A PROVISION MODEL AND DESIGN GUIDELINES FOR PERMANENT POST-DISASTER HOUSING IN RURAL AREAS OF TURKEY BASED ON AN ANALYSIS OF RECONSTRUCTION PROJECTS IN ÇANKIRI

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

NEŞE DİKMEN

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE
OF DOCTOR OF PHILOSOPHY IN BUILDING SCIENCE
IN
ARCHITECTURE

SEPTEMBER 2005

Approval of the Graduate School of Natural and Applied Sciences

Prof. Dr. Canan Özgen
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Doctor of Philosophy.

Assoc. Prof. Dr. Selahattin Önür
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Doctor of Philosophy.

Asst. Prof. Dr. Soofia Tahira Elias-Özkan
Supervisor

Examining Committee Members

Assoc. Prof. Dr. Arda Düzgüneş (METU, ARCH) _____

Asst. Prof. Dr. Soofia Tahira Elias-Özkan (METU, ARCH) _____

Prof. A. Müge Bozdayı (Hacettepe Unv., Interior Design) _____

Assoc. Prof. Dr. Ali İhsan Ünay (METU, ARCH) _____

Assoc. Prof. Dr. Ali Cengizkan (METU, ARCH) _____

I hereby declare that all information in this thesis document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name: Neşe Dikmen

Signature :

ABSTRACT

A PROVISION MODEL AND DESIGN GUIDELINES FOR PERMANENT POST- DISASTER HOUSING IN RURAL AREAS OF TURKEY BASED ON AN ANALYSIS OF RECONSTRUCTION PROJECTS IN ÇANKIRI

Dikmen, Neşe
Ph.D., Department of Architecture
Supervisor: Asst. Prof. Dr. Soofia Tahira Elias-Özkan

September 2005, 150 pages

Studies on post-disaster housing in rural areas of Turkey show that these houses do not respond to all the needs of users. After the earthquake of June 2000, 1,221 permanent post-disaster houses (PDH) were erected in the villages of Çankırı. Some of these PDH were built with *Typical Designs* while others were custom-designed for the beneficiaries who had rejected the *Typical Designs* of the Ministry of Public Works and Settlement.

The aim of this study was to pinpoint those factors of the PDH which led to satisfaction or dissatisfaction among the beneficiaries and, hence, abandonment of these houses. A survey was carried out in the area to determine the types of PDH built – used or abandoned – any additions or alterations made and for which purpose, and user's degree of satisfaction with their houses. Those PDH which were altered and to which any additional spaces were added were measured and drawn to visually record the changes made by the beneficiaries. A random sample of 90 families was selected for the investigation. A questionnaire was prepared for the study which was administered to the permanent users of the PDH with *Typical Designs* and *Custom Designs* and the beneficiaries who refused to move to

the PDH with *Typical Designs*. Data obtained from the questionnaires was analysed with the help of statistical tools. It was revealed that *Traditional Houses* in the villages are better equipped to answer the local needs; PDH with *Typical Designs* do not meet the needs of the users; PDH with *Custom Designs* are closer to user needs; and that some beneficiaries who refused to move to new settlements preferred to construct PDH on the lots of their previous houses.

In addition, a survey was carried out in the villages to understand geographical, topographical and climatic conditions and house typology in the region. Additions and modifications made in the PDH with *Typical Designs* were recorded and at the end of the study, guidelines for post-disaster reconstruction works and design of PDH in rural areas have been proposed.

Keywords: Post-disaster housing, post-disaster reconstruction, rural housing.

ÖZ

TÜRKİYE'NİN KIRSAL ALANLARINDA UYGULANACAK KALICI AFET KONUTLARI İÇİN ÇANKIRI'DA UYGULANAN YENİDEN YAPIM PROJELERİNİN ANALİZİNE DAYANAN BİR KONUT SAĞLAMA MODELİ VE TASARIM KILAVUZU

Dikmen, Neşe
Doktora, Mimarlık Bölümü
Tez yöneticisi: Yrd. Doç. Dr. Soofia Tahira Elias-Özkan

Eylül 2005, 150 sayfa

Türkiye'de kırsal alanlarda uygulanmış afet konutları ile ilgili yapılan çalışmalar, bu konutların kullanıcıların bütün ihtiyaçlarına cevap vermediğini göstermektedir. Haziran 2000 depreminden sonra Çankırı'da 1221 adet kalıcı afet konutu inşa edilmiştir. Bu konutların bir kısmı T.C. Bayındırlık ve İskan Bakanlığı tarafından önerilen tip projeler, bir kısmı da tip projeleri reddetmiş olan hak sahipleri için tasarlanmış olan özel projelerden oluşmaktadır.

Bu araştırmanın amacı, hak sahipleri arasında memnuniyet ya da memnuniyetsizliğe ve reddetmeye neden olan faktörleri ortaya çıkarmaktır. İnşa edilen – kullanılan veya reddedilmiş – afet konutlarının tipleri, bu konutlara yapılan ekler ve değişiklikler ve bunların hangi amaçlarla yapıldığı ve kullanıcı memnuniyetinin derecesini ortaya koymak üzere bölgede bir çalışma yapılmıştır. Yapılan değişiklikleri görsel olarak ortaya koyabilmek için değiştirilmiş ve ek yapılmış olan afet konutların röleveleri alınmış ve çizimleri yapılmıştır. Bu araştırma için rastlantısal olarak 90 adet aile seçilmiştir. Çalışma için, tip ve özel projelerin sürekli kullanıcıları ve tip projeleri reddetmiş olan hak sahiplerine uygulanmış olan bir anket hazırlanmıştır. Söz

konusu anketten elde edilen bilgi istatistik yöntemleri ile analiz edilmiş ve köylerdeki geleneksel konutlarının yöresel ihtiyaçları karşılayacak şekilde daha iyi donatıldığı; tip projelerin kullanıcı ihtiyaçlarını karşılamadığı; özel projelerin kullanıcı ihtiyaçlarına daha yakın olduğu ve yeni yerleşimleri reddeden hak sahiplerinin afet konutlarını önceki evlerinin parselleri üzerinde inşa etmeyi tercih ettikleri ortaya çıkmıştır.

Ek olarak, yörede coğrafi, topografik, ve iklimsel koşulları ve konut tipini anlamaya yönelik araştırma yapılmıştır. Tip afet konutlarına yapılan ekler ve değişiklikler kaydedilmiş ve çalışmanın sonunda kırsal alanlarda uygulanacak kalıcı afet konutları için bir konut sağlama modeli ve tasarım kılavuzu önerilmiştir.

Anahtar kelimeler: Afet konutları, afet sonrası yeniden yapım, kırsal konutlar.

To My Parents

ACKNOWLEDGMENTS

I would like to express my gratitude to my supervisor Asst. Prof. Dr. Soofia Tahira Elias-Özkan for her guidance and encouragement throughout the research. I would also like to thank to Prof. A. Müge Bozdayı and Assoc. Dr. Arda Düzgüneş, members of my doctoral steering committee, for their valuable ideas which contributed to this study.

I would like to express my gratefulness to the officials at the General Directorate of Construction Affairs and General Directorate of Disaster Affairs at the Ministry of Public Works and Settlement who provided the information about the post-disaster reconstruction program conducted in the villages of Çankırı.

Thanks are also due to Randolph Langenbach, who encouraged me to complement this research with his EERI research project “A Comparative Study of Earthquake Recovery issues involving the Performance of Buildings of Timber-laced Masonry Vernacular Buildings in Turkey”; and to Prof. Dr. Yusuf Ziya Özcan from the Department of Sociology at Middle East Technical University, for his help in finalizing the questions and format of the questionnaire.

I would like to express my appreciation to Prof. Dr. Colin H. Davidson for his advice during my research at Université de Montréal in Canada.

