happen. The Bam and Nepal case studies showcase cultural problems related to post-disaster shelter response provided to survivors.

43. Davis, Ian. Shelter after Disaster. Oxford, Polytechnic Press, 1978, p. 28.

Culture in Bam

What was very interesting to see in the case of the Bam earthquake, was the rejection of planned campsites and preference of residence near their original homes by survivors. This was seen in both the immediate relief phase, and later on when transitional shelters were to be constructed and used. A UN situation report dating from January 4th 2004, just over a week after the disaster, states that three planned camps which had been quickly erected in a couple of days, had started receiving affected

Affected families preferred to return to the site of their destroyed homes to set up temporary shelters. Source: Black, Christian, IFRC, 4 February 2003.

people who were in need of shelter. Continuing to mention that these survivors had declared that they preferred to stay near their own properties, and authorities tried to facilitate that for them. Having seemingly not learned from that experience, when it came to the phase of transitional shelters, authorities chose campsites in the outskirts of Bam as the location to host the affected families. As professionals and experts predicted, survivors were unhappy with the situation and they expressed that to officials in letters they wrote. These camps were said to have safety issues, especially for the more vulnerable groups such as women and children. Certain components were believed to be inconsiderate to local norms such as how women were forced to leave their shelter units in order to access the toilets[44]. The decision to set up these camps also had the effect of separating families from their main sources of income, which were the palm trees that most of them had in their garden houses[45]. Similar to what happened in the early days after the earthquake, these camps were rejected and people chose to stay in the gardens of their destroyed houses.

44. Fatemeh Farnaz Arefian. *Organising Post-Disaster Reconstruction Processes : Housing Reconstruction after the Bam Earthquake.* S.L., Springer International Pu, 2018, p. 124.

45. HFIR. *Temporary Housing Experience after Bam Earthquake, Iran.* Housing Foundation of the Islamic Revolution, 2012, p.69 (in Persian)

Culture in Nepal

As previously mentioned, in the aftermath of the Nepal earthquake, thousands of people were forced to leave their homes, certain damaged and others destroyed, and move elsewhere. Certain relocated to planned campsites, set up by the government on predefined locations. As studies have shown, campsites are among the lowest in the list of survivors' shelter priorities, and this case proves that yet again. A UN situation report states that the shelters on these sites lack adequate privacy for their users and mention a significant amount of overcrowding in certain campsites. Similar to the situation in Bam, women had further issues with their situation, citing difficulties such as their access to safe toilets, lack of private areas to change and having to sleep in groups with other affected people[46]. The majority of survivors would return to the site of their homes and build their own shelters there as soon as they had the funds to do so, since the campsite shelters were inadequate for their needs. Those who stayed, tried to change the campsite to make it more adapted to their customs like in the case of a campsite which was hosting an entire village who had relocated together, where the people tried to keep their traditional community functions by actions such as building a church out of the tarp they received within the site itself.

46. Khazai, Bijan. *Emergent Issues and Vulnerability Factors in Temporary and Intermediate Shelters Following the 2015 Nepal Earthquake*. Center for Disaster Management and Risk Reduction, 2015.

People use Red Cross tarpaulins to build temporary shelters next to their damaged houses in near Mangaltar Village, Kavre district. Source: Grandidier, Pierre. IFRC.

Summary

Although several researches and papers have advised against the use of campsites in post-disaster situations, they continue to be very common perhaps due to the ease in which governments can pursue this solution compared to others. The cases of Bam and Nepal show that survivors, indeed reject the concept as a whole, firstly because it keeps them away from the site of their destroyed homes; secondly because the living conditions that it proposes often strongly differ from those they are used to. Security and privacy, basic rights of any family, especially those affected by a disaster, are among the important issues which cause problems within campsites. The cultural differences between the local population and the shelters provided to them will either lead to the survivors' leaving and moving elsewhere, or their efforts in adapting the campsite to their needs. In the case of the Haiti earthquake, due to the scale of the disaster and the fact that reports and research papers often do not prioritize the topic of cultural problems within shelters, sufficient data giving an insight on the case study could not be found.

