

## **Transitional housing:**

### *An update on sustainability challenges and research opportunities*

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**Abstract.** Awareness and increasing concern about the many homeless victims of the many natural disasters the world is currently witnessing is pushing forward questions on disaster relief and temporary housing practice. Consequently, despite it being a relatively recent subject of study, research on transitional shelters is gaining momentum and the volume of publications on the matter is rapidly expanding. By means of a thematic analysis, this study seeks to organise some of the highly heterogeneous research material on temporary housing, produced by the scientific community to date. Ultimately, this paper presents its classification into themes and subthemes and shows patterns in the literature, including examples, as a base for the identification of research gaps, open questions, challenges and new fronts in the area.

**Keywords.** Temporary Housing; Transitional shelters; Disaster Relief; Sustainability; Literature survey.

## **Introduction**

There is a growing global preoccupation with sustainable post-disaster reconstruction (PDR) as many people in academia and outside agree that the incidence of earthquakes and other natural hazards has considerably increased during the last decades, posing a serious housing threat to many densely populated areas of the globe. As a consequence, research on PDR is increasingly attracting the attention of researchers and the number of related publications has multiplied by 5 from 2002 to 2012 (Yi & Yang, 2014). Within this framework, specific attention has been given to the issue of temporary and transitional housing (TH), which controversial nature has arisen much criticism in the past. In fact, previous studies show that, despite the perceived importance of TH for the well-being of the communities affected by natural disasters (UNDRO, 1982), TH plans tend to fail their objectives by: (i) coming too late; (ii) being culturally inadequate; (iii) having poor performance; (iv) causing undesirable environmental impacts as well as (v) delays in the permanent housing reconstruction process. Therefore, many studies in the last years have discussed the role of housing in the disaster relief phase and its vulnerability as an asset and then have questioned the sustainability of TH plans, their impact on the post-disaster urban configuration and their contribution towards community building and resilience.

Given the inherent complexity of the topic, its multidimensional and multidisciplinary nature, relative novelty and the growing rate of associated published studies, it seems useful to survey the state of the art on a wide sample of targeted publications. Ultimately, well beyond the limits of a review on the current state of the matter, a thematic analysis of literature on transitional shelters, based on previous works, offers the opportunity to further discuss the meaning of housing in the context of emergency and change (sociocultural, environmental and economic) and identify: research gaps, open questions, current challenges and potentially new research tendencies with respect to TH design and planning.

### *A multidisciplinary topic with unclear terminology*

Disaster relief is a relatively new field of study still lacking appropriate jargon and adequate language to describe certain key concepts. Back in 1978, Davis wrote “the

words 'Temporary homes' belong to the language of politicians, slick salesmen and sadly some relief officials" (Davis, 1978, pg.88), as shelter must be considered a process, rather than an object. At a later time, Quarantelli (1995) noted that the terms 'shelter' and 'housing' were used in an unclear and inconsistent way in literature, due to a lack of awareness of what is important in the definitions in post disaster contexts. He advocated the development of specific jargon detached from common language use to add clarity to relevant concepts in the field and build a library of commonly shared terms and expressions useful for discussion among researchers. Debate on the matter is still alive today. In fact, Wagemann writes "the terms temporary and transitional have been used to refer to both the process and the building solution, but there are some conceptual differences. Most notably, 'temporary' refers to a building that will be used for a defined and short period of time, whereas 'transitional' refers to a process that bridges a gap" (Wagemann, 2017, pg.828). The lack of a clear common language seems to affect the wider research area of disaster management, as it has been noted that even PDR is still lacking an authoritative, agreed definition. In fact, PDR is often referred to by various names such as Post Disaster Recovery, Post Disaster Rebuilding and Post Disaster Redevelopment, whose mutual differences are believed to exist, even if no comparison has been reported in the academia yet (Yi and Yang, 2014). Also for 'community participation', a lack of clarity in the expression makes it difficult to capture lessons-learned and store them for future use. In fact " 'Community' has been—often arbitrarily—used to refer to a neighbourhood, a slum, a group of local NGOs, a group of militant leaders, the residents of a small town, a workers' union, a group of women etc." (Davidson et al., 2007, pg.102), which means that commonalities and differences in the composition of the groups remain unknown, are not explicitly described or are just not taken into account. "Participation is also randomly used to denote civil debate and communication, consultation, delegation of activities, partnership, self-help construction, communal meetings, political decentralization, etc." (Davidson et al., 2007, pg.102) probably because it "has not been defined in terms of what it means in a project environment" (Davidson et al., 2007, pg.102), which is the case for post disaster housing reconstruction.