Many special thanks go to my dear friend Cassidy Johnson, who offered her house during my research in Canada, for her hospitality and valuable ideas.

I wish to express my gratitude to my parents Saniye and Mehmet Bozkurt for their encouragement and self-sacrifice throughout all my life; and to my

husband Barış for his support and patience throughout this research and valuable help during the field survey.

Finally, I would like to offer my thanks to the villagers in the study area for their hospitality and sharing their experiences and feelings about the post-disaster houses and post-disaster reconstruction program conducted in the region.

TABLE OF CONTENTS

LIST OF TABLES

TABLES

LIST OF FIGURES

FIGURES

LIST OF ABBREVIATIONS

ABBREVIATIONS

PDH : Permanent post-disaster houses

GDDA : General Directorate of Disaster Affairs

GDCA : General Directorate of Construction Affairs

Ministry of PWS: Ministry of Public Works and Settlement

TA : Traditional house

CD : Custom designs

TD : Typical Designs

CHAPTER 1

INTRODUCTION

In this chapter are presented argument and the objectives of the study, followed by an overview of its general procedure and outlines of the remaining chapters under the sub-heading “disposition”.

1.1 Argument

For centuries Turkey has been the scene of many natural disasters such as earthquakes, floods, landslides, avalanches *etc*. On an average, the number of houses damaged by disasters in the country are 4,000-5,000 per year (Şengün, 1996:1), 61% of which are damaged by earthquakes. Earthquakes are the most frequent and the most destructive among all disasters that strike this region. Turkey is located on the Mediterranean-Himalayan seismic belt, which is one of the most active earthquake-prone areas on earth (Acerer, 1999:80).

It is a fact that the material and the spiritual damage caused by disasters is less in developed countries when compared with the third world ones, for various reasons (Demiröz, 1996:4). El-Masri and Tipple (2002:157) state that natural disasters are becoming more severe and more frequent in the case of developing countries. This is undoubtedly the result of an increase of human settlements in vulnerable areas rather than a rise in the number of events such as earthquakes, hurricanes or floods.

Human settlements are generally divided into two, as rural and urban. Onat (1992:35-38) declares that the main differences between the two are their material and spatial specifications and their type of construction. In rural areas, agricultural production dominates the life style, whereas in urban

settlements, industrial production plays a more important role. In rural areas, a close relation exists between form and culture. The form is adjusted until it satisfies most of the cultural, physical and maintenance requirements. This model is fully uniform and dwellings are basically similar. Everyone in the society knows the building types and how to construct them. The owner is still a participant in the design process, but participation tends to decrease with urbanization and greater specialization. Rapid population growth leads to rapid design and construction in urban centres. Teams of professionals produce different types of designs for mass consumption thereby ignoring individual needs. In addition, there are differences between the construction materials; in rural areas the materials in the near environment are used to produce houses. One reason for doing that is to decrease the cost of the construction. In urban settings industrialized materials are used one reason for doing is that is to speed up the construction process.

Rural areas suffer more from disasters especially earthquakes in Turkey. Use of local construction techniques with indigenous materials without any engineering assistance is one of the reasons for vulnerability of the rural houses. In addition to economic constraints, climatic conditions and insufficiency of some materials may also force people to construct substandard buildings which are vulnerable to disasters.

Whenever a disaster strikes and leaves people homeless, there are some recovery works, including immediate and long term help carried out by governmental and/or private institutions. Permanent Post-Disaster Houses (PDH) are put up after disasters by the governmental and/or private agencies. The only difference between a PDH and a conventional house is that the former needs to be constructed as fast as possible in order to provide homes to people who have become homeless due to a disaster.

Demiröz (1996:7) claims that, a house fundamentally aims to satisfy the basic needs of human beings. But building a house is a cultural phenomenon. Its form and organization is greatly influenced by the culture to which it belongs. The cultural aspects of recovery after disasters haven't been given the same attention as the engineering and practical considerations; they have been almost neglected. Disasters of any scale are the interruptions of communities' cultural lives. The impacts may be sudden, immediate, devastating, traumatic and the most important permanent. It is a fact that post-disaster applications lead to changes in physical and social environments especially in rural areas where individuals are strictly stuck to their traditions. The form of change is large and the consequences are hazardous in most cases. According to Köse (1988:6), the important thing is not constructing at all, it is designing and constructing houses which are appropriate with the needs of communities.

It is a known fact that in rural areas where agricultural production is the mainstay of economy; a rural house also operates as the management centre of these agricultural activities, which is why it is constructed according to the environmental, geographical, social, economic and cultural factors specific to their area.

Rural areas have a priority in the evaluation of post-disaster housing activities since the majority of complaints and reaction stem from the houses built in these areas. Resettlements in rural areas are the end products of political decisions, governmental regulations and technological assessment, and are designed by outside agencies which have no or very little knowledge about communities. Thus they do not really match with the local patterns and traditional motives (Demiröz, 1996:1,93).

After the earthquake occurred on the 6th of June, 2000, 1,221 PDH were erected in the villages of Çankırı. The houses have been occupied by the

beneficiaries since 2002, so that this region was selected as the study area in order to reveal the positive and negative aspects of the PDH and the post-disaster reconstruction program conducted in the area.

Previous investigations focusing on PDH in different rural regions in Turkey at different times show that PDH projects have not been very successful; in fact these projects have been the cause of dissatisfaction amongst their users. It was also felt that the reasons for dissatisfaction with PDH lay both in their provision and planning strategies, hence the need for this study.

1.2 Objectives

The main objectives of this study were:

a) To investigate the post-disaster reconstruction program conducted in the villages of Çankırı.
b) To investigate the PDH erected in the area.
c) Find out negative and positive aspects of the reconstruction program.
d) Find out negative and positive aspects of the PDH.
e) To propose guidelines for post-disaster reconstruction projects.
f) To propose guidelines for design of PDH to be erected in rural areas of Turkey.

1.3 Procedure

The study was conducted in seven phases,

First, a literature survey was conducted in order to define the research problem and gain information about rural settlements, disasters and post-disaster reconstruction works.

Second, interviews were made with the officials from the General Directorate of Construction Affairs (GDCA) and General Directorate of Disaster Affairs (GDDA) at the Ministry of Public Works and Settlement (Ministry of PWS) several times to get information about the post-disaster reconstruction program conducted in the villages of Çankırı.

Third, initial visit was done to existing and new settlements in Çankırı in order to understand the house typology, types of locating PDH and types of PDH. Interviews were done with the beneficiaries to understand their experiences and feelings about the reconstruction program itself and the PDH constructed in the region.

Fourth, field survey was conducted in the villages of Çankırı: a) A traditional house in the study area was measured in order to understand the house typology; b) PDH constructed in the region were measured in order to reveal the alterations made on the PDH with *Typical Designs* and types of PDH with *Custom Designs*; c) A random sample of 90 families including permanent users of PDH and the beneficiaries who refused to move to new settlements, was selected for the study and a questionnaire was administered to the sample; d) As the author is involved in an international research project, field research was conducted and interviews were made by the author and civil engineer Sinan Akarsu for the "A Comparative Study of Earthquake Recovery issues involving the Performance of Buildings of Timber-laced Masonry Vernacular Buildings in Turkey" project under the leadership of Randolph Langenbach which complemented the study conducted for the doctoral research. Interviews were conducted with the officials of the Government and Prof. Dr. Polat Gülkan from the Department of Civil Engineering at Middle East Technical University about the subject of the project and some of the information gained through these interviews were included in this dissertation; e) A field survey was conducted including measuring and drawing the structural systems of the timber framed sun-brick

infilled "*hımış*" structures in Yuva Village of Orta for this research project but this work is not included in this dissertation.

Fifth, data obtained from the questionnaires administered to the permanent beneficiaries of the PDH was analysed with statistical tools in order to reveal the degree of satisfaction with the PDH and negative and positive aspects of these houses. Furthermore, data obtained from the questionnaires administered to the beneficiaries who refused to move to new settlements was evaluated in order to reveal the reasons for refusal of the new settlements.

