

A MODEL FOR POST-DISASTER RECONSTRUCTION: THE CASE STUDY IN DINAR/TURKEY

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Abstract

Post-disaster occupants may have different expectations from their post-disaster houses in relation with their living conditions, social and cultural structures formed in their previous urban or rural settlements.

Therefore, the objective of this study is to introduce a reconstruction model on the “design” of the post-disaster houses in rural or urban areas that is appropriate for the user background, requirements and preferences.

With the help of the case study in Dinar district, additionally Aktoprak and Gencali villages in Afyon, this research shows that appropriate design of post-disaster houses must be in accordance with occupants’ changing needs and preferences appropriate to regional living conditions.

Keywords: Post-disaster houses, housing preference, residential satisfaction, design criteria and evaluation, reconstruction/design model

INTRODUCTION

The residences, all living areas, buildings and human relations; in brief, the social and physical environment established by mankind are badly affected from natural disasters such as earthquakes, floods, tornados and others. For the sake of survival, human beings become helpless in overcoming the big loss when they go through in post-disaster period.

In order to re-organize the socio- economical life of survivors, the post-disaster period recovery actions should be identified in detail. The construction of post-disaster houses and settlement areas play important roles in these actions.

However, post-disaster occupants may have different expectations from their post-disaster houses in relation to their living conditions, social and cultural structures that are required by their previous urban or rural settlements. Therefore, the objective of this study is to introduce a reconstruction model on the “design” of the post-disaster

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houses in rural or urban areas that is appropriate for the user background, requirements and preferences.

Old settlement and the permanent post- disaster houses in Dinar

Dinar (population 35,000 in 1990) is in a sparsely populated rural agricultural city center in the "Lake District" of southwestern Anatolia, Turkey. Mostly farming, breeding animal and family poultry or governmental works are the profit sources of Dinar.

It was struck by an earthquake, its magnitude, 6.1 Richter Scale, in 1st October 1995. The damage that it created on habitat is; 1,228 houses were totally destroyed or heavily damaged, 990 houses were moderately damaged, and 1,558 received minor damages and minimum of 90 men, women, and children died in their homes or in public buildings. Over 250 people injured. The (lodging / accommodation/ sheltering) problems can be accounted as striking results of the impact of this natural disaster more than its resembling ones in history.

Buildings in Dinar are one to five storeys (mostly are one or two storeys buildings). The first levels of multistorey buildings in the center of Dinar are usually occupied by commercial retail stores. Almost all the five-storeyed apartment buildings were destroyed or heavily damaged. These buildings, as with the buildings on the main streets, were built with reinforced concrete. But mostly, one or two storeyed buildings' were built by either solid or hollow brick walls as also seen in village settlements of Dinar.

Permanent post-disaster housing construction was finished one year after (in 29th October 1996) the earthquake disaster. In the center of the Dinar there are two types of post-disaster houses. First type has 4 storeys and 16 flats in total. 4 flats were planned in each storey of the building. Second type also has 4 storeys but has 4 shops in ground floor and 6 flats in upper floors totally. Every storey has only two flats.