4. Architecture and Post-Disaster Shelter

The first chapter of this thesis started with an introduction to and familiarization with the topic of natural disasters and the severe consequences they generally create, from loss of life to the destruction of homes; from short-term struggles to lasting long-term effects; from damage done to a small community to entire countries being devastated. Subsequently, a closer look at the general process of disaster management and its pre- and post-disaster phases allowed a better understanding of the actions taken in different time periods, from the development of plans and policies in the mitigation phase; to the implementation of procedures and measures of preparation in the preparedness phase; to the immediate reaction necessary in the post-disaster relief phase; and finally to the long-term recovery and reconstruction of the disaster-hit area. The complexity of disaster situations requires the help and insight of various groups of different backgrounds working together, with defined roles and set goals. In order to gain an understanding of the underlying mechanisms and relationships within this topic, after the overview given of the disaster management process, the main actors of disaster relief were named and their usual roles were briefly explained. The surviving community should be at the center of all relief efforts; local and national governments have the important task of the direction and management of aid assistance;

professionals and experts provide theoretical and technical assistance; and international organizations help in large-scale aid assistance. In order to arrive at the role architects can play in post-disaster scenarios, a more in-depth at the shelter sector was needed. The different stages of shelter recovery were then developed, the transitional shelters and housing reconstruction stages were first described and temporary shelters were more extensively investigated. The various functions of these shelters were explained, namely protection against harsh weather; a space for storage and protection of the survivors' belongings; the establishment of territorial claims associated with ownership and occupancy rights; and provision of emotional security. The needs and tendencies of survivors when it comes to post-disaster shelters were reviewed and their priorities and preferences were studied, since meeting their desires should be at the center of all relief efforts. Certain of the main types of temporary shelter used in post-disaster assistance were named and their strengths and weaknesses briefly explained; tents as the most popular form of solutions; the experiment of imported designs or patent shelters; and the distribution of materials and tools as a survivor-focused self-recovery method. This chapter allowed for the development of a basic understanding of disasters themselves and the way they are treated, and a more in-depth comprehension of the topic of post-disaster shelters. The theoretical knowledge gained was complemented by the practical information gained by the analysis of case-studies in the following chapter.

The second chapter is dedicated to the study of three specific cases of earthquakes which brought different degrees of disaster and had different response strategies. The 2003 earthquake in Bam was chosen as it lead to the biggest disaster in Iran's recent history, and the lessons learned from it would serve as a reference for further projects located in the country, pursued by the writer. The earthquake caused high numbers of casualties and severe damage and destruction to the district of Bam. The

timing of the event, happening very early in the morning, was an influential factor. So was the quality of the area's buildings, mostly traditionally built mudbrick houses. The response to the disaster was immediate and the cooperation between the local authorities and international aid agencies and other parties involved, was a successful one. In the immediate relief phase, tents were the main elements of assistance distributed to the affected families. Due to the approaching of the hot summer, authorities deemed it necessary to provide survivors with more weather appropriate transitional shelters, which were delayed at first but finally delivered to those in need while the housing reconstruction was in progress. The 2010 earthquake in Haiti was chosen as it caused one of the worst humanitarian disasters across the world in the past decade. The scale of the deaths, injuries, damage and destruction seen in this disaster made all relief and recovery efforts incredibly hard. Local and international aid agencies focused their efforts on the distribution of tents and tarpaulins to the affected families in the first few months, and planned on following that with transitional shelters before the arrival of the hurricane season. With the delay in the delivery of transitional shelters for various reasons, stay in emergency shelters was extended and the reconstruction process became an extremely lengthy one. The 2015 earthquake in Nepal was chosen as it was one of the strongest earthquakes the region has seen, but its damages were limited. The country's efforts in mitigation and preparation for such events proved to be very influential on the consequences. The geographical situation of the country, with its mountainous regions and high elevations created some difficulties in the distribution of assistance, but the immediate relief phase was generally successful. Tarpaulins and non-food items or their cash equivalent were given to those in need, followed by the distribution of materials and tools, focused in all stages of the shelter response on the self-recovery of survivors. This was an opportunity for the affected families to prioritize the actions they wanted to take and take the reconstruction process into

