Transformability as a Factor of Sustainability in Post-earthquake Houses in Iran: The Case Study of Lar City

Parva, Mohammad and Pour Rahimian, Farzad

Parva, Mohammad and Pour Rahimian, Farzad ORCID: 0000-0001-7443-4723 (2014) Transformability as a Factor of Sustainability in Post-earthquake Houses in Iran: The Case Study of Lar City. Procedia Economics and Finance, 18 . pp. 431-438. ISSN 22125671

Available online at www.sciencedirect.com

ScienceDirect

Procedia Economics and Finance 18 (2014) 431 – 438

Procedia Economics and Finance

www.elsevier.com/locate/procedia

4th International Conference on Building Resilience, Building Resilience 2014, 8-10 September 2014, Salford Quays, United kingdom

Transformability as a factor of sustainability in post-earthquake houses in Iran: the case study of Lar city

Mohammad Parva[a]*, Farzad Pour Rahimian[b]

[a]*Islamic Azad University of Shiraz, Shiraz, Iran*
[b]*University of Central Lancashire, Preston, PR1 2HE, UK*

Abstract

Housing design and construction for post-earthquake victims need consideration of the victims' socio-cultural needs. Due to the particular economic conditions in Iran, hurriedly made post-earthquake emergency shelters often fail in complying with the minimum needs of the occupants. Consequently, such shelters are often either abandoned or transformed substantially, resulting in an overwhelming waste of resources. This paper aims to investigate the transformation process of post-earthquake houses, with attention to the architectural characteristics of the transformations and people's motivational factors for these transformations. The methods used include systematic observations and map analysis of the transformations of post-earthquake houses over a 37 years period (1970-2007) and interviews with the households. Relying upon analysis of the problems of the current post-earthquake houses in Iran, the results recommended that the design for these houses should address: transformability into pre-earthquake patterns and lifestyles, adaptability to new parts/construction besides original dwelling, and capability to reflect different requirement for indoor spatial circulations. The findings therefore proposed the use of mixed 'Temporary-Permanent' housing reconstruction models which involve participation of stakeholders and end users from very early stages of design and developments in order to predict and address the latter transformations issues. This study contributes to both research and practice by proposing new design approaches and guidelines regarding post-earthquake housing reconstruction in Iran.

Selection and/or peer-reviewed under responsibility of the Centre for Disaster Resilience, School of the Built Environment, University of Salford.

* Corresponding author. Tel.: +98-0917-1130477; fax: +98-7116541164.
E-mail address: mohparva@yahoo.com.

Selection and/or peer-reviewed under responsibility of the Centre for Disaster Resilience, School of the Built Environment, University of Salford.
doi:10.1016/S2212-5671(14)00960-5

Keywords: post-earthquake housing; housing transformation; sustainable disaster management; Iran

1. Introduction

Earthquake is one of the most catastrophic disasters, by which many homes are destroyed and thousands of lives are lost. Earthquake and reconstruction theories are mainly conferenced with hazard mitigation and reconstruction process immediately after disaster. During this process which should take on board both short-term, mid-term and long-term planning, post-earthquake houses (PEHs) are often made only with the aim of providing immediate shelters for the victims Davidson *et al.* (2007). Baradan (2008) argued that even though most of the past attempts for delivering PHEs have mitigated the immediate risks of the disasters, they all failed in addressing people's future needs. In particular, due to time and financial constraints of planning and constructions in post-earthquake circumstances, there is a risk of not getting satisfactory long term results in every project (Tasa *et al.*, 2007). This problem is magnified in the context of Iran due to its particular cultural and economic conditions (Fallahi, 2007). Consequently, the majority of PEHs' occupants in Iran transformed their houses after a short occupancy period. The intention has been made to adjust PEH to suit the occupants' lifestyle and minimum living requirements. However, lack of understanding about process, motivation, and results of housing transformation in Iran often leads to construction of some PEHs which are not suitable for transformations, hence resulting in eventually demolished or abandoned post-earthquake houses. In order to address this issue, this study investigated housing transformations in a natural bed of Lar's post-1960 earthquake. The study used systematic observations and interviews with the occupants of PEHs to investigate the architectural characteristics of these houses and their transformations across 37 years' time (1970-2007).