Despite all these issues and difficulties in the use of a proper terminology, it is however possible to sense an evolution both in the maturity of the subject and in the approach to the matter of TH. In fact, the term 'transitional' has been increasingly used from the late 1990s (Wagemann, 2017), to highlight the fact that post-disaster housing is an ongoing process which brings together highly complex factors of economic, environmental and social nature, rather than a mere physical, construction product with a given, pre-determined shape.

## **Methodology**

The literature review presented in this paper is based on a simultaneous study on the many past contributions on the topic of TH and is organized by means of a thematic analysis. This helps identifying and recording recurrent themes and sub-themes in past and current research on temporary housing and then to assign to them labels/codes in order to disclose relevant concepts or categories; such concepts may be useful to derive significant properties or hypothesis potentially able to foster the advance of knowledge in the field. Given the large amount of available material and its heterogeneity, and for the sake of consistency, the scope of the thematic analysis was restricted to research concerning TH design and planning following natural disasters. This leaves aside, for the moment, works on refugee camps and informal housing, which, however, seem to share some similarities and concerns with the investigated topic and therefore might be worth looking at later on.

The material for the analysis is collected by searching references in English across multiple specialized and multidisciplinary indexing platforms such as Scopus, Avery,

Iconda, Google Scholar and Web of science, which contain academic research records coming from different disciplines ranging from Architecture, Civil/Energy/Management Engineering, Economics, Environmental Psychology, Social Science etc. In fact, because of the manifold character of the surveyed topic, related research works have been randomly published in a wide range of academic journals, often not specifically focused on disaster management and connected issues. Within these platforms, the references have been gathered after compiling a list of 13 keywords: temporary housing; transitional housing; temporary shelter; emergency shelter; post disaster housing; interim housing; housing reconstruction; post disaster reconstruction, post disaster recovery, housing recovery, disaster relief, disaster recovery; disaster management. These expressions were largely suggested by the RIBA library cataloguing system, whose consistence is highly accredited. After a preliminary screening based on the key words, the bibliographic resources were kept or ignored according to the pertinence of the abstracts to the scope of the survey. In the end, 27 publications (papers, books and guidelines) were synchronously analysed and their content decomposed using a 51x27 synthesis matrix in order to isolate and organise the relevant concepts and coherent pieces of information. The final sample size was considered sufficient to reach the theoretical saturation (Bryman, 2008). To sum up, the study encompasses three steps: identification of the keywords and references; selection of the most relevant bibliographic research material; thematic analysis and interpretation of results.

### **Themes and sub-themes**

The holistic approach adopted for the analysis of the contents and the identification of research gaps is justified by the authors' understanding of the post-disaster urban environment as a complex system inhabited by seemingly complex interacting agents with heterogeneous goals. In such a context, housing units and aggregations are considered dynamic entities, which change over time. Besides, the environment in which TH plans are embedded is metamorphic and constantly evolving in terms of climate, demography, morphology, data and technology, among other things.

The ultimate challenge of this survey has been to organize the research material collected by the many authors who engaged with the study of one or more case studies, often under very different and unique circumstances, and then find common patterns and shared questions by analysing research themes and sub-themes. This approach helped greatly to identify present global challenges and future research opportunities in the field. As a result, some of the most recurring issues about TH, were classified into the three following themes: context and typology; housing emergency management; design and construction. The following section will explain each theme and sub-theme in detail and use extracts from the reading to illustrate sub-themes appropriately.

### **Results and discussion**

#### *Theme: Context and typology*

This theme includes issues related to people, the ones directly affected by disasters; how they live and how they wish to rebuild their lives and their cities.

#### *Subthemes: local housing patterns, community participation, assessment systems (post-occupancy)*

TH units have been spotted by numerous researchers as culturally inadequate and disconnected from local housing patterns (Barenstein, 2008; Gharaati and Davidson, 2008; Russell et al., 2008). Whether some literature links sustainability to vernacular

architecture (Asquith and Vellinga, 2005), Tucker et al. (2014, pg.172) clarify that “the study of traditional housing is not meant to enable a simplistic reproduction of those types, but rather to inform an appropriate design that must take account of all the various cost and material constraints”. Davis (1978) writes that despite the cultural unacceptability of alien housing typologies, societies are generally adaptable. Yet “living demands include the culture of local residents, which must be considered by the authorities when providing temporary houses” (Chen et al., 2014, pg.636) as well as changing social requirements up to date with the development of the country (Wagemann, 2017). In fact, formal modular units coming from a top-down approach often proved unsuitable solutions, neglecting local culture as well as users’ needs; so that “in some extreme cases, people abandon the housing units provided because they cannot live in them” (Felix et al, 2013, pg.139). It happened in Chile after the earthquake and tsunami in 2010, where “families in different parts of the country rejected the houses, preferring to stay in tents because they considered the houses to be inadequate for the medium term” and some “even torched their temporary houses to press the government for better solutions” (Wagemann, 2017, pg.842).

