

# Guidelines to Improve Sustainability and Cultural Integration of Temporary Housing Units

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## Abstract

Unfortunately, natural disasters have drastically increased over the last decades causing extensive material and non-material damages. The destruction of houses and the number of homeless people are some of the most visible effects of post-disaster scenarios. Housing is one of the people's most important needs and it is also essential for their well-being. After a disaster it is crucial to supply temporary accommodation in order to provide victims with comfort, protection, and privacy until they have a permanent house. Temporary housing is an extremely important solution of temporary accommodation allowing victims to gradually return to their normal life activities during the reconstruction process. Although it has been widely used after the most large-scale disasters, the urgent need of fast solutions has not led to effective options. Therefore, temporary housing solutions have been greatly criticized mainly for being unsustainable, and also culturally and locally inadequate.

Through literature review and case-studies' analysis the research points out the main factors and reasons that cause the problems of temporary housing units. It also refers to possible solutions to overcome or minimize those problems, offering guidelines based on concepts that have been proved effective in previous studies.

The guidelines focus on useful concepts in the development of more sustainable, locally sensitive and culturally integrated solutions. It was found that an essential change is needed in the development of temporary housing solutions. These solutions should be developed through a people-oriented strategy rather than focusing on the technical aspects of the units. The suggested guidelines have that objective.

**Keywords:** Temporary housing, Sustainability, Local integration, Cultural adequacy

## Introduction

Housing plays a crucial role on people's lives, providing a space to live with dignity, security and comfort. Therefore, it is essential for people to feel socially integrated and to have the sense of belonging. A house is also a source of pride and cultural identity (Barakat, 2003), and the people's home reflects that identity. Hence, reflecting their personality (Kellett and Tipple, 2000). While inhabiting a house, people create a strong relation with it, once it is much more important than a simple physical structure.

As housing is an extremely vulnerable asset, its destruction is one of the most visible post-disaster effects (Barakat, 2003); which leads to the loss of those symbolic references (Bedoya, 2004). Thus, post-disaster re-housing should be fast as losing a house is more than a physical deprivation, it is losing dignity, identity and privacy (Barakat, 2003).

The works to repair and rebuild the damaged houses usually take a long time. Due to the precarious conditions of those buildings after disasters, many of them may collapse or have no conditions to be repaired, and construction of new ones is imperative. Between the aftermath of the disaster and the conclusion of the reconstruction works, the provision of temporary accommodation is crucial to provide victims with a secure and private space. Temporary accommodation refers to all the different types of temporary lodging that can be used after disasters (Johnson, 2002), and two main types can be identified: (1) *sheltering*, which can be emergency shelters and temporary shelters, and (2) *housing*, which are temporary houses.

The main difference between *sheltering* and *housing* is that, while shelters provide a secure place to stay during the period that immediately follows the disaster interrupting daily activities, housing allows for a return to household responsibilities and daily routine (Quarantelli, 1995). Since people cannot stay in shelters for a long time, as they cannot resume their daily life in here, and reconstruction works often take time, there is a time gap to bridge and temporary housing seems to be the obvious solution (Johnson et al., 2010). Not only does it protect and provide privacy, but it also allows people to regain their daily life and it introduces some sense of normalcy, enabling them to perform the normal activities, such as housekeeping, cooking, working, etc. Additionally, it may promote the success of the overall reconstruction, since there is time for better community planning to reduce risks and improve sustainability of the future construction (Johnson, 2008).

Temporary housing can be defined both as part of post-disaster re-housing process, and as a physical type of building used temporarily by families during the reconstruction works (Johnson, 2007b). This research focuses on temporary housing as a physical type of housing unit, that is to say, the temporary building that people inhabit after a disaster until they have a permanent house to live.

In spite of its importance, temporary housing is a controversial issue of post-disaster reconstruction programs, and it has been criticized due to the persistence of some problems (UNDRO, 1982; Barakat, 2003; Johnson, 2007a; Johnson, 2007b; Johnson, 2008; Hadafi and Fallahi, 2010).

## **Why Have Temporary Housing Solutions Been Criticized?**

Even though there is a wide range of different temporary housing solutions available, they have frequently led to unsuccessful and undesirable outcomes. Most of those solutions are more concerned with the technical aspects of the units than with the people that will inhabit them, leading to culturally inadequate and locally inappropriate designs. Likewise, the implemented solutions have been economically and environmentally unsustainable.