2. Literature Review

2.1. Post-earthquake housing process

According to Barakat (2003), post-earthquake housing is influenced by the seven key factors namely land, human resources, institutional resources, community resources, building materials, level of technologies, and availability of funds. Baradan (2008) categorised these factors into two groups: 1) technology-based factors (including building material, human resources, and technology) and 2) community-based factors (including institutional resources and community resources). Alizadeh (2003) argued that amongst these seven factors those that are classed as community-based factors have often been neglected in designing PEHs in Iran. Therefore, this study mainly focused on these factors rather than those which are related to theology. Turan (1983) discusses two stages of housing reconstruction after disaster: 1) providing urgent shelters to victims, and 2) developing permanent houses. During the first short-term stage of reconstruction which starts immediately after earthquake, usually tents in relief campuses provide the victims with temporary shelters. In the second stage, normal houses are constructed for a long-term inhabit. Cole (2003) developed Turan's (1983) classification by identifying two additional stages: 1) temporary sheltering, 2) temporary housing. According to this theory, emergency and temporary shelters are occupied during the relief period (for less than one month), temporary houses are occupied during reconstruction period (for less than two years), and permanent houses are formed in order to provide normal life for people. From what discussed by both Turan (1983) and Cole (2003), it can be concluded that temporary houses are transitional dwellings which should be eventually transformed into other kinds of buildings or even completely replaced by new structures. However, both above discussed categorisations lack the considerations for evolution of temporary houses in order to be used after occupation period. To fill in this theoretical gap, Arsalan (2007) investigated the conditions of post-occupation temporary housing period and proposed a method for reusing temporary houses after occupation. Arsalan developed Cole's (2003) category by adding the fifth stage so called *"temporary housing transformation"*. According to Esin and Cosgun (2007), of the most important considerations in post-disaster reconstruction process is controlling the constructional wastes. They proposed two types of constructional systems in order to archive this. Arsalan (2007) developed their model and proposed a comprehensive system in order to support establishment of post-earthquake temporary houses. This included use of some kinds of recyclable and reusable temporary houses in post-earthquake area. Arsalan (2007) also identified two types of post-occupancy usage for the post-earthquake temporary houses, namely passive measures and active measures. Arsalan (2007) argued that in *"passive measures",* temporary houses are changed into permanent houses (or to any other functions until the end of lifetime), but in the "*active measures"*, temporary houses or their material are sent to another area or stored for being used another disaster.

2.2. Post-earthquake housing, approaches and models

Barakat (2003) proposed two models for establishment of reconstructed post-earthquake houses: 1) contractor-driven model, and 2) self-build model. According to Barakat, in contractor-driven model, professional construction firms contract to carry out the housing reconstruction. In this model, contractor-driven model is considered as the fastest and easiest way to lead mass housing projects as it is capable to produce large number of houses in a short time. Moreover, contractor-driven model (in which national or international public sectors provide financial sources and control the quality and quantity of construction) shortens the time and decreases the cost of post-earthquake housing construction (Kennedy *et al.*, 2008). On the other hand, self-built model which is also called "owner-driven" or "self-help" model, mainly focuses on the victims and local builders (Alexander, 1984; Barakat, 1993). According to Barakat (2003) self-build model is considered as the most beneficial model when local labor is already available and housing design is simple enough. In this model, national or international public sectors just construct infrastructure and provide financial sources whilst, post-earthquake houses are constructed by victims (Barakat, 2003). One of the most recent post-earthquake housing models is the model proposed by Barenstein (2005) who presented the experiences of reconstruction project of Gujarat-2001 by adopting six approaches to reconstruction: owner-driven, semi-permanent shelters, subsidiary housing, participatory housing, contractor-driven approach in situ, and contractor- driven approach ex nihilo. This model adopted some case studies in order to provide a comparative conclusion about the specifications of each approach. According to this model, houses reconstructed based on owner driven approaches are capable of transformation during occupation. On the other hand, houses constructed based on contractor-driven approach ex nihilo and contractor-driven approaches in situ have not be transformed after occupation. Besides, under the contractor-driven approach and the duration of reconstruction can be decreased. Taking into account the urgent need for shelters in case of emergency, the high speed of work can be considered as the main advantage of this approach.