Sixth, plans of the *Traditional House*, PDH with *Custom Designs* and modified PDH with *Typical Designs* were drawn to compare the spaces provided and their locations in the houses. Modifications in the PDH with *Typical Designs* were revealed with the help of the measurements, data obtained from the questionnaires, photographs taken and visual observation of the houses. These helped to understand daily life activities of the beneficiaries, spaces required and organizations of these spaces in their houses.

Seventh, a research was conducted at Université de Montréal in Canada from April to July 2005 as per the advice of Prof. Colin H. Davidson, the author's mentor at this university. Research includes literature survey about the subject domain and study on guidelines for post-disaster reconstruction works and design of PDH.

1.4 Disposition

In the second chapter is presented a literature survey on housing in rural areas, disasters, post-disaster reconstruction works and PDH erected in two different rural regions of Turkey.

In the third chapter, the materials used to conduct this study and methodology of the doctoral research are described.

In the fourth chapter, the post-disaster reconstruction projects undertaken in the villages of Çankırı are presented and housing provision and housing design for the projects are evaluated. In addition, data collected by means of the questionnaires is statistically analysed. The drawings of a *Traditional House*, PDH with *Custom Designs* and the altered PDH with *Typical Designs* as prepared by the author are also presented in this chapter.

In the fifth chapter, a provision model including pre- and post-disaster strategic planning and organizational design of the post-disaster reconstruction works are proposed. In addition, guidelines for design of PDH are also proposed in this chapter.

In the last chapter, conclusions derived from this research and recommendations for permanent post-disaster housing works as well as suggestions for future studies are presented.

CHAPTER 2

LITERATURE SURVEY

In this chapter is presented the literature survey on rural settlements including factors which form rural settlements and house construction in rural areas. Furthermore, a general overview on disasters, aspects of disasters and concepts of risk and vulnerability are included. Post-disaster reconstruction policy in Turkey, post-disaster housing types and post-disaster housing provision are presented under the subheading "post-disaster reconstruction works". Finally, two examples of permanent post-disaster reconstruction works in rural areas of Turkey; the cases of Gediz and Erzurum villages were examined.

2.1 Rural Settlements

Differences in urban and rural life styles affect the formation of the layout and spatial requirements of the houses. Housing units in urban areas cater only to the daily life of the occupants, such as; cooking, eating, bathing, entertaining and sleeping *etc*. On the other hand, in rural areas production related activities are also catered for and so are the requirements of the animals owned by the occupants. Therefore, it can be said that the planning of the buildings is affected by the social and economical activities of the users (Candan, 1993:15).

According to Tosun (1983:7), environmental adequacy in rural settlements is mainly related to flexibility of spaces. Buildings in rural areas have the capacity of being added to, subtracted from and changed without losing their basic character. They are open-ended in nature; this makes them different from the closed final form of the urban style design.

2.1.1 Factors Which Form Rural Settlements

According to studies on the subject done so far, communities of rural areas suffer from both disasters and post-disaster applications. To design and construct PDH for rural areas, it is essential to understand housing in rural areas. Rural settlements of Turkey are determined basically by three groups of factors; which are presented in more detail in the following paragraphs:

a) Physical Factors
b) Socio-Cultural Factors
c) Economical Factors

a) Physical Factors

These include site, climate and geology (abundance or shortage of specific building materials).

Site: Site is an important factor that shapes rural settlements. Buildings in rural areas are not isolated pieces but parts of their immediate surroundings. A complete and relevant picture can never be obtained by taking a single, isolated building. On the other hand, topography, orientation, presence of water resources and fertility of land can not be disregarded in the form in the construction process of rural houses (Tosun, 1983:48-49).

Climate: Ceylan (1983:29) insists that, in general, one of the basic characteristics of architecture in rural settlements is that of its consistency with the climate. The climatic variables that influence architecture can be listed as follows:

- Wind
- Precipitation
- Radiation and light.

Geology: Potential building materials can be found in nature. In rural areas, these most readily available materials are used to their ultimate level. As Onat (1992: 45) explained materials in nature are selected for longevity not just for immediate efficiency and function. Those, requiring minimal maintenance and durability contribute to the visual quality through their ability to withstand deterioration under climatic stresses.

b) Socio-Cultural Factors

Ören (1996) says that socio-cultural characteristics and the life style of the inhabitants have a profound effect on the design of the dwelling unit and the settlement. The same author maintains that there is a relation between the concept of family and its corresponding architectural embodiment. According to Cimrin (1996:79-82) socio-cultural factors that shape rural settlements can be explained under four groups: family structure and size, safety, privacy and religion.

Family Structure and Size: Usually extended family structures predominate and a single basic type of house form is sufficient to meet the requirements of all families in a given rural environment. In this case, the family structure determines qualitative requirements, while family size determines the quantitative requirements like the number of rooms, the size of the house, *etc*. (Tosun, 1983:155). Since generally more than one family lives in a house in a rural settlement, the rooms are arranged in such a way that each of them has the traits of a separate house to be used by a different family (Cimrin, 1996:79).

Safety: Safety plays an important role in deciding house form and use of stockades, palisades and fences (Onat, 1992:147). Houses are usually two storied in rural settlements. The ground floor is assigned to storage and animals. Here, the most important concern is safety of crops and animals. On

this floor there are hardly any windows and if any, they are small and barred (Cimrin, 1996:80).

Privacy: Tosun (1983:160-161) declares that privacy can be explained on three hierarchical levels. These are personal privacy, social privacy and public privacy. Public privacy is concerned with the privacy of a house from outsiders and the family interactions with its near surroundings and neighbours. Social privacy requires the social distance of communication with the people with whom one has no intimate relations. Social relations of some members of the family, relations between guests and the family members, relations to men folk who come to the door, or relations with the next-door neighbours are examples of social privacy. Personal privacy requires personal space which belongs to individuals and consists of rooms and space for individual activities. Privacy in a room and the relation of the sequential activities between the rooms are examples of personal privacy in a home.

Religion: Religion forms an essential part of rural settings. It affects the form, plan, spatial arrangements and orientation of the house and it also influences the existence of round or rectangular plans of houses; not alone, but together with the effects of other factors (Onat, 1992:47).

c) Economic Factors

It may be regarded that the rural house is determined by the economy attributing its form, the owner's goods and animals to be close together, since husbandry takes place just near the house (Tosun, 1983:189). According to Onat (1992:45-47), that it should not be forgotten that to be economical does not mean to save but to prevent waste. It is simply constructed meeting the basic functions of a house in the most economical way. In rural areas we see the effect of the economy mostly in the materials used. Materials are chosen from the environment so they are cheap and easy to reach.

2.1.2 House Construction in Rural Areas

Forms develop as man learns to master more complex building techniques, and all forms are part of a progressive development in a series of almost inevitable steps. Thus, any kind of development in construction techniques changes the house form although the material and the other forces remain same. Indeed construction techniques are more related to cultural aspects and must be explained in the context of the cultural factors (Tosun, 1983:111). Important aspects of rural house design are given in the following sections:

a) Spatial Organization

Günay (1998:57) says that the plan of houses is formed with the arrangement of the rooms around a "*sofa*". The room serves as a complete living unit whose form, size and qualities do not show very significant differences. Conversely the sofa is variable and the house form is usually defined by its sofa. The three most characteristic plan types are those with inner, central and outer or open sofas, which are shown in Figure 2.1 below.