### *Inadequacy issues*

Most of the times, the units are developed by experts that are not familiar with the place of the disaster. This cultural distance between the professionals and the victims creates misunderstandings and the given solutions are not often the most suitable for users, but what professionals consider appropriate (UNDRO, 1982; Lizarralde and Davidson, 2006). This approach neglects cultural patterns, local conditions, as well as users' needs (El-Masri and Kellett, 2001). Besides being developed in a foreign country, these solutions are often based on standardized and mass-produced units in order to reduce costs and maximize production. Thus, standard solutions tend to ignore the real needs of users, the variations in cultural values, the climatic differences, the variations in family size, the diversity of local housing architecture, etc. (UNDRO, 1982). Therefore, units are prone to be inappropriate in terms of style and culturally unacceptable, creating a totally alien built environment (Gulahane and Gokhale, 2012).

After losing their home, one of the most important primary factors of stress, the victims' relocation in a temporary housing often becomes a relevant secondary source of stress (Caia et al., 2010). Some types of solutions resemble more the prototype of a home than others, and the way people become attached to a temporary house may benefit their long-term psychological well being (ibid). When the units do not meet the users' needs and expectations, they frequently abandon or modify them, which may reduce the safety of the building (El-Masri & Kellett, 2001; Dikmen et al., 2012; Sener and Altun, 2009).

### *Lack of sustainability issues*

Since most of the units are produced in a different country, they have to be imported, so they have to be transported to the site where they will be placed. This procedure may be highly expensive because it implies the cost of the units and its transportation. Sometimes, it may be necessary to hire skilled workforce to set up the units, which represents more expenses. All these investments have been considered both high and unnecessary due to the units' expected short period of usage. Thus, it is a very expensive kind of housing when compared with its lifespan, once it can cost the same as a permanent house (UNDRO, 1982), or in some cases three times more (Hadafi and Fallahi, 2010). As a consequence, temporary housing has also been criticized for drawing away resources from the construction / reconstruction of permanent houses (Johnson, 2007a), negatively affecting the overall reconstruction program.

The lack of planning for units' disposal after usage has led temporary housing solutions to be perceived as unsustainable. Previous studies have found that the units can still be further used (Johnson, 2007a), but they are often simply dismantled or demolished regardless reusing or recycling, which is a very unproductive approach (Arslan and Cosgun, 2007). This unsustainable waste of resources adds to the effects temporary houses have on the site due to the pollution caused by the foundations, infrastructures, garbage, etc., that results from their removal.

## **Guidelines to Improve Temporary Housing Units**

The problems previously identified allows for proposal and discussion of some guidelines to improve temporary housing units. Those problems seem to result from misconceptions about the circumstances in which victims live in post-disaster scenarios, unfamiliarity with the local reality, depreciation of the potential of local resources, and technologically oriented solutions in detriment of more sensitive approaches. The strategies to overcome those problems may be strengthened through the application of the following principles: designing for people, community participation, usage of local and indigenous resources, simple construction systems, flexible spaces and solutions, designing units and their sites as a whole, and designing for long-term possibilities.

### *Designing for people*

More than physical structures, temporary housing is a space that provides for social, spiritual and psychological needs (Hadafi and Fallahi, 2010). Thus, solutions should be designed from users' point of view (UNDRO, 1982). It is imperative to shift the focus from the units' technical aspects to the development of more sensitive and friendly solutions, thinking more on creating 'homes' than designing houses. There is no need for new inventive, original or high-tech solutions. Those kinds of "interesting creations" may be attractive for other approaches related to design, but have no significant value for disaster victims (Kronenburg, 2009). The design is important to meet users' needs and not to simply be a spectacular architectural image or shape.

### *Community participation*

The participation of the community is a crucial aspect to improve the outcome of temporary housing units. On one hand, the satisfaction of the users is greatly related to their participation (Lizarralde and Bouraoui, 2012). The affected community should be involved in the assessment of their own needs and expectations, so the units can address them (UNDRO, 1982). On the other hand, people are often capable of actively participate in the re-housing works, since they usually have basic knowledge about construction and also the will to contribute. Indeed, survivors have provided the primary response to their shelter needs after disasters (UNDRO, 1982), and that ability should be promoted (Bedoya, 2004). However, not all types of participation can be used and it has to be carefully and locally defined (Davidson et al., 2006).