2.3. Post-earthquake housing transformations

In analysing housing transformation, it is important to identify the factors affecting on the housing transformation. Shiferaw (1998) recognised five factors for evaluating physical quality of housing transformation: *1) morphologies, 2) occupancy rate, 3) functions, 4) building materials,* and *5) façade.* This categorisation was later experimented in low-income and informal houses in Haifa-Israel by Portnov and Odish (2006). With regards to key indicators of housing transformation, Shiferaw (1998) asserted that the following five indicators have the highest influences on housing transformations: *1) tenure form, 2) original dwelling (initial housing plan), 3) financial sources, 4) employer labor,* and *5) infrastructure*. With regards to motivations of housing transformation, Rapoport (1995) claimed that socio-cultural determined aspirations are the main motivations for constructing the houses and focused on housing changes in traditional contexts. From a similar perspective, Salam (2006) developed housing motivations and chaining houses with lifestyle theories by analysing the impacts of lifestyle models on housing transformation. He also analysed housing transformation in three lifestyle models namely *work-based, attitude-based,* and *status-based.* This concurred with Shiferaw (1998) who claimed that common motivation of housing transformation are: socio-culturally determined aspirations; changing of households' structure, comprising of the size and structure of the family; desire of generating income (by modifying the function of housing to a commercial building); reply to harsh climatic conditions; desire to copy prevalent housing forms; new aspiration to change traditional housing forms. Based on the reviewed theories, this paper investigated the motivations of housing transformation in Iran by categorising them into three groups: 1) architectural factors, 2) socio-cultural factors, and 3) economic factors.

2.4. Types of architectural transformation

Brand (1994) identified two types of housing transformation, namely "add-In" and "add-On". In add-In transformation, the changes are done inside the existing building without constructing any additional space whilst add-On comprises of additional constructions. Consequently, add-On transformation system has the potential to expand the built area of the building. According to Tipple (1996), in add-In building transformation, internal walls are capable to be modified based on households' requirements so it gets hold of adjusting indoor spaces into new condition, whilst add-On transformation is done for getting larger indoor spaces. In another classification of housing transformation, Salama (1998) categorised the transformation into two categories namely exterior and interior transformations. According to Nguluma (2003), exterior transformation consists of changing façade, windows, and housing extensions, whilst, interior transformation refers to modifications of indoor spaces by only relocating internal walls and changing room sizes. This paper also discusses the level or extent of the house transformation. Mahmud (2007) developed Brand's (1994) findings in order to categorise housing transformation into four levels: slight adjustment, addition and division, total conversion, and reconstruction. Okatay and Orcunoglu (2007) added 'Rebuilt' as one more level, where the houses are changed fundamentally; normally, for transforming courtyard and terrace-houses into apartments. Housing transformation process determines the actual relationship among initial housing quality, transformation period, and final product and the determinant factors during this process could be categorised as: 1) physical, 2) functional, 3) financial, 4) architecture, and 5) ecological factors (Flier *et al.*, 2004).

3. Research Methodology

In order to investigate long-term and short-term impacts of post-earthquake housing in Iran, this study employed case study research methodology (Yin, 2003). The study sought advantages and disadvantages of current trends in post-earthquake housing reconstruction in Iran and extended the previous experiences to form its theoretical recommendations for enhancing the post-earthquake housing process in the future. Lar city was selected as the case of this study for three major reasons as follows: 1) completing a full lifecycle for post-earthquake houses, 2) similarity between climatic and geographical conditions of Lar and those for high-risk zones of central parts of Iran, and 3) homogeneity in original dwellings in post-earthquake houses of Lar city. This research documented full details of specifications of any original dwelling in Lar's post-earthquake area as the units of analysis. The presented information comprises of urban design drawings and documents, architectural drawings and documents, and photographs of construction process in 1961. Here using content analysis, the study extracted the existing familiarities and differences among all houses from different periods. Afterwards, the study investigated the transformation process of each house and documents the similarities and differences. In this stage, the study mostly relied on the aerial photographs as the horizontal indicators and the photographs of the façades as the vertical indicators. The study repeated this stage for four different decades. It also relied on the further clarifications by occupants of these houses who attended interviews. For data collection purposes, the study used systematic observation method. McCall (1984) argued that although systematic observations are similar to formal observations, the could also control observational errors by preventing the bias of researcher. The conducted observation investigated transformations by thoroughly reviewing the plans layouts and elevations of the buildings. Afterwards, the study encoded the collected data based on prepared observation checklist sheet.