Some argue that the correct way to solve these problems is through community participation, whose value is a widely accepted paradigm (Wesener, 2015; Forouzandeh et al., 2008; Chen et al., 2006; Jalali, 2002; Maskrey, 1989).

*However, “when user participation occurs at late stages (either as sweat labour for constructing standardized houses or assuming responsibility-without guidance-for construction procurement, financial management and contracting), there are frequent problems either with the project process, as was observed in the La Hermandad (El Salvador) and C- ankırı (Turkey) case studies or with the project outcomes, as was observed in the Marmara (Turkey) and C- ankırı (Turkey) case studies” (Davidson et al., 2007, pg.112).*

This opens a debate on whether participation in the up-front decision-making (design of the processes and their organisation) would lead to results that are more positive. However, no reference to the application of this theory in practice has been found in this review. Nonetheless, there are a few experiences worth mentioning. One of them is the case of Duzce, Turkey, where participation was used as a means to support designers and planners in the transformation of existing TH into permanent ones (Arslan et al., 2008). Another example comes from Bam, Iran, where evidence shows a correlation between the perceived length of reconstruction and the extent of families’ participation and monitoring during the reconstruction (Rafieian, 2017).

Also, decisions regarding TH should be supported by suitable assessment systems, which could help evaluating the sustainability of different available options in both the reconstruction process and reconstructed projects (Yi and Yang, 2014). Post occupancy assessment, in terms of TH overall performance, is also crucial to capture lessons learned. Ultimately, “how well or poorly sheltering and housing are provided to disaster victims, depends in part on the criteria used in any assessment made” (Quarantelli, 1995, pg.46), and thus on the level of guidance, training, and evaluation available during the design and planning processes.

#### *Theme: Housing Emergency Management*

This theme is related to policies, processes and procedures and potentially the role of governmental authorities in emergency management and reconstruction, how strategic planning is put in place and what are the associated relief measures, including reuse of resources.

*Sub-themes: Strategic planning, Delays in TH provision and PDR, TH life span, reuse*

Until recently, the matter of housing disaster victims has been ignored in detailed planning or operational activities except in some earthquake-prone areas (Quarantelli, 1995). Now, on the contrary, many stress the need to plan ahead (Tucker et al., 2014; Félix et al., 2013), besides “to take advantage of the second life of temporary housing, upfront strategic planning is needed” (Johnson, 2007, pg.331). Davidson et al. (2007) sustain that organizational design should guide strategic planning in establishing the balance between short-term goals and long-term outcomes. Additionally, all the stakeholders must be taken into account, including for example workers and builders who must be housed, which “adds to the demand for housing capacity and may not have been fully accounted for in pre-planning” (Rakes et al., 2014, pg.168).

Delays in TH provision are a recurrent source of concern, as many authors agree that TH should be delivered promptly in order to protect the livelihood of communities, foster recovery and to satisfy donors who want to see results (Chen et al., 2014; Félix et al., 2013; Davis, 1978). However, evidence from the past show that in the majority of cases, provision of TH has delayed consistently. “Timing is often wrong as shelters have arrived too late to fulfil their role of filling a gap (Davis, 1978, pg.51); in Bam “reconstruction involved providing TH for disaster victims that took more time than anticipated” (Rafieian et al., 2017, pg.65) so that sometimes squatter or improvised shelter are created in the meanwhile (Davis, 1978) or TH solutions are privately bought and implanted without complying with local regulations (ANSA, 2017). According to Quarantelli “the time it takes to find temporary housing for victims seems partly related to the capacity of organizations seeking housing for victims to maintain flexibility and not become imprisoned by bureaucratic procedures” (Quarantelli, 1995, pg.49). Nonetheless, speeding too much is risky as well as “transition can be forgotten owing to an urgency to implement programmes” (Wagemann, 2017, pg.830). In fact, it is reported that in southern Taiwan, the design of housing units was finalised in a very short time prior of the beginning of construction, but later on, the units presented various problems among which bad sound insulation and insufficient heat dissipation (Chen et al., 2014).