their own hands. The case-studies were further analyzed with a focus on specific aspects. Firstly, the aptness of the chosen shelter strategies in regards to the urgency of the matter was approached. All cases showed that shelters in the form of tents and tarpaulins are preferred by authorities because they address the urgency of the situation well enough, to allow the faster development of other phases. However, as seen in Haiti and Nepal, other factors such as the scale of the disaster and the access to hard-to-reach areas can complicate the early distribution of aid. Transitional shelters, used in Bam and Haiti, showed to be more complicated and their construction and distribution in both cases were delayed and caused various inconveniences. Subsequently, the appropriateness of shelters in terms of climate was studied. The three cases proved that the usage of the same shelter forms, in three different weather and climate conditions, makes little to no sense. The Bam district's extremely hot summers proved to be difficult for the inhabitants of the tents used. The extended stay in emergency shelters in the Haiti earthquake and the rainy and hurricane season lead to the authorities having to replace and redistribute hundreds of thousands of tarpaulins until over a year after the disaster. In Nepal, the majority of the affected families feared that their shelter did not provide enough protection against the possible landslides and floods of the monsoon season. Finally, the cultural aspect of the local population and their usage of shelters were studied. The proposed shelter solutions in Bam, especially in the transitional shelter phase, proved to be inadequate for the local community, leading to safety and privacy concerns. Similar issues were found in the case of the Nepal earthquake, leading to the question of the usage of standardized solutions for different populations with different customs and living habits.

This chapter will see a return to the three main questions raised in the introduction of the thesis. The theoretical and practical knowledge gained in the previous chapters will help more specifically determine the ways in which architecture and architects

can influence the topic of post-disaster temporary shelters.

4.1 Standardized shelter (global approach) vs. site-specific shelter (local approach)

When it comes to the topic of emergency shelters, the choice between standardized and site-specific ones is generally an easy one for authorities responsible with post-disaster recovery. Standardized shelters, mainly in the form of tents and tarpaulins, are the preferred method of immediate relief for nearly all disaster scenarios. Both theoretical studies and practical uses have shown that no other form of shelter, provides a better solution when it comes to the urgency of matters in these situations. Natural hazards which lead to disasters cause moments of severe panic in the early minutes, hours and days after the event, for both the people affected and those trying to find effective ways to counter it. When entire homes are brought down and destroyed within a matter of seconds in an earthquake, and thousands of people move to streets and parks in fear of further building collapse, the provision of shelter, in its most basic definition, is the highest priority. Tents and tarpaulins have characteristics which seem to be best suited to answer such problems. The ease with which these shelters can be stored means that local authorities, after identifying the areas at risk of hazards, can prepare themselves for eventual disasters by having large quantities of tents and tarps in nearby warehouses. They are also easy to transport and can be set up and put to use very fast and with little effort, meaning that the authorities can push efforts towards the distribution of shelter in a short amount of time after the hazard. Additionally, governments seem to prefer tents because they can be stockpiled by the army and be quickly released to survivors; unlike improvised settlements they are unlikely to become permanent; they are a visible demonstration that authorities are taking action to help the homeless. There are certain aspects to such shelters however, which show the weaknesses of the standardized approach to