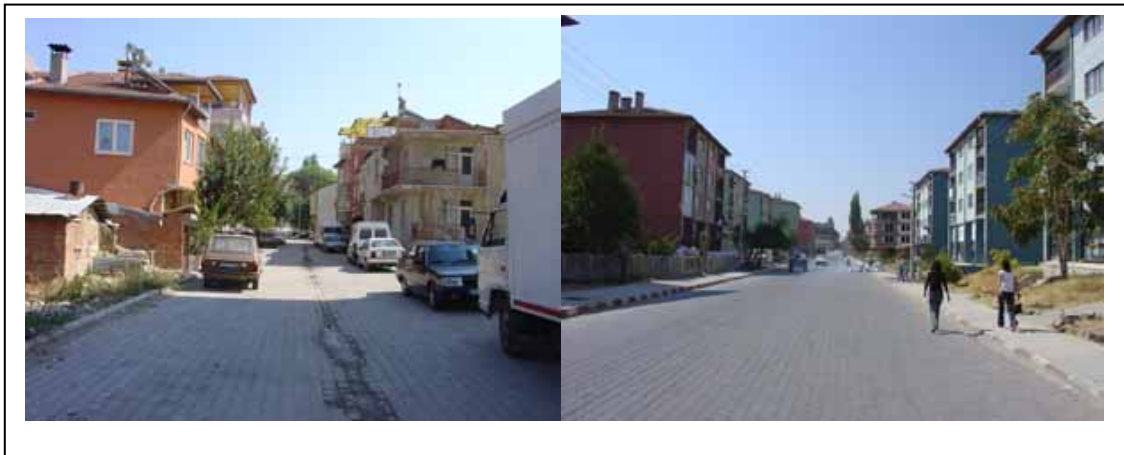


Two types of post-disaster houses in center of Dinar

Crowded families in the center of Dinar who get used to live in one or two storey buildings and have no experience of apartment life, start a new life in small apartment flats with new neighbors. The post-disaster houses don't have eligibility for daily usage. These apartment flats with two bedrooms have insufficient space for their social and cultural life style, not enough for large families, not flexible for constructing additional parts, cause serious problems and stress on survivors. Before the disaster, when they need, could easily add parts to their old houses, but the strict structural features of the post-disaster houses don't let them. Because of that most of the survivors built their new houses without controlled by local authority.

With the new urban master plans of Dinar, instead of narrow, disordered, spontaneously developed streets within one or two storeyed, solid or hollow brick walled buildings with large gardens; new gridal formed wide streets and four storeys buildings constructed by tunnel mould system with small gardens, were organized.

Post-disaster houses with shops were built on the main streets and new intercity motorway to make additional new city trade and shopping centers.



Old and new streets in Dinar City

In villages of Dinar there is only one type of post-disaster house. It is one storey building with a detached storeroom in a small garden. Survivors, according to their needs, built additions and changed some part of their post-disaster houses which can make the structures of the houses weaker against to new earthquakes

Therefore, with the help of the case study held in Dinar district, additionally Aktoprak and Gencali villages in the countryside of Afyon, we might easily understand the user background, requirements and preferences for suitable design of the post-disaster houses in rural or urban areas.



Post-disaster houses in villages of Dinar



Additional parts of post-disaster houses in villages of Dinar

Method

The case study was done with the people living in villages of Dinar (Aktoprak Village and Gencali Village) and center of Dinar City with the method of individual face-to-face interviews and conducted among the selected sample of a total of 70 earthquake survivors. The sample group consists of 35 people living in center of Dinar City, and 35 people living in rural area of Dinar City.

The case study was applied in two steps. In first step with a “fill in questionnaire”, in order to learn about socio-demographic structure (age, education, income, job, social development and standards, family structure, neighborhood relations, etc.) and about features of their old houses and the settlement before earthquake happened and thirdly getting responses and opinions about their permanent post-disaster houses.
















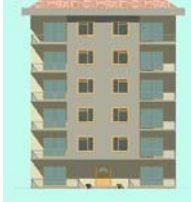
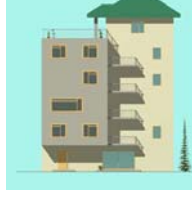

Showing the house images

In second step with the help of house images (one storey, two-three storeys and multi storey houses) asking questions to the survivors which are related with housing preference (strength, safe, eligibility and aesthetic view) and find out the answers of design criteria in new physical environment by using survivors perception and experiences.

According to answers of the survivors, data were inserted to variable tables. By using these variables; expectations, reactions and preferences of occupants about the post-disaster houses were compared to their socio-demographic background, disaster experience, perceptual changes, individual values, living habits and spatial occupancy durations. And by using chi-square test, correlations in variables ($p \leq 0.05$) were explored and meaning of the dispersals was evaluated.



Showing the house images

One Storey	OS 1	OS 2	OS 3	OS 4
				
Two-Three Storeys	TS 1	TS 2	TS 3	TS 4
				
Multi Storeys	MS 1	MS 2	MS 3	MS 4
				
	MS 5	MS 6	MS 7	MS 8
				

House images that were shown to survivors

Results

In the context of case study, held in Dinar district, additionally Aktoprak and Gencali villages, these results were found in analysis of architectural design of post-disaster houses in rural or urban areas;

- Need of garden, according to family structure: Differences were found in preferences of garden use according to occupant's economic responsibilities in family, need of semi-opened areas, number of person living together in one flat, age and living experience in other settlements. Because of that, according to the need of open areas and gardens in a disaster area, we have to decide the size and form of the garden(s) and also design different types of house plans with or without garden.
- Living in an apartment, being citizen: In rural areas like Dinar, people use to live in one or two storeys buildings instead of multi-storey apartments. They were

forced to live in an apartment building (four storeys post-disaster house) with many families who never know each other before. A new experience of living in an apartment life, make deep social problems. Because of that before starting to design we have to make a research about the height of the existing old buildings, social and cultural life style of the disaster area.