### *Local and indigenous resources usage*

The use of local materials and building techniques, as well as local workforce, contributes to reduce costs considerably and to improve the local economy. The temporary housing units may be available earlier once the time-consuming transport of these materials and workforce is no longer required. As the materials belong to the region, cultural and local integration is promoted and the participation of local workforce is incited as well. Adding the fact that most of the times the population master those materials and techniques. The fact that they are using local resources and construction systems also allows better maintenance and modifications. Furthermore, some indigenous building solutions may be more resistant to disasters, more effective, and probably suit better the local needs than some modern technologies (Twigg, 2006; Shaw et al., 2008; Gulahane and Gokhale, 2012).

### *Simple construction systems*

In addition to the previous concept, simple construction systems facilitate and accelerate the erecting works. The construction systems should be based on light and small elements, which are easy to handle, assemble and dismantle (Arslan, 2007). In the same way, the solutions should be non-polluting and easy to remove (Johnson, 2007a). However, preferring simple and local construction systems does not mean rejecting innovation. Actually, if properly introduced and culturally integrated, new materials and technologies, such as prefabrication, may give a useful contribute to improve temporary housing solutions (Davidson et al., 2008; Garofalo & Hill, 2008).

### *Flexible spaces and solutions*

Flexible spaces can be easily modified by users according to their needs. In disaster scenarios housing is frequently combined with working activities (Kellett and Tipple, 2000), and this flexibility enables the co-existence of those various activities. Flexibility allows users to customize the spaces according to their tastes, and therefore getting them to feel more attached to the house. Flexible solutions also allow the expansion of the original unit, promoting the development of the building over the time and according to the families' means. Due to these advantages, the flexibility concept has been considered essential for post-disaster housing solutions (UNDRO, 1982; Kellett and Tipple, 2000; El-Masri and Kellett, 2001; Barakat, 2003; Bedoya, 2004; Lizarralde and Davidson, 2006; Lizarralde and Root, 2007; Arslan and Cosgun, 2008; Sener and Altum, 2009).

### *Designing units and their site as a whole*

The spaces surrounding the units are as crucial as the units themselves. Designing buffer zones between the public domain and the private area of the units is essential to create privacy among

neighborhoods, and fomenting socializing and interaction (Caia et al., 2010). The possible uses of gardens surrounding the units can range from entertainment or work purposes to growing fresh produce, thus improving the family finances.

### *Designing for long-term possibilities*

When the units are designed, it is imperative to determine sustainable options to apply after their intended period of usage. This way, it may be possible to compensate the high initial investments and to reduce the environmental impact of temporary housing. Previous researches have demonstrated the possibilities and advantages of reusing and recycling the units (Johnson, 2007a, 2007b, 2008; Arslan, 2007; Arslan and Cosgun 2007). With a similar aim, a study developed by Bologna (2004), presents the concept of reversibility of the construction process, which is the possibility to re-introduce the materials in another production cycle, or to re-integrate them in the natural environment without causing waste or residue. All those alternatives improve the sustainability and outcomes of temporary housing units and therefore they should be well planned and developed during the design phase.

### **Case-Studies**

There are numerous examples of different kinds of temporary houses units. In this section, four examples of temporary buildings are presented and analyzed considering previously discussed the principles. Two of the examples seem to suffer from the problems identified and discussed above, while the other two seem to reflect the successful implementation of some of the proposed principles.

#### *Future Shack*

Future Shack is a prototype for mass-produced emergency housing built from recycled shipping containers, see Fig. 1(a). The solution requires heavy machinery, and the volume of the container occupies much space, mainly with air. Thus, the transport to difficult access areas is complex since a truck or a crane needs to be placed in the site, which may be expensive and time-consuming. Despite being referred by Helsel (ibid) as a friendly object and easily adapted to local versions of “home” due to its roof, the solution does not regard ethno-cultural and social-cultural issues, and the detail of the interior seems superfluous and expensive (Hamilton, 2012), see Fig. 1(b) and (c). The unit seems to be closer to what El-Masri and Kellett (2001) consider an expensive and alien housing unit, rather than a friendly object. The solution matches what Lizarralde and Davidson (2006) describe as the “box effect”, which considerably decreases the conditions for mixed indoor and outdoor use, and it also becomes difficult to expand or modify it according to users’ needs over the time. Although it is claimed to be fully erected in 24 hours through simple assembly of parts that require basic tools and skills, the solution seems too complex to involve the victims in the assembly works and skilled workforce may be needed.