emergency shelters. Tents and tarps in most cases, unless those with special treatment, are not able to provide adequate protection from harsh weather, as shown both by theoretical studies and the analyzed examples. Considering the fact that hazards occur in various locations across the world, and that each region has its own specific climate, using the exact same shelter solution for all disasters seems rather foolish. Nevertheless, standard tents are used in both dry and humid areas; in both extreme hot and cold regions, in both avalanche- and hurricane-prone countries. As the case-studies showed, when faced with the question of the need for protection against harsh weather, authorities' solution seems to be the planning of a three stage recovery, meaning the need for the development of transitional shelters. Another aspect in which standard solutions show weaknesses is their adaption, or lack thereof, to the local culture of the disaster area. The architecture of housing as a program has different characteristics and qualities across different regions of the world. The identity of a middle eastern house for example, is totally different from that of a european house. Each identity is rooted in the traditions, customs and culture of the population of that specific region. Countries within one continent, districts within one country, and even cities and villages within one district can have different ways of inhabiting their homes and distinct living habits. It is true that disaster survivors who have their homes damaged or destroyed are in immediate need of shelter, but authorities should not be of the belief that any shelter will be a good one and better than none for those in need. The dignity of survivors must be respected. Tents, as the most used form of emergency shelter, are rarely adapted to the local culture in which they are used. The same tents are provided for small and large families, and they are impossible to extend. Campsites often have further problems which is why they stand close to the bottom of survivors' priorities when it comes to shelter solutions. Security and privacy problems witnessed in Bam and Nepal showed the difference between the local and the imposed living habits and caused survivors' dissatisfaction. Considering the various aspects, standard emergency shelters such as tents and tarps seem to be the most used solutions not because of the survivors' preference, but rather that of the authorities in charge of the relief process.

When it comes to site-specific shelters, the main advantage could be a better general adaptation to the specific needs of a society, whether those needs are related to protection against harsh weather, to local habits, or even to the inhabitants' preference in terms of living spaces. When a shelter makes use of traditional or local building knowledge, or at least is taken into consideration during the design process, its eventual users' satisfaction levels will be improved. The use of local materials and building techniques would certainly lead to shelters which are better suited for the climate of the target area. Traditional constructions generally tend to be very well adapted to the climate and weather of their region. The garden houses of Bam created a microclimate of their own, providing protection against the city's extreme summertime heat. The usage of mudbrick as the main material for the construction of houses played a similar role. There are, at the very least, several lessons to be learned from the study of the target area's constructions. Additionally, if enough research is done on the local population's ways of living, habits, usage of spaces, relationships within families and etc., a shelter can be designed which does not feel like a foreign object to the affected people. The devastation caused by natural hazards is enormous on its own, and being forced to reside in unfamiliar conditions adds to that toll. If an emergency shelter manages to provide the smallest amount of comfort and familiarity that the affected families had in their original homes, it is a successful one. The conception of such a shelter however, not only requires extensive research on hazard-prone areas prior to any disaster, but also a significant amount of time to build and deliver to those in need. The gravity of post-disaster situations rarely allows for such tasks which would need the involvement of large groups for extended periods of time.

Although standardized emergency shelters have solidified their role as the go-to solution when it comes to post-disaster immediate relief, they do have certain weaknesses that could be addressed. The area of strength of standardized solutions, their effectiveness in the urgency of matters, is an area of weakness for site-specific shelter solutions. And vice-versa, the areas of weakness of standardized solutions, their inability to provide answers for specific local needs, are the areas of strength of site-specific solutions. In an ideal situation, the combination of the positive aspects of the two strategies could lead to a shelter which answers the needs of both the disaster survivors and the aid facilitators. A vision which attempts to balance the two approaches could provide the sought solution. The part of the balance dedicated to standardization has a clearer path, as it has been vastly developed. Materials are needed which can be found in large scale, are easily accessible and inexpensive. On the other hand, little research has been done on the development of site-specific solutions. More important than anything, various in-depth studies and research are necessary for a complete understanding of the specificities and characteristics of the target area. As mentioned, there is little time after a natural hazard occurs to do such extensive work, that is why the majority of these efforts need to be done in pre-disaster mitigation and preparedness phases. What is required is the understanding of the local built environment and the local society's specific needs and desires.

The way in which these two sides of the balance, standardization and site-specificity, can come together requires more specific research and could be the subject of a thesis on its own. But what is clear is that the potential for a better shelter solution exists. Architecture, in its essence, comes down to finding solutions for existing problems. The side of the balance on which an architect can have great influence is that of site-specificity. A site-specific shelter is essentially a shelter which belongs in its

used context. The subject of context is of utmost importance for architecture and is at the heart of all projects. The study of the location of an architectural project, the program intended, the specific users and their needs and desires. The design of a post-disaster emergency shelter is by definition an architectural project. Its conception requires the study of the location at risk of natural hazards, the understanding of housing within that community, and the analysis of its people's needs and desires. And yet, rarely do architects encounter such topics during their studies or career and very few architects seem to develop an interest towards this field. The establishment of a project which improves the current emergency shelter solutions is of significant importance, and this thesis aims to take a first step towards that direction.