The sample of this study comprises of 189 post-earthquake houses. All the collected data have been assigned a code in accordance to observation checklist sheet in order to be analysable in Statistics Package for Social Sciences (SPSS). The observation checklist sheet was developed based on research objectives and research questions. It consisted of six parts. The first part which covered the house numbers assigned 2 numbers to each house: 1) number of block and 2) number of the house. The second part of observation checklist which referred to housing transformation activity recorded the quality of extensions, changes in function, demolishing, and division of each house. In addition, it identified transformation of opening, morphology, and façade in PEHs. The third part of observation checklist which focused on housing transformation explained the date of post-earthquake house transformations throughout four decades. Moreover, it highlighted the type of transformation and extension. The fourth and fifth parts of observation checklist referred to research hypotheses. They compares transformed PHEs with original dwelling and per-earthquake houses in accordance to five components: 1) layout, 2) typology, 3) materials, 4) openings, and 5) ornamental elements. In the last part of observation checklist, locations of houses were illustrated for finding relationship between housing transformation and the location. Moreover, two pictures and four plans of post-transformation houses were attached to each observation checklist. Pictures also illustrated vertical transformation and changes in façades, whilst plans highlighted housing transformation process from 1970 to 2007.

The initial observation checklist sheet was designed without including the parts Four and Five. Photos and plans were also not attached to the initial observation checklist sheet. During the pre-test of systematic observations, data addressed one block of grid houses (block number 15). The pre-test highlighted two deficiencies in observation checklist as follows: 1) result of pre-test was not quite related to research objectives; and 2) observation checklist did not have documentable photographical resources. Observation checklist, therefore, was redesigned in order to cover research objectives and also to attach pictures and plans. It has been checked again in one block of grid of houses (block number 15) and analysed in SPSS. The site was observed for 25 days. Each observation took place from 6:00am to 11:00am and also from 4:00pm to 7:00pm. The first author personally carried out the observations and took photos.

With respect to validation and reliability, the study maintained the similarity among the viewpoints of all photographs in indexing the PEHs. Besides, the bias of the observers was controlled by designing and validating the checklist sheets prior to the data collection starts. However, in the pre-test of systematic observations a same post-earthquake house was investigated by two independent observers in order to increase the degree of confidence. When compared the results, the similarity of the information by two observers affirmed the reliability of the checklist sheet. Moreover, the attached photographs and as built drawings facilitates offsite supervisions on the collected data.

4. Results and Discussions

This section presents the specifications of the PEHs in Lar and their transformations based on the descriptive analysis of the results of the conducted systematic observations. The approaches of post-earthquake original dwellings in Lar are dependent on design patterns and reconstruction this city during 1960-61. Since there was no established post-earthquake housing policy in Iran, the reconstruction and rehabilitation approaches of Lar city was formed mostly based on the local experiences. This study identified three different stages for disaster management in Lar: relocating the city, constructing semi-permanent houses, and preparing infrastructure for future extensions.

Since the old city of Lar was located on high-risk zone of Iran, the first policy of post-earthquake house in Lar was relocating the city. Therefore, new constructions of Lar city were located on a land 4 km from the original city As such, the first task of the government was to convince people to move to the new city. The preparation of infrastructures for the new city and also constructing semi-temporary houses were completed within one year (1960-1961). However, most of the houses were occupied 2 years after this and this forced the government to prepare another phase of houses in the third year (Housing Planing Department, 2001). The very long delay between construction and occupation shows that the people were not quite satisfied with the built dwellings. This was further affirmed by the results of this study which showed that only 22.3% of the respondents who lived in post-earthquake houses were happy with their houses; whilst 51.1% of them did not like the houses, even after 49 years.

The second factor which led to better understanding about the specifications of post-earthquake houses in Lar was revealed through investigating the construction process of promptly constructed semi-permanent houses. Immediately after the disaster, public sector started to prepare 375 semi-permanent houses in order to address people's urgent needs. According to Alizadeh (2003), although this rapid construction assisted people by providing them with some immediate shelters, the low attention to previous qualities of the pre-earthquake houses was the most important reason that people mostly did not like the post-earthquake houses. According to the results of the conducted systematic observations in this study, 98% of post-earthquake houses have been transformed during occupancy period.