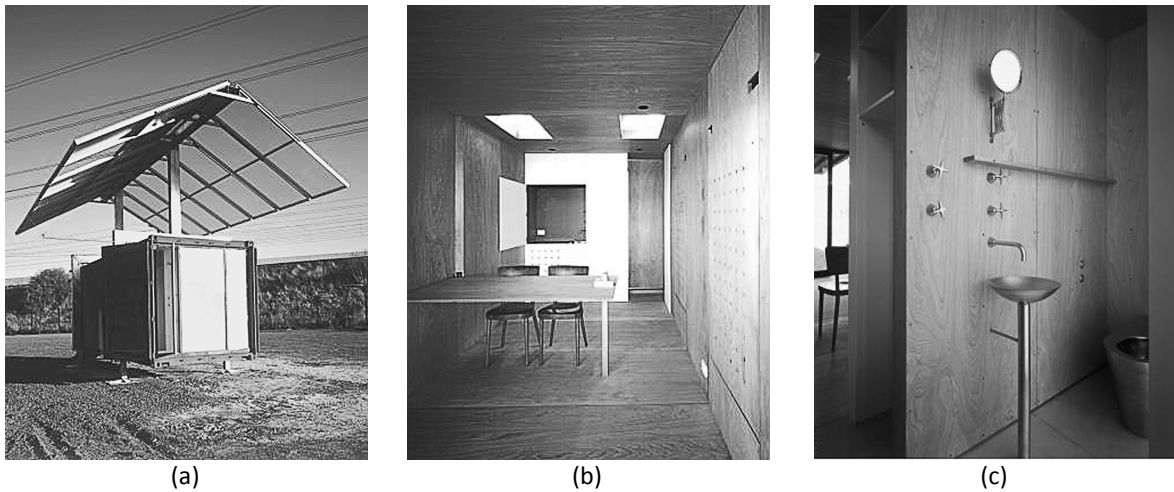


Fig. 1. Future Shack: (a) exterior aspect, (b) and (c) interior space (<http://www.seangodsell.com>).

### *IOM unit*

The IOM unit was used in Haiti to rehouse the victims of the earthquake of 12 January 2010, and it seems to have several problems as in the previous example, see Fig. 2a. The unit is built in-situ, which means that only the materials need to be transported, and the construction systems are relatively simple. However, the foundation is made of concrete blocks under a concrete slab for the floor, and these are difficult elements to remove after dismantling. The walls are built with wood frame covered with plywood, and corrugated steel is used for the roof, but the hurricane straps are not consistently installed (Saltzman et al., 2010). It has one door and two openings, which are minimal and provide poor ventilation. This is another example of the “box-effect” (Lizarralde & Davidson, 2006) that does not address the victim’s needs. As a result, users frequently added a covered exterior area to meet their needs for space and accommodate a variety of activities. Nevertheless, the solution creates a clear gap between interior and exterior, which results in lack of integration between the original and added spaces, and also structural unsafeness, see Fig. 2b.



Fig. 2. IOM unit: (a) exterior aspect, and (b) after additions (<http://openarchitecturenetwork.org/>).

## Paper Log Houses

Paper tubes are the main construction material used by this temporary housing solution, see Fig. 3a. The lightness of the elements, which are easy to transport, and the simplicity of the structure allowed the affected community to perform the erecting works, see Fig. 3b to 3d. The first solution was used after the Kobe earthquake, Japan, in 1995, and consisted of a foundation made with donated beer crates loaded with sandbags, walls and structures made with paper tubes, and the roof made with tenting material. An outdoor common area was created between the units that could also be used to expand the houses over the time, see Fig 4a. After their usage, the units are easily dismantled and the material easily recycled, leaving the place completely recovered since the foundations do not cause irreplaceable damages on the ground. The solution has shown to be flexible and to adapt to different contexts and functions, such as temporary schools and churches. In Turkey, in 2000, the units had a different configuration to fit the standard size of the country's plywood as well as the size of the families. The solution implemented in India in 2001 used rubble from destroyed buildings in the foundation due to the lack of beer crates. A traditional mud floor was used as well as a locally made woven mat on a bamboo structure for the roof. The small holes in the mats provided ventilation, allowing people to cook inside and helping to repel mosquitoes, see Fig. 4b. Ultimately, this solution is easily erected, provides community participation, adapts to different circumstances, and uses recyclable and reusable materials, and besides being mass-produced and standardized, it allows interesting combinations with local materials and construction techniques.