- Use of semi-opened space: The size, form and number of balconies or terraces that are needed in houses show differences, related to social and cultural life in disaster areas. Because of that before starting to design we have to know about customs in use of semi-opened spaces in disaster area.



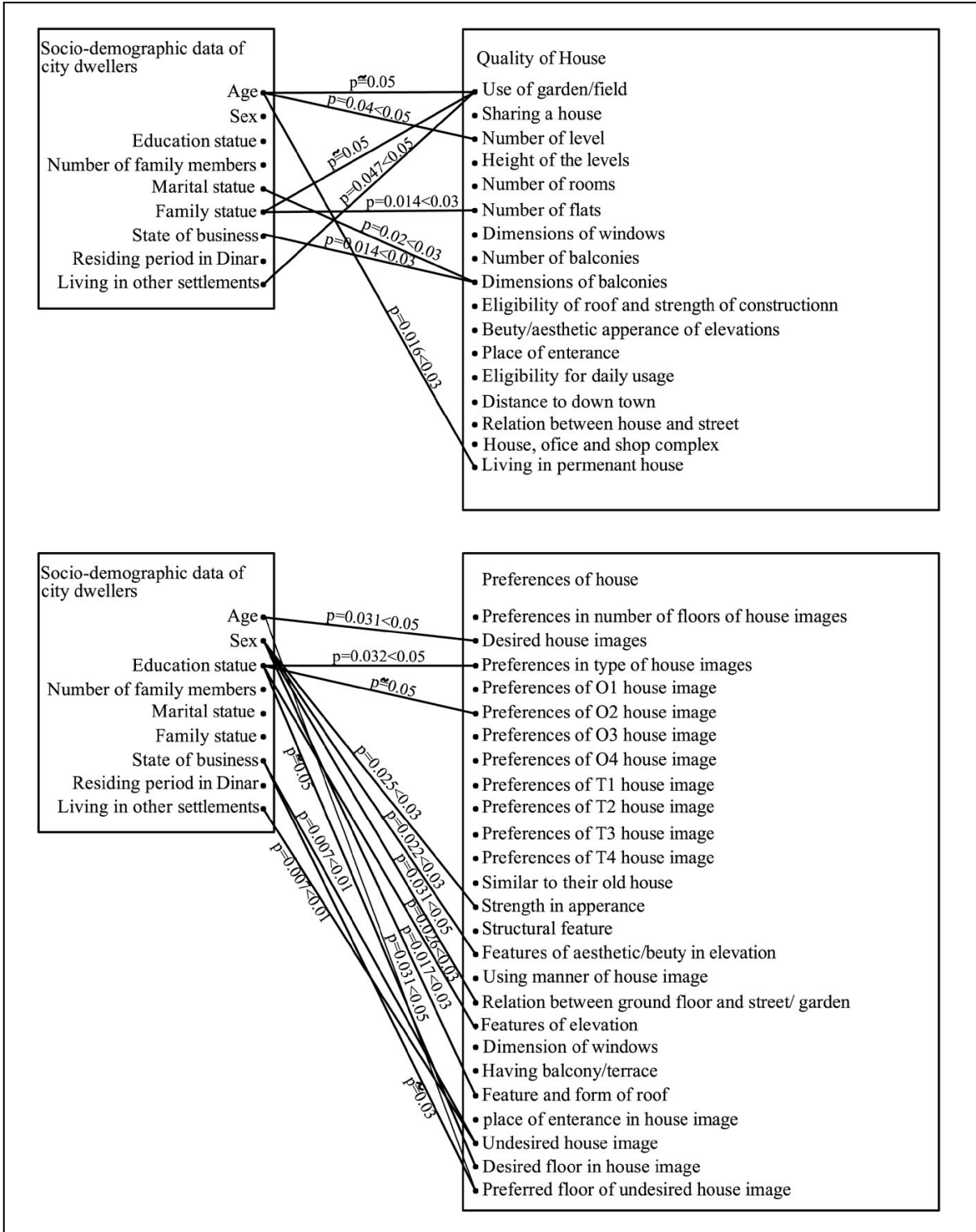
Need of semi-opened space

- Feature of building elevation and aesthetical appearance: In design of the elevation, order of windows and balconies, proportions and structure give an aesthetical appearance to the building but also make survivors feel the strength and safe in their new houses.