The third approach for mitigating the risks of the disaster in Lar was preparing infrastructure in order to facilitate consequent improvements and developments of PEH area. Therefore, the considerations were targeting the conversion of post-earthquake housing area into a comprehensive urban zone including all necessary facilities. The considered infrastructures for this purpose comprised of commercial facilities, pedestrian and vehicle accesses for all units, appropriate public transportation, easy access to offices and government services, and electricity and water supply. Providing these facilities was expected to prepare the PEHs for future developments during the occupancy period. The capacity of infrastructure was designed for addressing the needs of people when the population increases by 300% from 1960 until 1990 (Housing Planing Department, 1991). Therefore, Lar city can be considered as a transformable city in terms of over capable infrastructures as Shiferaw (1998) recognised this factor as one of the basic parameters in determining the transformability of urban areas. Therefore, this research was concerned whether there is a significant positive relationship between appropriate infrastructures and the rate of transformations in Lar city. Based on the nature of the question and taking into account the confirmed assumption about the normality in distribution of the independent variable, the hypothesis was tested by conducting *"Pearson Product-Moment Coefficient"* test on the results of the questionnaire. The conducted test affirmed the asserted hypothesis ($r=.191$, $n=189$, and $p<.01$). The study was also concerned with the relationship between accessibility of workplaces and the rate of transformations. However, based on the results of the study, there is not significant to support this assumption ($r=-.002$, $n=189$, and $p>.05$). This paper argues that this was because most of the people who lived the new-city area of Lar did not work in their neighborhood and they go to old-town for work. Therefore, there is equality for all respondents in answering the question about accessibility of their workplaces. This explains why there is no significant relationship has been detected.

The quantity of transformations in PEHs relate to the level and the type of their transformations. These factors reveal the differences in the post-earthquake houses before and after the transformations. For investigating the level of transformations in Lar's PEHs, this study employed Mahmud's (2007) categorisation which comprises of 5 levels: Slight Adjustment, Addition and Division, Total Conversion, Reconstruction, Rebuilt. Results showed that the lowest frequency belongs to Slight Adjustment and Rebuilt whilst the highest is for Addition and Division. This shows that the original dwellings are retained in Lar city whilst their specifications are changing in order to address minimum requirements of the residents. With regards to the types of transformations, the study identified three types of PEHs transformation in Lar, namely extension, demolish and division. According to the results from the observations, most of the transformations in Lar's PEHs could be classed as extension (83.5%), whilst only 5.2% of PEHs have been demolished and reconstructed and just 11.3% of them were divided into more houses. Quality of transformations however refers to architectural variables which evolve during transformation process. According to Shiferaw (1998) and Portnov and Odish (2006) the most important variables influencing the quality of housing transformations are as follows: morphologies, occupancy rate, function, building materials, and Façades.

Due to differences between morphology of pre and post-earthquake houses in Lar, people tried to transform the post-earthquake houses in order to fit them to their previous lifestyle. In other words, they transformed the new semi-detached PEHs into central courtyard houses which is was closer to the morphology of their pre-earthquake houses. Table 1 presents 8 types of transformed post-earthquake houses in Lar. From Table 1, it can be concluded that more than 51.1% of houses transformed into 7 and 8 type houses. A simple comparison reveals that these types are very similar to pre-earthquake houses. Therefore, it can be concluded that people have a strong tendency for rehabilitation of vernacular architectural forms. In the meantime, 32% of houses are transformed based on prevailing modern architectural styles. This also reveals that people also are following modern design in their transformations.

The other indicator in determining the quantity of transformations deals with land and built-up area or transformation in occupancy rate. Table 2 compares the land and built-up area of post-earthquake houses before and after the transformations. As it can be seen in Table 2, the most obvious transformation was on the utilisation of post-earthquake houses in which the residents made 98.4% more constructions on the same land.

According to data coming through the selected sample, only 6.9% of post-earthquake houses (26 units) have been transformed in terms of function. In those cases people have changed the houses into small commercial buildings (e.g. grocery shops, butchery, and vegetable and fruit shops), limited service centres (e.g. traveling agencies, house dealers, and beauty centre), or local clinics. All those facilities are equally distributed especially near main roads in all over the city. The results of the conducted systematic observation also revealed that only 6.5% of post-earthquake houses (18 post-earthquake houses) have been transformed by using similar materials of original PEHs, and changes in materials mostly have been caused by changes in functions or by housing extension. Moreover, the investigations reveal that the transformations of materials were independent of the time. Table 3 reveals this independence. Finally, the results revealed that 53.5% of Lar's PEHs have some transformations in façades. These transformations comprised of changes in colour, materials, and mass of the façades, and demolishment of the whole façade (Figure 1). The other important factor in transformations of façades is related to time. For example, there were very little transformations in façades prior to year 1990 after that, rapid pace of transformation occurs.