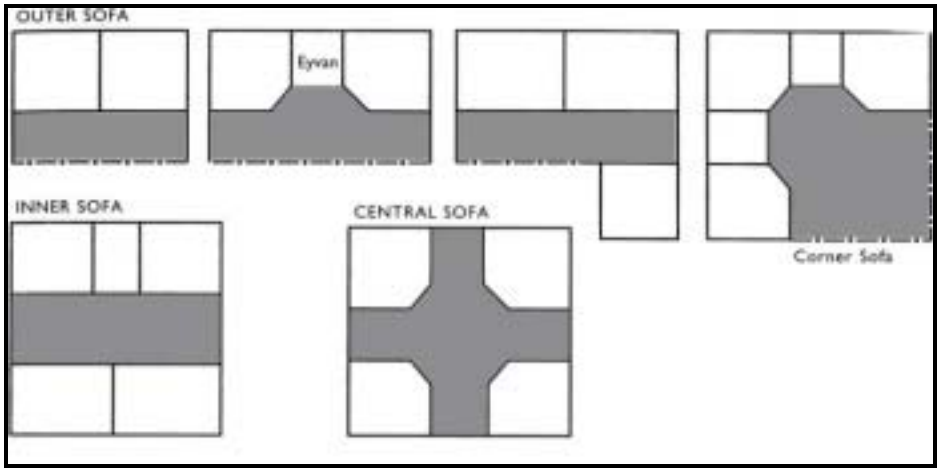

Figure 2.1 "*Sofa*" types. Source: Günay (1998:17)

As mentioned earlier, in rural houses, each room has the ability to meet the needs of a single family. It is possible to sit, rest, sleep, wash, eat and even cook in each room. The interior of the room is shaped in compliance with the dimensions, which human functions necessitate. There is very little movable furniture in the rooms. The bedding is kept in built-in closets during the day. "*Divans*" for sitting are placed along the walls, and the center of the room is left unfurnished for different functions. Most houses have at least two storeys. The top floor is the living area. The ground floor generally has a high, solid stonewall and is usually used as the cattle shed (Günay, 1998:46). Keeping animals on the ground floor enables people to benefit from their heat thus reducing their fuel needs for wintertime heating.

b) Building Materials

Building materials used in rural areas of Turkey are mainly timber, adobe, stone, brick and blocks. According to Şahinkaya (1973), the building materials used in rural settlements differ with location and climate of the area. Adobe is mostly used in plains while in mountainous and rainy regions timber houses are more common.

The stone used in the foundation and ground floor walls is abundantly available in every region. Infill materials can be stone, adobe, brick or wood. While mud and lime are usually used as mortar and plaster, clay tiles are widely used for cladding timber roofs. In some regions only cut stone is used in while in others rubble stone with wooden lintels is more commonly used. Generally, in humid and windy coastal areas the exterior is cladded with timber siding while in others the buildings are finished with lime plaster (Günay, 1998). The floors are mostly finished with compacted earth or wooden planks but this differs according to the climatic characteristics of the region and whether there is a forest nearby (Şahinkaya, 1973).

c) Construction Systems

Construction systems of rural buildings in Turkey can be divided in three types, as masonry, framed and composite structures. Masonry structures are built with timber, stone, adobe, brick and blocks:

Masonry structures
Masonry structures can be divided into the following 4 types:

a) Timber Masonry Buildings: Timber masonry buildings are built by putting logs, whose diameters are 20-25 cm., side-by-side and one on the top of the other.

b) Stone Masonry Buildings: They are examples of stone masonry buildings constructed with natural or cut stone. Natural stones are used without shaping; mud, mortar or nothing at all is used in joints. This type of wall is generally accompanied by a roof, formed by poles laid between the wall tops: then a mat of straw is provided, a thick layer of earth is put on and pressed, then partly waterproofed with clay. The thickness of the earth layer is sometimes about 50 cm. Hewn stone is pre-shaped, so that the geometry of the wall is smoother.

c) Brick and Blocks Masonry Buildings: In this type the coarse material can be brick, briquette, aerated concrete etc. The construction is made by putting together side-by-side and one on the top of the other. The spaces between the materials are filled with mortar.

d) Adobe Masonry Buildings: Adobe is made locally by mixing clay mud with hay. Although it is not as strong as brick, it is light, easy and cheap to produce. Its heat insulation is excellent. It can be used in load bearing walls of one-storey buildings and in filling timber frames. Mud mortar is

used with it. It requires repair after heavy rains and earthquakes (Aytun 1973).

Framed structures

Framed structures can be divided in two: timber-framed and reinforced concrete. Use of reinforced concrete in rural areas is very limited. Günay (1998) declares that the timber-framed buildings can be grouped in two:

a) Timber-Frame and Masonry Blocks Fill Type Buildings: Here the timber frame is filled with blocks like stone, brick and adobe. Timber is a very difficult material to hold plaster so the joints between timber and the masonry blocks can be weak. Wire is nailed because of this purpose.

b) Timber-Frame and Wood-Lath Siding Type Buildings: The studs, posts diagonals etc. are connected by nailing wood-lath siding. This is done at both inner and outer surfaces of the walls. The space between the sidings is sometimes filled with loose material such as earth, gravel for insulation, or left empty. The sidings are covered with plaster. In addition to insulation value the wood-lath siding retains he filling material. These types can be seen in the different regions of Turkey in accordance to the regions' environmental and geographical characteristics and economic conditions.

Composite structures

Composite structures are the structures consisting of at least two different systems. Common mixed system used in majority of the rural houses in Turkey is that ground floor is stone masonry and the upper floor is timber framed with stone, adobe or brick infill.

2.2 Disasters

Renee Pearce (2000:22) defines disaster as a non-routine event that goes over the capacity of the affected area to respond to it in such a way as to save lives, preserve property and to maintain the social, ecological, economic and political stability of the affected region. According to Demiröz (1996:4) disaster is a severe, relatively sudden, and frequently unexpected disruption of normal structural arrangements within a social system or subsystem, resulting from a force, internal to a system or external to it, over which the system has no firm control. Although one knows where and when the next disaster might occur, mostly nobody has an idea of its (especially an earthquake's) scale or the number of people who may suffer from its consequences, nor whether it will happen in the city or in a rural area. It is known that disasters especially natural ones are inevitable (Tercan, 2001).

It is essential to define hazard to differentiate a hazard and a disaster. Renee Pearce (2000:30) states that hazard is the potential for a disaster. For instance a meteor were to fall on a desolate area; even if it killed no one and destroyed no property, and left minimum damage to the environment, it would be considered a potential hazard.

Disasters are such events that they are unusual, complex and difficult to respond to and their impacts may last for generations. When people are killed and homes are destroyed those who survive will suffer long-lasting emotional and psychological effects of the disaster. These events cause damage to property which results in both direct (e.g. property loss) and indirect (e.g. job loss) economic consequences (Renee Pearce, 2000).

Lau (1998:9) claims that every natural or unnatural disturbance is not a disaster; there must be a large population suffering the effects of the disruption. For instance, if a huge earthquake happens in an uninhabited

location, it can not be defined a disaster. According to Benson and Clay “from an economic perspective a disaster implies some combination of losses in terms of human, physical and financial capital, and a reduction in economic activity, such as income and investment, consumption, production and employment in the ‘real’ economy”.

It is a fact that disasters are more inevitable in recent times. There are probably no more disasters than there were in the past but rapidly increasing population of the world and urban concentrations have contributed to loss of life and property that is associated with fast impacts of disasters (Demiröz, 1996:4). It is generally agreed that natural disasters are becoming more severe and more frequent in the case of developing countries. This is undoubtedly the result of an increase in human settlements in vulnerable areas rather than a rise in the number of events such as earthquakes, hurricanes or floods. In 1980, the number of people affected by major natural disasters was 100 million; this number reached to 311 million by 1990, and it was estimated to be half a billion- or 8% of the world’s population- in the year 2000 (El- Masri and Tipple, 2002:157). According to Barakat (2003:1) losses due to natural disasters are 20 times greater in developing countries than in developed ones.