Quarantelli (1995) adds that discontent for lengthy delays seems especially high when it comes to permanent housing reconstruction. Opinions on the causes of the delays diverge: on the one hand “overspending on temporary housing can jeopardise permanent housing programmes” Johnson (2007, pg.325), whereas reuse and recycle of temporary houses and housing sites “give a chance for the rapid reconstruction of the affected regions” (Arslan et al., 2008, pg.709) by using the resources made available by the families who move from temporary to permanent housing solutions. On the other hand, sometimes “the reason for delays in reconstruction are not technological, but legal, political and economic” such as exploitation and corruption (Davies, 1978, pg.22).

Furthermore, there seems to be a risk for TH sites to “become a squatter area in the long term” (Arslan et al., 2008, pg.703). This is very likely for trailer camps, which “show little collective unity or morale, and not infrequently become the source of certain kinds of social pathologies, especially when children and young people are part of the camp population” (Quarantelli, 1995, pg.49). Besides, “the ensuing housing crisis in most post disaster areas means that temporary housing has a great likelihood to become permanent, unplanned, housing for the lowest income residents” (Johnson, 2008, pg.325) as for South Taiwan (Chen et al., 2014).

Finally, it is thus crucial to consider TH life span as “units are often still in good condition after the few months or few years they are needed to house affected families” (Johnson, 2007, pg.323). In fact, due to TH unique requirements, materials have longer life than usage period (Felix et al., 2013), which in theory should vary from 6 months to a maximum of 3 years only (Song et al., 2016). However, the term temporary itself, when applied to housing seems a myth, as “prefabs of the world wars

are still being lived in Britain” (Davis, 1978, pg.65). Nonetheless, in relation to its designed service life TH is highly expensive, so that “in some extreme cases can cost the same amount as a permanent dwelling” (Johnson, 2007, pg.325) or even more, up to three times the cost of a permanent house in developing countries (Hadafi & Fallahi, 2010). Then, additional money is needed to cover transportation and infrastructure costs. For these reasons, the poor financial and time management of TH plans is regarded as a risk factor, which can affect PDR in a very negative way.

Some argue that reuse and recycle would solve this problem by increasing TH life span or at least take advantage of materials and components’ residual life after the units are deconstructed (Perrucci et al, 2016; Song et al., 2016; Félix et al., 2013; Johnson, 2007; Arslan et al., 2008). However, questions about how to design TH second life in practice are still widely debated. In fact, dismantling the units and storing them to reuse in future disasters may cost as much as new ones and long-term use in the same place is often considered problematic due to social dysfunctions, illegal occupancy and high crime rates, so that normally as they are just dismantled (Félix et al., 2013). Even when social problems are not part of the equation, past experience such as in Haiti, 2010, demonstrates that sometimes transitional shelters which evolve into more expensive and resistant solutions are not cost-effective if compared with the price of permanent houses (Wagemann, 2017). Nonetheless, many agree that TH demolition is the least efficient option because of the scarcity of building resources in disaster-affected areas and disposal costs, whereas rational land use and recycle of materials could put low-cost housing on the market (Johnson, 2008; Arslan et al., 2008). After the 2012 earthquake in Peru TH “were thus recycled and reused because families viewed them as an investment, or an endowment, as well as an object awash with emotions and memories” (Wagemann,2017,pg.841).

*Theme: Design and construction*

This theme is related to actions undertaken in the reconstruction process starting with pre-disaster design, urban location and site layout up to buildings in use, including how users adapt and configure them as their new homes.

*Sub-theme: Pre-disaster design, critical design variables, design additions, materials, construction system, TH site layout and location*

From the literature, it emerges the need for pre-disaster design; specifically, Arslan et al. (2008, pg.702) report that in Turkey “the results showed the need for pre-disaster design and organization to accelerate reuse and recycle potentials of the houses and sites”. Despite ideally “emergency shelters and temporary housing must be designed for their ultimate state in the evolutionary process” (Davies, 1978, pg.64) it seems quite hard to get early enough sufficient data to design TH and their future transformations in detail, as exact specifications for TH can be given only in a precise context (Johnson, 2007). Furthermore, the possibility of sudden unannounced changes in policy and rules further complicates things.

Another difficult task is to isolate the critical design variables. Wagemann (2017), Perrucci et al. (2016) and Félix et al., (2013) among others, formulate design requirements by using generic concepts such as safety, healthiness, reversibility (reintroduce materials and land into another production cycle or dispose of them without waste production), flexibility (possibility to accommodate different functions), transformability (to suit local patterns and lifestyles) and adaptability (the addition of new parts). The last three ones implicitly refer to the tendency of disaster affected people to recur to TH modifications and additions. This issue is again controversial for “houses are evolutionary, not static” (Davis, 1978, pg.63) and additions cover users’ necessities (Johnson, 2007). Besides, “changes made to the

houses produce variety out of uniformity” and “not necessarily lead to the creation of slums” (Wagemann, 2017, pg.832), but “this approach is unplanned and non-experts make the changes to the houses. Thus, there is a risk of messing up housing sites” (Arslan et al., 2008, pg.704). Modifications are made according people’s capacities, resources, security of tenure, and social status, and “in many cases [...] without any knowledge of building, with a dearth of technical supervision, and with poor quality materials” (Wagemann, 2017, pg.830) which make them vulnerable.