4.2 Pre-disaster (planning) vs. Post-disaster (execution)

The topic of this section is not a debate consisting of choosing between pre-disaster efforts and post-disaster ones, both are obviously essential in different ways. The question is rather, how much work can be done prior to a disaster? And how much does that pre-disaster work improve the post-disaster situation? As shown in the first chapter, disaster management as a field of study and research is very vast and covers various topics, but all of its efforts can be divided into four main phases. Mitigation and preparedness which take place before any natural hazard happens, followed by the response and recovery phases which come once a disaster has struck. The mitigation phase is defined as the sum of all actions and activities designed to eliminate or reduce the possibility of a disaster in the case of a natural hazard, and minimize the loss of human life and damage to property. Time-consuming actions designed to have large-scale and long-term effects belong to this phase such as the enforcement of stricter building codes, the development of city plans and the study of hazard-prone areas. The preparedness phase is dedicated

to, as the name states, work done in preparation for an eventual disaster. On one hand, certain of this phase's activities are focused on the local authorities and aid agencies and their role in laying the groundwork for post-disaster relief efforts. They include the stockpiling of food and non-food items, the designation of roles and the dedication of workforce to eventual needs. On the other hand, certain actions are focused on the local population which is at risk of natural disasters. Educational sessions on how to prepare for a natural hazard and things to do or avoid doing when a disaster strikes are essential to this phase. The response phase starts immediately after the disaster. The devastation caused by the event and the needs of the affected population must be carefully assessed and relief efforts should be put in action accordingly. The actions taken in this phase are dedicated to the short-term future of the community. Search and rescue operations, medical care for those injured, provision of food, provision of shelter and non-food items and debris removal are examples of tasks done within the response period. Although they all address the immediate problems in sight, planning for the longer-term recovery phase must begin early on. The two post-disaster phases overlap and there is no distinct point in time when one ends and the other begins. The recovery phase consists of actions such as restoration, repair or reconstruction of housing, infrastructure and public facilities; the redevelopment of the local economy; long-term counseling for survivors and the rebuilding of the various aspects of community life. Recovery later on transitions to mitigation and the cycle continues. All stages of the disaster management cycle are vital and none are more important than the others. Pre-disaster phases however, gather less amounts of attention in many countries. Enormous investments are made to cover the damages done in the response phase, whereas the investment in and development of the pre-disaster phases could minimize the human and economic costs of natural hazards.

The case studies analyzed in the second chapter showed

that the amount of work done in preparation for a natural hazard, among several other factors, influences the degree of success in response to and recovery from a disaster. In the aftermath of the Bam earthquake, coordination between the local and national authorities, aid agencies, international organizations and all other parties involved was a constructive one which lead to efficient response to the disaster, especially in the immediate relief stage. The pre-existing relationships between the various actors meant that they all knew what their specific role was in the provision of aid and there was no time or effort wasted. The provision of emergency shelter was effective because it was stockpiled to an extent and more were quickly transported to the disaster area. The conception, construction and distribution of transitional shelters however was an extremely lengthy process and their delivery to those in need was delayed, this could have been partly avoided and the situation could have been improved if there were prior study and work done on the topic, in mitigation and preparedness phases. In the case of the Haiti earthquake, the immense scale of the disaster naturally complicated relief efforts, but a lack of preparation was still present. An IFRC (International Federation of Red Cross and Red Crescent Societies) report mentions that among pre-existing conditions that hindered any humanitarian action despite the type and scale of the disaster was the bad quality of many infrastructures and the housing stocks which lead to significant amounts of houses being destroyed or damaged beyond simple repair. Various aid agencies also reported that at certain stages they were unaware of the aid they could provide because there was no organization within the different groups of actors. The large scale of the disaster made for a difficult distribution of emergency shelters, but with the stock available in the country and the help of international actors, the needs were met within a few months. The distribution of transitional shelters however, exactly like in the case of Bam, were delayed several times and could have been avoided with better preparation. The Nepal earthquake was an example of how pre-disaster efforts