Being a developing country and locating on Alp-Himalayan seismic belt, Turkey has been suffering and at risk of natural disasters. The natural disasters that occur in Turkey are earthquakes, landslides, floods, rock falls, fires, avalanches and strong winds. Among those, earthquakes are the most frequent and the most destructive disasters that strike the country. 61% of the damage are caused by earthquakes, 15% by landslides, 14% by floods, 5% by rock falls, 4% by fires and 1% are damaged by disasters such as avalanches, strong winds (Acerer, 1999:80).

2.2.1 Aspects of Disasters

According to Balta (1998:6) since they are defined as breakdowns in the normal functioning of society there are some effects of disasters on both society and victims. The aspects of disasters can be examined under four groups: physical, socio-cultural, economic and psychological aspects.

a) Physical Aspects

According to Gürsu (1986:1) when a disaster strikes, it is assessed and reported in terms of number of people killed and in terms of the monetary value of material damage; the major disasters throughout history have earned their places almost entirely due to their destructive impact on human settlements. Disasters are events, causing changes on physical environments which lead to some difficulties on communities' living conditions (Köse, 1988). The majority of the buildings have important damages in disasters; some collapse and some become so destroyed that they cannot be used any more. Thus, people become homeless and face with sheltering problems. Immediate help of accommodation is put up after any kind of disasters by governments and/or by private institutes and sometimes new physical environments are put up. According to Gürsu (1986:1) man by nature has the ability to adapt to the natural or artificial environment in which he lives with his capabilities, abilities and limitations. But it is very difficult for the man to adapt to his new destroyed environment after a disaster. In addition besides new living environment, people may face with pollution of the air or some natural resources like water. These may lead to health problems of victim communities.

b) Socio-Cultural Aspects

Demiröz (1996:7) declares that disasters are the interruptions of communities' cultural lives. The impacts may be sudden, immediate,

devastating, traumatic and the most important permanent. Building a house is a cultural phenomenon; its form and organization are greatly influenced by the culture to which it belongs. The changes on the physical environment of communities may lead to changes on their cultural lives. According to Balta (1998:71-75) cultural chaos is a diachronic result of social chaos, which has been defined as the unexpected disruption of an anticipated and culturally defined sequence of events. Problems related with life changes include: changing roles of the family members (e.g., man's role as a protector of family), job related problems, declines in perceptions of social support and social participation, household disruption (related to migration), bereavement *etc*. (Atakuman, 1995).

c) Economic Aspects

A disaster has an adverse effect on the economic life of a society. After disasters people become homeless and unemployed because of the damages on both residential and office buildings. Financial needs of the society increase to serve accommodation, food, heating, sanitary equipment *etc*. and for re-establishment of the settlement. In some cases, economical disabilities are obstacles to meet all these needs and disaster becomes severer. Increase in financial needs does not have the same effect on all societies. What has happened is less important than to whom it has happened. The consequences in developing countries are severer than the developed ones (Balta, 1998:18-19,62).

d) Psychological Aspects

At the psychological level, the actual or anticipated traumatic effects of hazards may be perceived as threatening and may generate considerable stress among inhabitants of disaster areas. Psychological consequences of disasters usually include emotional reactions, such as depression, anxiety,

fear, guilt, grief and anger. Impaired concentration, sleep disturbances, increased frequency of nightmares, general anxiety and some gastrointestinal disturbances were also reported after the studies done in disaster areas. The results of studies showed that the psychological effects of disasters are long-lasting (Atakuman, 1995). While re-establishing disaster areas, psychological condition of victims has to be taken into consideration. In the new environment there should not be infrastructure, heating, adapting to the new settling and new houses etc. problems. On the other hand these problems may have negative effects on the psychological consequences of disasters.

2.2.2 Concepts of Risk and Vulnerability

In this section concepts of risk and vulnerability, which are the phases of disaster mitigation plans are presented.

A) The Concept of Risk

It may be impossible to reduce the probability of an event, especially in the case of natural disasters (e.g. an earthquake), while there are some actions that can be taken to minimize the consequences of an event (Renee Pearce, 2000). Risk assessment and vulnerability analyses are two of these actions. According to Coburn *et al.* (1994:9-10) knowledge of what makes a person or a community more vulnerable than another determines the steps that can be taken to reduce situation of being at risk. The term *risk* is the expected losses from a given hazard to a given element at risk, over specified future time period.

NTSC (2003:13) defines risk assessment as determining a disaster in a given area, which includes advanced scientific modelling to estimate loss of life, threat to public health, structural damage, environmental damage and economic disruption that could result from specific disaster scenarios. Risk

assessment takes place both before and during disaster events. Blakie *et al.* (1994) points out that vulnerability analyses combined with disaster assessment are the key elements of risk assessment. Populations, structures, utilities, systems and socio-economic activities constitute the elements at risk.

In general risk is measured in terms of loss of life. It is mostly accepted that saving life is the highest priority of disaster mitigation and preparedness. In addition, deaths can be counted more easily than injuries. However, many other parameters of disaster consequences may be of equal or more practical value. For instance, prediction of injuries is more useful for the medical profession than fatality estimates because injury risk is related to resources needed for treatment. The most common and the most easily dealt with parameter of loss is economic cost. This parameter is widely used because many types of loss can be converted into economic cost. Effects which can be converted into economic costs are known as tangible losses, and the ones which cannot be converted into a monetary equivalent are referred to as intangible losses. Risk would include a complete range of effects, both tangible and intangible. The range of undesirable consequences of natural disasters that might be considered as loss parameters are listed in Table 2.1 (Coburn *et al.,* 1994:10-26).

Qualitative differences of loss parameters make it impossible to aggregate them into any single indicator of disaster impact. For instance, it is almost impossible to compare environmental impact with social disruption. In some cases intangible parameters may have the same importance as the tangible ones or sometimes intangibles may have more importance than tangibles. However, as it is difficult to quantify the intangibles, only one or two loss parameters, such as deaths and tangible costs of physical damage, are used for most risk analyses procedures as their main concerns (Coburn *et al.,* 1994:26).

Table 2.1 Loss parameters for risk analyses.

Consequences measure		Losses	
		Tangible	Intangible
Deaths	Number of people	Loss of economically active individuals	Social and psychological effects on remaining community
Injuries	Number and injury severity	Medical treatment needs, temporary loss of economic activity by productive individuals	Social and psychological pain and recovery
Physical damage	Inventory of damaged elements by number and damage level	Replacement and repair cost	Cultural losses
Emergency operations	Volume of manpower, man-days employed, equipment and resources expended for relief	Mobilization costs, investment in preparedness capability	Stress and overwork in relief participants
Disruption to economy	Number of working days lost, volume of production lost	Value of post production	Opportunities, compeativeness, reputation
Social disruption	Number of displaced persons, homeless	Temporary housing, relief, economic production	Psychological, social contacts, cohesion, community morale
Environmental impact	Scale and severity	Clean-up costs, repair cost	Consequences of poorer environment, health risks, risk of future disaster

Source: Coburn *et al.* (1994: 27)

Coburn *et al* (1994:27) indicates that there are three essential components for determination of risk each of which should be separately quantified:

g) Hazard occurrence probability: likelihood of experiencing any hazard at a location. It involves not only the probability of a hazard, but also probability of occurrence of a hazard of a range of strengths.
h) Elements at risk: identifying people, buildings and/or other elements which would be affected by the hazard if it occurred. Elements at risk consist of people's lives, their health, economic activities, equipment,

crops, livestock, houses, roads and services. Schools and hospitals can also be counted as elements at risk so is the natural environment.

i) Vulnerability of the elements at risk: how people, buildings and/or other elements would suffer if a hazard occurred. A building, a person and an activity will be affected by hazards of different severity in different ways.