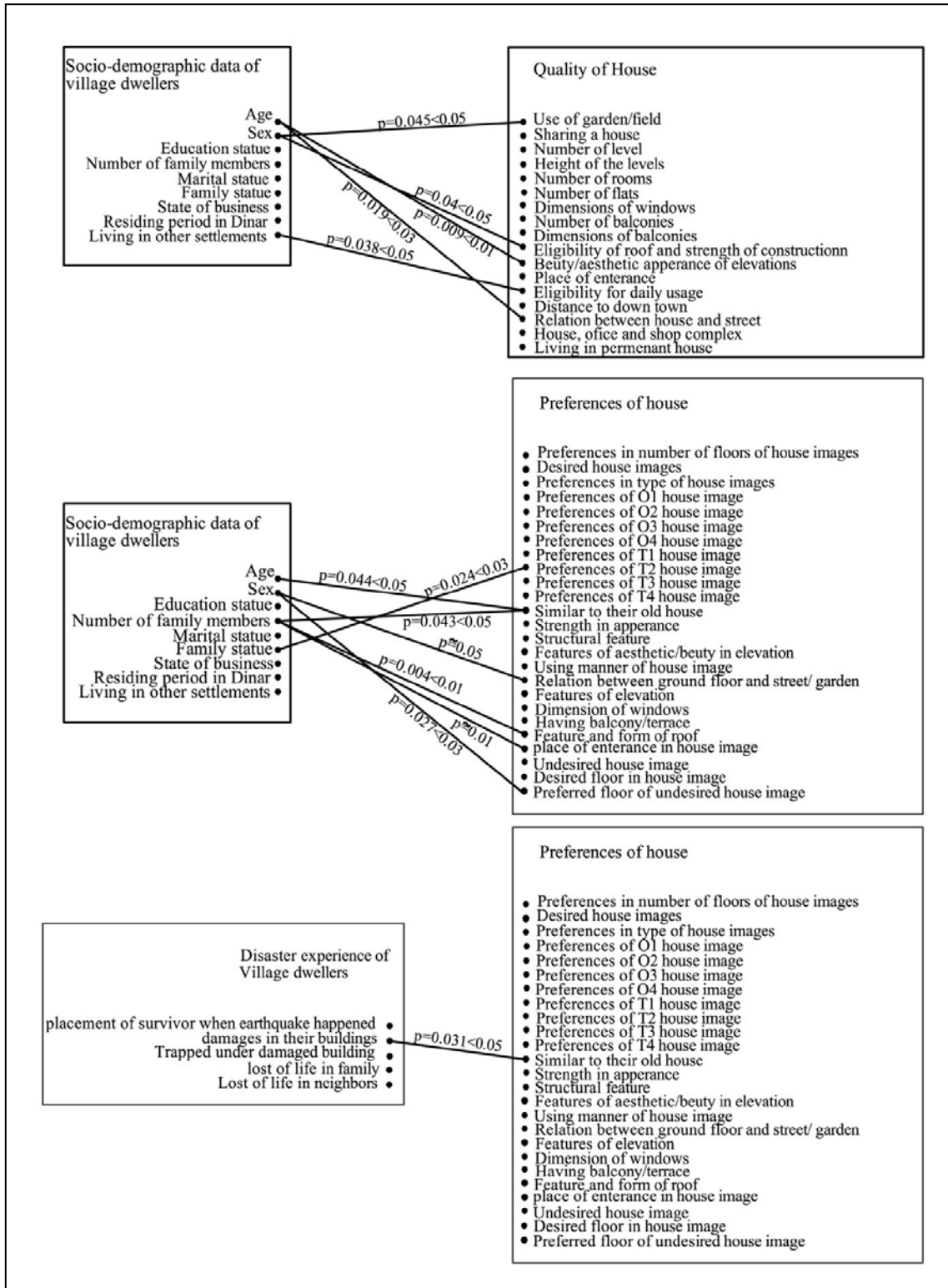
- Building, garden and street relations: In rural and urban settlements, according to occupant's needs, we have to make different levels of relations (privacy, semi-privacy and public spaces) between building, garden and street.