can have a positive impact on the short-term and long-term reaction to disasters. Due to the fact that the country is situated in a region very prone to natural hazards and is not unfamiliar with the disasters they can lead to, national officials had taken measures throughout the years to create more hazard-proof and less vulnerable communities and safer homes. The earthquake nevertheless caused some damage and destruction, but the local authorities and their international counterparts, with whom they had pre-established relations, were prepared to react. A short, medium and long-term strategy, which followed pre-disaster studies and planning, was set and put into action early on. With a focus on self-recovery, emergency shelters were followed by direct cash transfers to the affected families in order to allow them to lead their own reconstruction. An alternative recovery strategy like this would be impossible without prior research and planning.

Disaster management is in no way a simple task. The complexity of the matter lies in the scale of damages of different nature and the necessity for incredible amounts of effort on behalf of various actors to manage those damages. It is evident that once a disaster happens, especially when it is in the scale of events such as the earthquake in Haiti, national and even global attention is brought onto it. Images of the damage, the destruction and the affected families are a difficult sight to see, which is why aid, in various forms, is sent from across the world to help those in need. The response phase of disaster management receives the most amount of donations and investments from both local and foreign sources. The response phase is the so-called highlight of the cycle. Perhaps architects, like others, only pay attention to this phase. That is why they see no opportunity to intervene as an architect. They might be thinking, how can an architect be of immediate help to those in emergency shelters like tents? Architectural projects require time, and it is not wrong to see little potential for the architectural practice immediately after a disaster. The medium and long-term generally sees more of the

involvement of architects. The pre-disaster phases however should not be forgotten. Little attention is paid to it by the general public, and even governments in some countries. Those phases present incredible opportunities for professionals of all backgrounds, to work on and develop strategies which will bear fruit much later in time. The amount of investment, of both time and finance, in the mitigation and preparation for natural hazards and disasters need to be much higher than they are. As seen in practice, these efforts lead to significantly less costs and much better recovery. If architects take all phases and aspects of disaster management into consideration, and do not only see the event of a disaster itself, they will understand that they do have an important part to play in the conception of emergency shelters, one that could lead to a higher satisfaction from disaster-hit families.

4.3 Role of the architect

As one can imagine, the response to a major disaster needs the help and involvement of various large-scale actors. Local authorities, the national government, aid agencies, NGOs, international organizations, foreign governments, local and foreign donors and volunteers are among those who often participate in some way, shape or form, in the provision of aid, resources and funding in the different disaster management stages. The needs in these situations are generally numerous, therefore each actor can have an influential role. And it is only when all these parties come together that efforts are successful in being effective and efficient. The cases of Bam and Nepal showed that good organization and coordination between the different actors leads to a better execution of orders, while the Haiti earthquake was lacking in this sense. When it comes to the small-scale, the same concept applies. Disaster management is a multi-dimensional field of study and every single task done at any stage requires the input of multiple professionals.