B) The Concept of Vulnerability

Benson and Clay[1] defines *vulnerability* as the potential to suffer harm or loss. Poor and socially disadvantaged groups are usually the most vulnerable to and affected by disasters, reflecting their social, cultural, economic and political environment. It can be said that, at the household level, poverty is the most important factor determining vulnerability, in part reflecting location of housing (e.g., on floodplains, riverbanks or steep slopes), primary types of occupation and level of access to financial and other resources.

According to Perez Lugo (2003:15) vulnerability to natural hazards is the group of characteristics of a community that influences its capacity to anticipate, cope with, resist and recover from the impact of a natural hazard. Physical aspects of vulnerability due to their impact into its physical environment include the community's geographic location or its proximity to hazard prone areas, construction techniques in the area and the amount and the quality of the infrastructure. Furthermore, community's socio-economic conditions, such as race/ethnicity, household structure and poverty can be included in the physical aspects of vulnerability.

Most of disaster mitigation works are focused on reducing vulnerability. In order to reduce vulnerability, development planners need an understanding of which elements are at risk from the principal hazards which have been identified. Principal elements vulnerable to specific hazards are seen in Table

[1] *Disasters, Vulnerability and the Global Economy*

2.2 below. Vulnerability of an element is usually stated as a percentage loss or as a value between 0 to 1 for a given disaster severity level. The measure of loss depends on the elements at risk and may be measured as a ratio of the numbers of killed or injured to the total population, as a repair cost or as the degree of physical damage defined on an appropriate scale (Coburn *et al.*,1994:40).

Table 2.2 Principal elements vulnerable to specific hazards.

	Principle vulnerable elements	
	Tangible	Intangible
Floods	Everything located in flood plains or tsunami areas; Crops, livestock, machinery, equipment, infrastructure. Weak buildings.	Social cohesion, community structures, cohesion, cultural artifacts.
Earthquakes	Weak buildings and their occupants. Machinery and equipment, infrastructure, livestock. Contents of weak buildings.	Social cohesion, community structures, cohesion, cultural artifacts.
Volcanic eruption	Anything close to volcano; crops, livestock, people, combustible roofs, water supply.	Social cohesion, community structures, cohesion, cultural artifacts.
Land instability	Anything located on or at base of steep slopes or cliff tops, roads and infrastructure, buildings on shallow foundations.	Social cohesion, community structures, cohesion, cultural artifacts.
Strong winds	Lightweight buildings and roofs. Fences, trees, signs; boats fishing and coastal industries.	Social cohesion, community structures, cohesion, cultural artifacts.
Drought/ Desertification	Crops and livestock. Agricultural livelihoods, people's health.	Disruption of populations, destruction of the environment. Cultural losses.
Technological disasters	Lives and health of those involved or in the vicinity. Buildings, equipment, infrastructure, crops and livestock.	Destruction of the environment. Cultural losses, possible population disruption

Source: Coburn *et al* 1994:41

As long as risk assessment and vulnerability analyses are done for a location, then measures can be taken to reduce the vulnerability in order to minimize the effects of future disaster(s). Erdik (1995: 118) states the

measures that should be considered for building disaster resistant structures on carefully chosen sites as follows:

Earthquake damage can be greatly reduced through:

a) Reduction of structural vulnerability,
b) Siting and land-use regulations,
c) Design and construction regulations,
d) Relocation of communities,
e) Public education/awareness programs. Specific measures should also be considered for secondary effects such as fires, landslides and flooding.

Landslide probabilities can be decreased and their damage can be minimised through:

a) Land-use regulation,
b) Protective measures such as sheet piling or retaining walls- however, these are costly if not impossible options in areas at risk of sizable landslides,
c) Site improvement involving drainage and slope modification measure- these can be cost effective when land-use regulation or relocation of activities are not feasible options,
d) Prudent siting, involving adequate setbacks from steep slopes, flattening cut slopes and the avoidance of unstable areas,
e) Appropriate warning measures and emergency response preparedness.

Floods may be mitigated through:

a) Better farming practises, terracing, reforestation and prevention of overgrazing,
b) River control structures, early warning systems and evacuation plans,
c) Removal of existing developments through public expropriation and conversion of use,
d) Discouraging development in hazardous areas through information management, taxation, pricing, financing and insurance policies,
e) Land-use management such as zoning laws, flood plain regulations, and building ordinances.

According to El-Masri and Tipple (2002:167) design of a house should be based on a comprehensive analysis of the physical conditions of the building in relation to probable disaster(s). Shape, height, building materials, construction techniques and space arrangements of the arrangements of the building should be improved and modified by applying appropriate

strengthening measures. All of these could be undertaken by the help of regularization and upgrading process. Different solutions depending on the type of disaster, physical conditions of settlements and available resources offered by The United Nations Disaster Relief Co-ordinator are presented in Table 2.3.

Table 2.3 Construction considerations in case of various natural disasters.

Type of natural disaster	Technical considerations (building materials and construction methods)
Earthquake	● use regular and symmetrical forms which perform better in earthquakes ● separate buildings of different heights and provide expansion joints at regular intervals in long buildings ● provide openings as small as possible, they should not be located near corners ● build walls at right angles and avoid bevelled corners ● build walls from good-quality materials and provide good bonds between blocks with alternated vertical joints ● strengthen building by use of horizontal and vertical reinforcements which lead the rigidity of the building to be distributed uniformly
Landslide	Strengthening buildings is not a recommended option in landslide prone areas because of the high level of vulnerability. However, in some cases measures could be implemented to: ● strengthen walls subject to damage from land erosion ● build a strong framed structure to avoid collapse of the building due to debris flow
Flood	● elevate buildings above the flooding level ● use materials resistant to water ● build foundations and basements on a layer of gravel to prevent scouring caused by the flood
Cyclone	● avoid low-pitched and flat, light weight roofs ● ensure wall and roof stability ● use good anchoring systems and anchor window frames ● avoid objects projecting from buildings ● close the space under the building to prevent its uplifting by wind force from under the structure ● avoid roof overhangs, canopies, etc. ● connect roofs to walls and to foundations strongly.
Volcanic eruption	● strengthening structures to withstand the direct effects of volcanoes is not a partial option. It is best to avoid settling on sites which are prone to volcanic activity. However, some of the indirect effects of this type of disaster could be reduced by: ● avoiding flat roofs in order to reduce the potential damage expected from the fall or ash; using pitched roofs at a slope of more than 20 degrees covered by smooth metal sheeting ● protecting windows facing to a volcano with metal sheeting ● avoiding the use of material which could burn because of hot lava fragments.

Source: Adapted from El-Masri and Tripple (2002:168)

2.2.3 Post-Disaster Reconstruction Works

After disasters there are some works including immediate and long term help. Immediate help provides fast accommodation, food, heating, sanitary equipment *etc*. The character of long term help is rather different from the first one. It is the kind of support that is given to the victim community in order to establish itself, to get back to its former pattern (Köse, 1988:4).

A) Post-Disaster Reconstruction Policy in Turkey

In Turkey, the "Law for Natural Disasters" (No. 2769) is used as a guideline to determine the kind of actions to be taken to minimise the effects of the disasters. Erdik (1995: 121,123) summarizes the articles of this law as follows[2]:

Article 1 :The provisions of this act are to be put into effect when it is determined that structures or public facilities are damaged, or are likely to be damaged, and the life of the general public affected by disasters such as earthquakes, fires, floods, landslides, rock falls, or avalanches. The Ministry of Reconstruction and Resettlement determines whether disasters are of a magnitude to affect the life of the general public. The governor(s) of the province(s) where the disaster occurs is (are) empowered to take immediate measures in compliance with the provisions of this act.

Article 2 :Boundaries of the area affected by floods will be determined by the ministry responsible for the General Directorate of State Waterworks; for others the Ministry of Reconstruction and Resettlement promulgates the boundaries. Governors are charged with the declaration of the directives of the Council of Ministers.