Table 1: Morphology of different types of transformed post-earthquake houses in Lar.

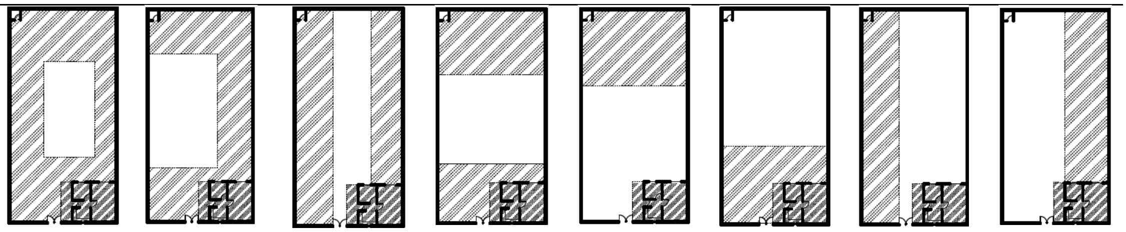
	TYPE8	TYPE7	TYPE6	TYPE5	TYPE4	TYPE3	TYPE2	TYPE1
Plan Figure								
Type	Courtyard	Semi courtyard	Type 1&2	Type 3&4	Separate Widthwise	Contiguity Widthwise	Separate Longitude	Contiguity Longitude
Freq.	40 (10.7%)	148 (39.4%)	1 (0.3%)	32 (8.5%)	123 (32%)	15 (4%)	4 (1.1%)	2 (0.5%)

Table 2: Comparison of land and built-up area of pre and post transformation post-earthquake houses.

	Districts 1-3	District 4 (post-earthquake houses before transformations-1962)	District 4 (post-earthquake houses after transformations-2007)
Number of residential units	4465	375	400
Average land area	375.8m^2	450 m^2	421.9 m^2
Average built up area	221 m^2	35 m^2	229.1 m^2
Average open spaces area	154.8 m^2	415 m^2	192.8 m^2
Average percentage of land area occupied by ground floor	58.8%	7.7%	54.3%

Table 3: Material transformations in post-earthquake houses during different periods.

First time of transformation	1960s	1970s	1980	1990	2000
Completely	3.6%	14.5%	9.1%	34.9%	37.5%
Very much	25.0%	25.5%	20.5%	16.3%	31.3%
Moderate	46.4%	40.0%	54.5%	32.6%	31.3%
Small	10.7%	18.2%	15.9%	14.0%	-
Very small	14.3%	1.8%	-	2.3%	-

Figure 1: Pre-Earthquake (Left), Post-Earthquake (Middle) and Transformed (Right) façades in Lar.

5. Conclusion

Reconstructed post-earthquake shelters in Iran are usually not suitable due to the limited time and funds. Eventually, victims need to transform initial temporary shelters in order to make them suitable for permanent occupancy. This study introduced new approaches for increasing housing transformability in PEHs in Iran. It considered housing transformation as a result of collaboration among government, designers, and occupants. The study posits that leveraging transformability in PEHs could promote temporary houses into permanent homes in post-earthquake area. The recommendations of this study could contribute towards creating some post-earthquake housing reconstruction policies, which could help the society achieve the following four main objectives: 1) enable occupants to modify PEHs based on their requirements and needs; 2) reduce PEHs reconstruction expenditure by designing PEHs for a long-term occupancy so that they are not demolished after occupancy; 3) provide the PEH residents with a high quality living area; 4) enable the residents for adapting their PEHs based on the changes in household structures. It is suggested that the above objectives must be achieved through three phases: 1) Pre-earthquake phase (through study of vernacular architecture in high-risk earthquake area and understanding the household's idea about their house in high-risk earthquake area); 2) Reconstruction phase (through considering the vernacular architecture in design of PEHs, taking into account the characteristics of original dwelling, and well in advance planning of infrastructure for PEHs); 3) Post-occupancy phase (by providing regulation for transformation of PEHs, continuous training of labours and contractors, and leveraging social corporate responsibility at PEH sites.