- Flexible design: The post-disaster houses in Dinar have insufficient space for survivors' social and cultural life style, not enough room for large families. Because of that, to find out the number of space, which is needed by the occupants, we have to know about the family structure and search the average number of people living in a family. And also we have to design flexible spaces for new additions, which may not be harmful for structure against to new earthquakes.

- Density of occupants in houses: Different types of post-disaster house must be designed according to number of flats and density of people, which can be accepted by occupants.



Correlations of city dwellers



Correlations of village dwellers

- Fear of earthquake: People in Dinar are afraid of four or more storeys post-disaster buildings, because they think that, when an earthquake starts, getting outside from these houses is impossible compared to one or two storeys buildings which seem better in rescuing and make them feel in safe.

- Depending on farming: In rural settlements, people make farming. They need additional parts for different functions such as bread house for making bread, a stable, a poultry-house, a sheep-fold, larger storeroom, a garage for their tractor. Because of that we have to make one or two storeys post-disaster house designs that can be developed horizontally.

The results of the case study showed us that, the design of post-disaster houses in accordance with occupants' changing needs and preferences that is appropriate to the regional living conditions, the issue of having no adaptation problem is mainly depended on serious design decisions.

Therefore, before starting to reconstruct the post-disaster settlements, we need a model in which data on demographical structure, cultural characteristics, disaster experience, spatial occupancy habits included and post-disaster house usage in general should be evaluated with a high rate of user participation.

A model for post-disaster reconstruction

Within the help of the case study, a model for post-disaster reconstruction is proposed, in which design input as knowledge and experience of each post-disaster house construction will be transferred to the next design and construction processes. This model consists of four stages: preparation, design, construction and post-occupancy evaluation.

- Preparation: In this preparation stage, governmental and non-governmental organizations make researches about socio-demographic variables, cultural attributes and manners, climatic variables, disaster experiences and the psychological problems that are seen in disaster area and also decide about new construction sites and distribution of the post-disaster houses to the survivors.

- Design: This design decisions stage consists of three parts: post-disaster house alternatives, user participation and design of post-disaster houses.

Post-disaster house alternatives: In this pre-design part, different plan and elevation alternatives are prepared according to the construction materials and working sources that are found in the disaster area.

User participation: Suitable design for post-disaster houses in accordance with occupants' changing needs and preferences that is appropriate to the regional living conditions is mainly depended on user participations. Because of that in this level designer use the images of post-disaster house alternatives to evaluate them with

the survivors by face-to-face interviews. With the help of post-disaster house images and questionnaires, designer(s) learn about occupant's needs, residential satisfaction, housing preference, order of the spaces and stressors in the disaster area.

Design of post-disaster houses: With the help of the inputs from interviews and preparation level, post-disaster house designs are done.