Article 3 :Technical requirements for all buildings to be reconstructed or repaired are determined by means of a regulation chartered by the Ministry of

[2] The Ministry of Reconstruction and Resettlement and the Ministry of Public Works have since been combined to create the Ministry of Public Works and Settlement.

Reconstruction and Resettlement, upon approval of the Ministry of Public Works.

Article 4 :Relief organization and plans shall be jointly drafted by the Ministries of Interior, Reconstruction and Resettlement, Public Works, Health and Agriculture. This regulation shall carry stipulations for a relief program, care of the injured, temporary shelter, burial, fire control, debris removal, and food facilities.

Article 5: :The Ministry of Reconstruction and Resettlement is empowered to set up investigations for the required measures, cooperate with other ministries and institutions, provide instruction and published materials on the effects of natural disasters.

Article 6 :This defines emergency powers for civilian authorities.

Articles 7-11 :This specifies obligations of various agencies and persons described in these articles.

Article12 :This allows compensation, premiums and advance payments to persons other than civil servants.

Articles 13-15 :This defines technical work in disaster areas. Guidelines for damage assessment, and conditions requiring repair and construction.

Article 16 :This regulates relocation of affected population. A joint committee consisting of representatives from the Ministries of the Interior, Finance, Public Works, Health, Agriculture, Education, Industry, Reconstruction and Resettlement, and Rural Affairs decides this matter. Their instructions are carried out by the Ministry of Reconstruction and Resettlement upon approval of the Council of Ministers.

Articles 17-25 :This defines the evaluation and distribution of land appropriations and the steps in selecting new settlement areas.

Articles 26-27 :All reconstruction expenditures including public works such as roads, sewage systems, water, and electricity shall be borne by the Ministry of Reconstruction and Resettlement.

Articles 28-32 :This defines individuals to be aided and conditions for distribution of aid.

Articles 33-39 :Accumulation of disaster funds and expenditures from these funds. Sufficient funds must he available at all times, kept in an account in one of the state owned banks. The funds are primarily contributions from the national budget, government enterprises,

and public companies. When funds are depleted, the Ministry of Finance may double contributions budgeted for the fiscal year, or the Council of Ministers may allocate funds required by the Ministry of Reconstruction and Resettlement.

Articles 40-41 :This provides reimbursement of credits extended after the disasters.

Articles42-46 :This provides exemptions from tax and duties.

Articles 47-49 :This defines penalties.

Articles 50-51 :This provides miscellaneous requirements.

Erdik (1995:123) goes on to say that the legislation on urban planning includes the Settlement Planning Act of November 1985. This act states that 'the Ministry of Public Works and Settlement has the authority to prepare plans for public buildings, post-disaster settlements, and collective housing and to carry them out in accordance with "Squatter Housing" legislation'.

B) Post-Disaster Housing Types

Post-disaster housing is put up after disasters by governmental and/or private institutions. Turan and Cengizkan (1983:64-65) claim that there are two types of housing built after a disaster: one is principally a shelter put up for immediate relief purposes, and the other one is more permanent housing with long term settlement purposes. The contextual characteristics of these two types of post-disaster housing are quite different from each other. It can be said that if "immediate shelter" is a category in itself, "housing with a more permanent character" is closer to the category of "housing" under normal conditions. Cole (2003:17) describes housing recovery after disasters in four different stages as emergency sheltering, temporary sheltering, temporary housing and permanent housing.

a) Emergency Sheltering

Emergency sheltering is a makeshift haven provided just after the disaster mostly in hours. According to Demiröz (1996), it consists of tents, plastic sheeting, plastic cardboard panels, etc. This type may offer weak selection or a forcefully imposed location for the site as a result of the conditions being lived. The contextual characteristics of this kind of shelter are totally different from the other two as a result of its fundamental aim that is to house people for a very short period just after the disaster.

b) Temporary Sheltering

Cole (2003:19-20) declares that if victims are unable to return to their dwellings after the threat has ceased both public and private temporary shelters are provided to the victims. Public shelters are pre-planned, mass-care sheltering arrangements in public or other large buildings (e.g., school buildings, factories). They provide victims with sleeping arrangements, medical services, and provisions for temporary subsistence. Research has shown that these types of public sheltering locations can be culturally insensitive, may lack or have limited resources, are sometimes inappropriately located, and are feared by some of the victims. There is ample evidence in literature that victims avoid public shelters if alternative sheltering arrangements are available. Little is known about private forms of temporary shelter with the exception that family, friends, and neighbours unaffected by the disaster often open their homes to victims.

c) Temporary Housing

According to Gürsu (1986:22), temporary housing is the stage of disaster housing that is built after a short period of the disaster occurs, offering better living conditions than the emergency and temporary sheltering. But still it is conceived as temporary solutions, in order to evacuate the displaced people.

This type of shelter stands at a very critical point where temporary housing might turn out to be permanent one.

Existing structures, including vacant apartments and houses, dormitory rooms, the homes of family, friends, and neighbours, and mobile homes are sources of temporary housing for disaster victims. Much of the current research on temporary housing focuses on the need for mobile homes supplied by governmental or private organizations if adequate housing in the community is not available (Cole 2003:21).

d) Permanent Housing

According to Akünal (1986), permanent housing, which is the last stage of housing recovery, basically aims to be a final solution after disasters to provide housing individually which would fulfil the needs of the inhabitants in relatively much longer period of time. They aim not only to serve as housing units or only basic protection but also to satisfy all necessary requirements regularly.

For re-establishment of permanent housing, victims may repair or rebuild their pre-disaster houses or relocate to other permanent housing locations within or outside the community. As mentioned earlier, temporary houses, such as mobile homes, can become permanent ones. If there is not adequate housing for permanent post-disaster housing in the same area, victims may be relocated to another place. It is claimed that relocation outside and away from the pre-disaster area can compound readjustment and recovery problems for the victims. Research shows that lower socioeconomic status and the elderly disaster victims have fewer resources to facilitate their return to permanent housing and thus this takes longer to do. But in domestic natural disasters, victims, with or without public or private assistance, find places to live. Researchers believe that the vast majority of victims attempt to

relocate with their relatives, and, if possible, to return and resettle on the pre-disaster housing site. Nonetheless, there is little evidence that documents the rate in which this occurs, especially for disadvantaged populations. In addition, there is no empirical evidence that shows where victims who do not re-establish permanent housing go (Cole 2003:21).

When there is a need to construct PDH, a decision needs to be made whether to relocate the settlement and construct the PDH in a new area, or to rebuild on the same site. According to Barakat (2003:27) findings of UN shelter projects indicate a strong preference among survivors for remaining as close as possible to their previous sites and strong opposition to forced evacuation. This suggests that, unless there is a serious threat to the original location, forced relocation to another site is not desirable. The same author lists the situations when relocation may be desirable. On the other hand, he advocates relocation when:

- The new settlement is sufficiently close to the old one so that people can retain their existing livelihood patterns,
- Damaging events, with high losses, continue to threaten the original area,
- The disaster event has rendered the area simply uninhabitable, or the after-effects of a conflict – the presence of unexploded ordnance, for instance – present unacceptable risks,
- Measures to reduce the risk are too costly and difficult to implement,
- The continuing psychological impact of the event(s) associated with the original site might be insupportable for the community, or the surviving community might regard the area as a burial ground and therefore sacred, and so inappropriate for reconstruction or resettlement.
- Considerable decline, due to environmental degradation, pollution or economic change, has occurred in the pre-disaster period; or
- Relocation is part of a peace settlement or other political factors are at work. A peace agreement might redistribute land for political reasons, or reallocate certain area to different ethnic groups. If the housing destroyed in a disaster belonged to illegal squatters,

governments may use the opportunity to prevent the area from being resettled.