References

Alexander, D. (1984). Housing Crisis after Natural Disaster. *Geoforum, 14*, 489-516.
Alizadeh, A. (2003). Lar city after eartquake-1960. Lar: Fars education.
Arsalan, H. (2007). *The Evaluation of Temporary Earthquake Houses Dismantling Process in the Context of Building Waste Management.* Paper presented at the International Earthquake Symposium Kocaeli-2007.
Baradan, B. (2008). Review of Literature for the Concept of Post-Disaster Housing in Turkey. *Journal of Science, 2*(21), 43-39.
Barakat, S. (1993). *Rebuilding and Resettlement Nine Years Later: Case Study of the Contractor Built Reconstruction in Yemen Following the 1982 Dhamar Earthquake*. York: University of York,Inst.of Advanced Architectural Studies.
Barakat, S. (2003). Housing Reconstruction after Conflict and Disaster. London: Demand LTD.
Barenstein. (2005). A Comparative Analysis of Six Housing Reconstruction Approaches in Post-Earthquake Gujarat. Lugano: SUPSI.
Brand, S. (1994). *How building learn-what happens after they are built?* . London: Phonix illustrated.
Cole, P. M. (2003). *An Empirical Examination of the Housing Recovery Process Following Disaster*: TexasA&M University.
Davidson , C. H., Johnsona, C., Lizarraldea, G., Dikmena, N., & Sliwinskia, A. (2007). Truths and myths about community participation in post-disaster housing projects. *Habitat International, 31* 100–115.
Esin, T., & Cosgun, N. A. (2007). study conducted to reduce construction waste generation in Turkey. *Building and Environment 42*(4), 1667-1674.
Fallahi, A. (2007). *Architecture of post-disaster shelters*. Tehran: Shahid Beheshti University Press.
Flier, K. v. d., Schalkwijk, L., & Thomsen, A. (2004). *Sustainable Housing Transformation; towards an elaborated model for best practice analysis.* Paper presented at the ENHR "Housing: Growth and Regeneration",, Cambridge.
Housing Planing Department. (1991). Master Plan of Lar. Tehran, Iran.
Housing Planing Department. (2001). Comprehensive Plan of Lar. Tehran, Iran.
Kennedy, J., Ashmore, J., Babister, E., & Kelman, I. (2008). The Meaning of 'Build Back Better': Evidence from Post- Tsunami Aceh and Sri Lanka. *Journal of Contingencies and Crisis Management, 16*.
Mahmud, S. (2007). Identity Crisis Due to Transformation of Home Environment: The Case for Two Muslim Cities, Dhaka an Hofuf. *METU JFA*, 37-56.
McCall, G. J. (1984). Systematic Field Observation. *arjournals*, 263-281.
Nguluma, H. (2003). *Housing Themselves*. Stockholm: Royal Institute of Technology.
Okatay, M., & Orcunoglu, H. (2007). *Evaluation of Traditional and Recent Residential Environments from User's Point of View: The Case of Ozankoy, Northern Cyprus.* Paper presented at the Sustainable Urban Areas.
Portnov, B. A., & Odish, Y. (2006). Factors Affecting Housing Modifications and Housing Pricing: A Case Study of Four Residential Neighborhoods in Haifa, Israel. . *Journal of Real Estate Research, 27*(4), 371-408.
Rapoport, A. (1995). A Critical Look at the Concept "Home". In D. N. Benjamin (Ed.), *The Home: Words, Interpretations, Meaning, and Environments* (pp. 25-51). Hants, UK: Avebury.
Salama, R. (1998). Understanding Transformation of Public Housing in Egypt. *Open House International, 23*(1), 23-40.
Shiferaw, D. (1998). Self-initiated transformation of public-provided dwelling in Addis Ababa,Ethiopia. 437-448.
Tasa, N., Cosgunb, N., & Tasa, M. (2007). A qualitative evaluation of the after earthquake permanent housings in Turkey in terms of user satisfaction—Kocaeli,Gundogdu Permanent Housing model. *Building and Environment, 42*, 3418–3431.
Tipple, A. G. (1996). Housing Extensions as Sustainable Development. *Habitat International*, 367-376.
Yin, R. K. (2003). *Case Study Research: Design and Methods* Sage Publications.