Materials play an important role. Many factors are to consider when choosing among them such as durability, local availability, recyclability, fire resistance, lightness and suitability to local climate. Davis (1978) suggests the possibility to use salvage material from destroyed or damaged homes, but he also reports that the distribution of imported corrugated iron or zinc sheets after the 1976 earthquake in Guatemala turned out an effective policy as people made large use of them.

Materials and construction systems are different aspects of the same problem. Here, many agree that the construction technology should allow for rapid building, possibly without the need for specialized labour or tools (Perrucci et al., 2016; Song et al., 2016; Davis, 1978). Recent experiments with 3D printing in New Zealand (WikiHouseNZ, 2015) show that this technology holds potential for disaster relief programmes, the main advantages being “a reduction in production waste, a decrease in construction time, and a decrease in labour costs. 3-D printing and manufacturing shelters on-site at the disaster region could prove to be more feasible and practical than shipping containers or parts across long distances should the technology further progress” (Perrucci et al., 2016, pg.330).

Last but not least, it is necessary to consider both TH site layout and location. It seems particularly important to carefully design the space between the buildings with buffer zones from the public domain to the unit's area and include public open spaces and amenities to support the community. A pioneer of this is F. C. Cuny, whose plan for El Coyotepe in Nicaragua “produced a humane environment in sharp contrast to the regimented military camps”, resulting in far higher occupancy figures (Davis, 1978, pg.55). Here, the plot size is crucial: “in Peru the shape of the plot influenced future expansion” and “the orientation of extensions appears to be governed by availability of plot space instead of factors such as sunlight or protection from the wind” (Wagemann, 2017, pg.840). Just as much important is the spatial integration of TH sites within the urban grid, but “usually temporary housing units are built in periphery areas, which can cause social isolation and the need for extra infrastructure and services” (Felix et al., 2013, pg.140) as well as rejection (Rafieian et al, 2013). Alternatively, TH may be implanted on land owned by the families, as an extension of the permanent house or part of it, which was a successful strategy in Peru, 2007 (Wagemann, 2017). Noticeably, this requires careful evaluation because “vulnerability comes from exploitation of the poor by the affluent, in particular of land” (Davis, 1978, pg.91) and the future form of the settlement must be considered. The issue of site selection has recently triggered research on multi-criteria decision support systems and computational methods (Hosseini et al., 2016; El-Anwar et al., 2013), however to date, these systems seem to remain confined to the academy.

## Conclusions

It appears that past studies have primarily attempted to organise factual information collected in a number of case studies, both in developed and in developing countries, to discuss successes and pitfalls of TH schemes. However, the literature is populated with a series of proposals but very little case studies which show the testing of them. The thematic analysis of the literature on the synthesis matrix enabled to classify the research material without losing track of the original context. Three major themes

were found: context and typology, housing emergency management, design and construction. Issues, gaps and questions were identified in the following fronts:

- Participation can potentially be included in different phases of the decision-making process. In which phase would it have more impact? Proof that the answer is in the up-front decision-making is still missing.
- Community involvement in re-construction and re-use vs. the need for pre-disaster design. How can participation be taken into account in this case?
- In which context should re-use be considered? The same event? A different event? Is re-use something to be considered in pre-design and/or to be evaluated post occupancy?
- How the evolutionary nature of TH (modification, insertion of different materials, etc.) affect re-use?
- Digital fabrication seems to hold the potential to enable customisation of TH solutions and reduce delivery time. Which advances does this technology still require to be able to contribute effectively to the implementation of TH plans?
- Nowadays a number of collaborative platforms and powerful computational tools are available. How can they better support strategic and operational decision-making in PDR? Why have not they been used in practice yet?
- There is a lack of methodologies to isolate evidence-based variables critical to TH design and planning

Future research could explore theoretical models in relation to the several aforementioned issues and attempt to more systematically organise the body of knowledge in these different areas. Some ongoing research projects are testing advanced computational tools and multi-criteria analysis methods to better deal with TH complexity. It is the authors' belief that further efforts in this respect could be promising and therefore could also be explored.

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<sup>1</sup> Only the twelve most relevant references are reported here because of template constraints.

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