The topic of shelter, the main focus of this thesis, presents various challenges which can only be overcome with the presence of people with different backgrounds and perspectives. That can be seen in the pre-disaster phases of mitigation and preparedness, where for example the common task of enforcing stricter building codes in a country requires the knowledge of structural engineers and the involvement of policy and lawmakers. The identification of cities and areas at risk of potential disasters, or the definition of safe zones in case of need for relocation, requires the input of natural disaster experts such as seismologists. Planners are needed in order to come up with the development strategy of a specific hazard-prone city. The various stages of post-disaster shelter demand a cooperation between a significant number of professionals who are each able to provide one piece of the complicated puzzle which is the conception, construction and provision of shelter to affected families. Many post-disaster communities are at risk of diseases which can easily spread due to poor sanitation or infected water. The presence of WASH (water, sanitation and hygiene) experts in the planning of shelters, especially campsites, could prevent such dangerous issues. The psychological effects of disasters are among those which affect the majority of survivors and last the longest. Psychologists are often brought in after a disaster to help the affected community cope with what they have gone through, but their involvement in the conception of shelters can also help introduce specific survivors needs that would be unknown by other professionals. When it comes to the construction of shelter, various engineers should be consulted. The insight of an expert in construction materials is needed regardless of the conceptual approach taken towards the design of a shelter, whether the use of locally sourced materials is encouraged; or standard and industrial ones; or a combination of both. If one takes the decision to move towards site-specific shelters, as previously mentioned, the study of the local population, their customs, their culture and their living habits is something that can be provided by a sociologist. And most importantly, a group of people who can provide the best knowledge and information on several aspects of shelter are the local community or survivors themselves. The participation of all the mentioned professionals could still lead to a failure if the local population is not involved in the different stages of the lengthy process. Their needs and desires must be reflected in any shelter solution given to them, and they are the only ones who can provide professionals with that information.

Now where does an architect stand within this group and what role does he play? The architectural profession, willingly or unwillingly, has become more open to cooperation with other experts in recent years. The days of an architect being the sole person in charge of the conception, design and construction of a building are past. Buildings nowadays are constructed with the intervention of a number of various other professionals such as structural engineers, landscape architects, electrical engineers and other technicians. Architects tend to play a managerial or organizational role. They gather the knowledge and expertise provided by other professionals and combine them in a way which best serves their purpose. When it comes to shelter design however, a different approach is necessary. The architect cannot be in a higher hierarchical position compared to others. The inputs from all experts of different backgrounds are identically important, as they all serve the purpose of providing a better shelter for disaster survivors. The sharing of information among these professionals allows them to have a better general understanding and overview of the different issues in hand and therefore work together to provide a unique solution for them.

4.4 Final Remarks

It is no secret that working in the field of disaster management as an architect is not very common today and is considered to be marginal within the profession. The services

offered by the architectural profession can only be afforded by those who are financially at ease, whether it is individuals, corporations or governments. Architectural offices are paid large sums to provide solutions to the problems that their clients have. There seems to be a paradox in the way the profession functions today. On one hand, the majority of architects work for clients who are all within a very limited group in the grand scheme of society, those wealthy enough to afford such services. On the other hand, the majority of the world's needs when it comes to the most basic aspect of architecture, housing, are the needs of the much larger group of society which cannot afford the expertise of an architect. The importance of the needs of various groups of society are evidently relative, however, one cannot and must not ignore the fact that the architectural needs of the general public are much more urgent than those of the wealthy. At the end of the day, it is architects who decide to which group they would like to offer their knowledge, expertise and services. Certain call the architectural work dedicated to those most in need humanitarian architecture. It is clear that this field has difficulties for the architect which generally are not found within the common practice, mainly the struggle to earn a living. Humanitarian architecture consists of various topics such as working to improve issues such as poverty or homelessness, provision of shelter for refugees and disaster relief. Although disaster relief seems like a foreign field of work for most architects today, the research done in this thesis has shown that such programs function essentially in the same way that most architectural projects do. Various phases of study and research, followed by conception and planning, completed with the final step of construction. The design of a post-disaster temporary shelter, at its core, is no different from the conception of a housing project which is so common for most architects. Yet, most architects tend to stay away from disaster management, not necessarily due to disinterest in the subject, mostly because these aspects of architecture are rarely the focus of architectural studies. The need for the involvement of architects in disaster management

is nevertheless strong. So is the need for their presence in various other humanitarian issues. Architects must realize that whether they work on the design of affordable housing, the conception of settlements of refugees, or post-disaster shelters for affected families, their mission is more than simply constructing a safe and adequate place for these people to live in. Architecture is beyond the construction of an object. The end goal is the improvement of various aspects of people's lives, in the present and in the future, and the object is merely a tool for an architect in achieving that.

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