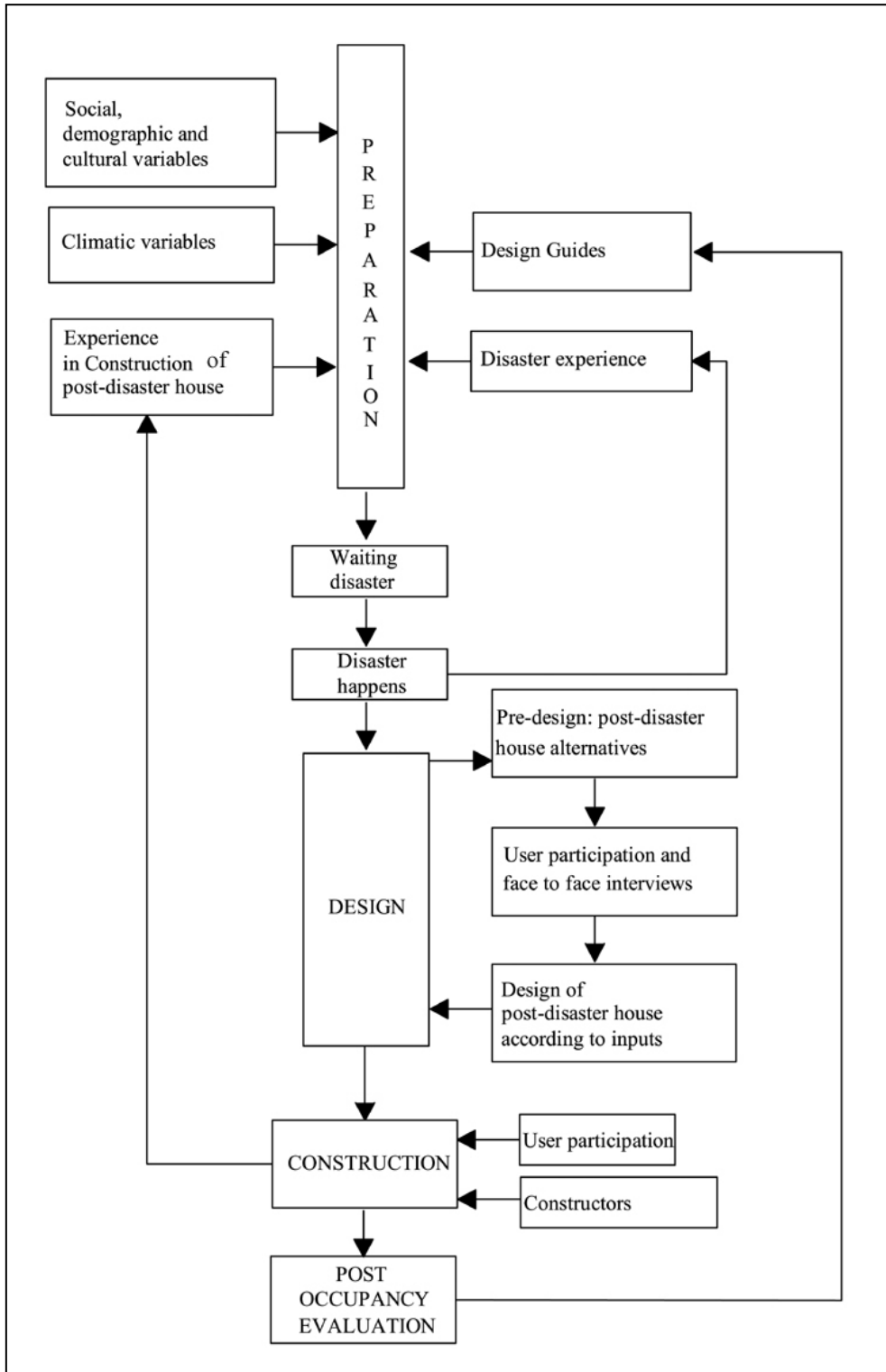
- **Construction:** Within the scope of this construction stage, two different construction methods are proposed, which have both advantages and disadvantages compared to each other. The methods are chosen according to material and working sources in disaster areas and the participations of survivors. First proposed method is user own construction and the second one is conventional construction method.

User own construction: In this method, according to master plan (decisions about sites, roads, general settlement plans and types of post-disaster houses) users participate to the construction. Each survivor selects one of the suitable post-disaster house projects, then obtains the construction materials and starts to construct their house due to master plan with the help of controllers.

Advantages; constructions are under controlled so structure of the houses are strong against earthquakes. Because of survivors' own construction, no need for new additions, houses reflect their identity, having no adaptation problems, psychological and environmental stressors are decreased. Disadvantages; because of their first construction, teaching the construction details and knowledge takes time.

Conventional construction: In this method, a constructor does construction of the post-disaster houses. Survivors participate to the design stage, but not construction. Advantages; construction is done faster than other method. No risk, problems will be solved by constructor. Disadvantages; this method increases the costs, all buildings similar to each other (stereotypical) because of that adaptation problems and uncontrolled additions can be seen.

- **Post-occupancy evaluation:** In this stage, design guides that can be used in new design and construction stages, are introduced according to occupants' experiences of living in post-disaster houses. All variables such as order of opened; semi-opened and closed spaces, additions, residential satisfaction and housing preferences are composed into the design guides with the help of written and visual questionnaires. In each experience, design guides will be investigated and revised and after that it can be used as a reference for new design processes.



A model for post-disaster reconstruction

Conclusion

The results, which are obtained from case study, show that almost complete damage of the physical environment, moreover disrupted social environment of the people who lived in this area, unpredicted amount of the property loss and the sudden change in their living conditions increase the pessimism in their lives, thus the increasing level of environmental stress has been tied to these conditions. And we can say that the effects of disasters can be decreased by a model on the “design” of the post-disaster houses in rural or urban areas that is appropriate for the user background, requirements and preferences.

So that in this paper, a post-disaster reconstruction model is proposed which helps us as a reference for arranging pre-design data, introducing design measurements, choosing construction methods and making design guides in design and construction processes. And also which is revised according to new inputs as knowledge and experience of each post-disaster house construction and transferred to the next design models

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