(a)



(b)



(c)



(d)

Fig. 3. Paper Log Houses: (a) general aspect (<http://www.shigerubanarchitects.com>), and (b) to (d) assembly works by local people (<https://archnet.org>).





Fig. 4. Paper Log Houses: (a) works to transform two paper temporary houses into a three-room dwelling using the space between, unfortunately using concrete (Johnson, 2008), and (b) solution used in Gujarat, India (<http://www.shigerubanarchitects.com/>).

### *Temporary Dormitories*

At a school in the state of Myanmar, the need of space and immediate accommodation for new students, led to the construction of temporary low cost and easy to assemble dormitories. These buildings are constructed with the local materials available and through simple structures that are erected only with manpower, see Fig. 5a and 5b. The assembly and maintenance are easy because the construction techniques and materials are well known by local people. The spaces meet the lifestyle of the students, creating semi-private spaces, room for storage, and also an open and airy interior adapted to the climatic conditions. Using local materials, the building fits into the local environment, see Fig. 5c, and provides a sustainable solution because there is no need for complex ways of transportation or tools. After the intended period of use, the building can be dismantled, the place totally cleaned and restored, and the materials may be re-used or easily disposed of.

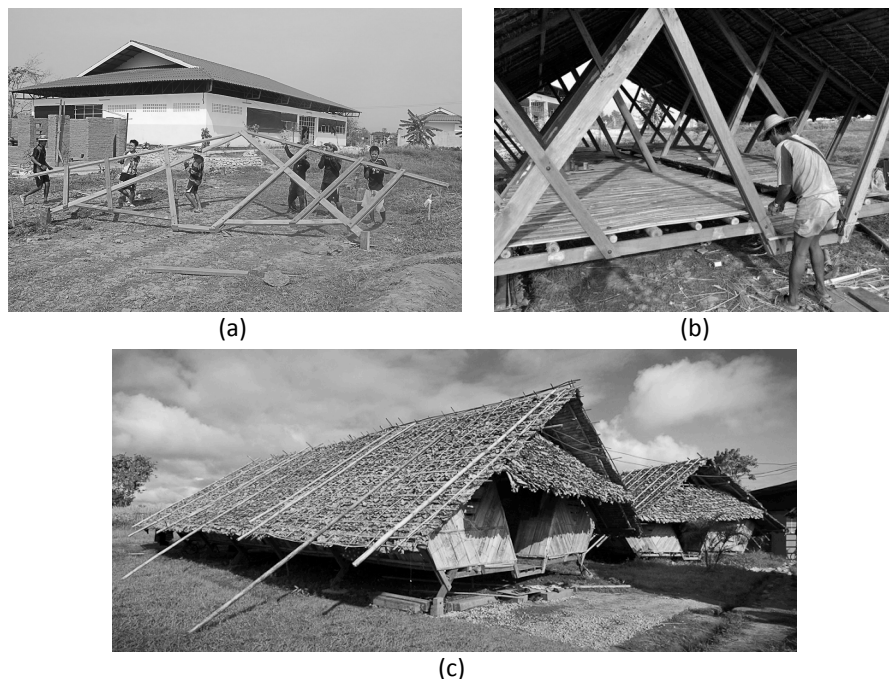


Fig. 5. Temporary Dormitories: (a) assembly process, and (b) exterior aspect (<http://openarchitecturenetwork.org/>).

## Conclusions

The provision of temporary housing units is undoubtedly a crucial task to improve the communities' quality of life after disasters. The flaws of the solutions that have been implemented seem to result from misunderstandings about the reality of disaster scenarios. Most of those misconceptions have their origin in what people's real experience in disaster situations is and in wrong interpretations about the local capacity for reconstruction.

This research has revealed that a careful understanding of the context, identifying the real needs of the victims and evaluating the potential of local resources correctly, combined with a people-oriented design approach, will certainly help develop more sustainable and culturally appropriate solutions.

There is no need for new sophisticated or high-tech solutions. The key to develop effective and successful solutions is to design temporary housing units according to precise specifications, context-based, thus allowing people to transform them into a temporary home.

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He has made contributions in the fields of Wood Structures, Structural Rehabilitation of Wood Structures and NDT Tests on Wood Structures. In his experience, he has the opportunity to participate in several consultancy projects in Portugal, including inspection diagnosis and strengthening design. He is actively involved in some National and European standardization committees.



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