C) Post-Disaster Housing Provision

Barakat (2003:8,31-35) describes post-disaster housing financing models as outright gift, partial support and loans. There are advantages and disadvantages of these three models which are presented in Table 2.3. The same author explains three models of post-disaster-housing as follows:

a) The contractor model: Sometimes housing reconstruction programmes are contracted to professional construction companies. Large scale contracted constructions may have disadvantages. For instance, specific housing needs of individual communities may not be met and diversity within the community may not be taken into consideration. On the other hand, large numbers of houses with standard specifications can be constructed relatively quickly using staff with technical expertise, employing specialist skills. This model is also appropriate when target groups lack the skills and resources to undertake the construction work themselves.

b) The self-build model: This model, which is also called self-help or owner-driven, enables the communities to undertake construction works of their houses themselves. The model is possible when labour is available, housing design is relatively simple, communities have a tradition of self-build and there is strict time limit. Post-disaster reconstruction work can be set up on a family self-help basis or as a joint community reconstruction programme. In some instances food for work is also included as a part of the programme.

c) Cooperative reconstruction: This model, which is an alternative to self-build model, focuses on mobilizing a community to undertake

reconstruction programme together. It requires a high level of community involvement and cooperation. In this model, materials are provided for the whole community as a whole, rather than for individual families. Agencies can control the process and make sure that community members are benefiting form the programme equally.

Table 2.4 Advantages and disadvantages of various housing reconstruction finance options.

Finance option	Description	Advantages	Disadvantages
Outright gift	Beneficiaries are given houses on the basis of meeting certain conditions of entitlement. The recipient has no obligation to repay the cost of the house.	Removes the need to set up a system to recuperate costs. Allow recipients to use their assets to meet other needs.	Encourages dependency and undermines local coping mechanisms. Bypasses and thus weakens local institutions. Is often imposed solution. The assisting agency can not recuperate money for new projects. Number of houses provided is limited.
Partial contribution through self-help	Beneficiaries may receive building material and/or technical advice, and/or a partial grant. They build their own house, usually on a communal basis or by contracting local builders.	Removes the need to set up a system to recuperate costs. Allows recipients to use their assets to meet other needs. Increases involvement and participation by the recipients.	As with the outright gift, this option can undermine both local capacity to cope and local institutions. Materials provided may not meet the requirements or aspirations of the recipients. Time spent on building may conflict with other priorities of the recipients, such as income generation, which may be a vital element in family recovery.
Loans	There are many variations of loan programmes. The most common for reconstruction is the long-term loan. Some loans may be without interest, while others apply normal interest rates.	People without resources are able to rebuild their homes and repay the loan over time. Recipients have freedom to build a house according to their own choice. Encourages independence and sustainability.	May encourage renters to become owners. Credit systems may not exist and so may need to be set up. Loans may be a significant financial burden for recipients, especially if they have no previous experience of credit systems. Loan systems are costly to administer. Many financial institutions favour only the most credit-worthy people and they demand the creditor's house as a guarantee.

Source: Barakat (2003:7)

Johnson *et al.* (2005:87,88) state that post-disaster housing involves strategic and tactical decision-making resembling procurement: organizing programs of work, allocating resources, initiating and carrying out projects, and sharing responsibilities between the survivors and the experts. Experience shows that pre-disaster planning is usually inadequate and needs to be up-dated after the disaster in the light of actual vulnerabilities. The protagonists behind the strategic issues that can influence the recovery process, work within a context that existed before the disaster and which persists even afterwards (Figure 2.2).

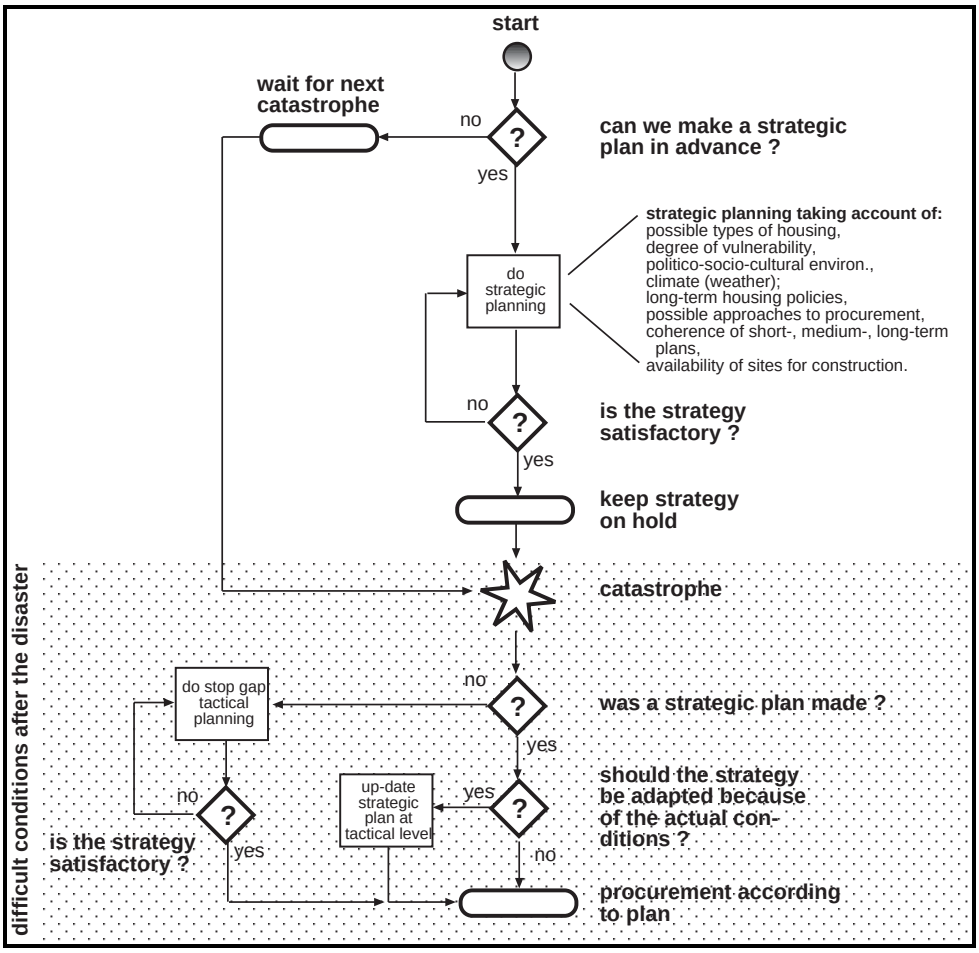

Figure 2.2 Strategic and procurement planning - before or after the disaster?
Source: Johnson *et al.* (2005:88)

Johnson *et al*. (2005:89) emphasize the need for a systems approach to what is called "organizational design". The authors argue that no conventional procurement process is possible; there is no clear contracting client, the survivors have few resources and probably no "voice" in decision-making and resources have to be shared among several options. Figure 2.3 shows an example of organizational design prepared by Gonzalo Lizarralde for the rural reconstruction project conducted by The Colombian Coffee Growers' Organisations (CGOs) after the 1999 earthquake in Colombia.

The earthquake affected five Departments and destroyed great part of the the west high mountain region of Colombia where the coffee industry is concentrated. To conduct the reconstruction project in the disaster stricken rural area of Colombia, the CGOs decided on the optimisation of the regional, national and international network of institutions and contacts established by the organisation for the regular development of the coffee industry. The organisation developed the project by using the different levels of committees. The reconstruction project was coordinated in the region by transferring there some of the managers normally located in the headquarters of the Coffee Growers' Federation in Bogotá. A general external audit and an internal technical audit were established for the project. The latter, including engineers working as construction inspectors, was established in order to control the execution of individual projects. Furthermore, the coffee growers were also directly involved in the project. Although they are represented in the base of the pyramid, the coffee growers had total responsibility of their own projects (Lizarralde, 2004:221-222).

2.2.4 Examples of Post-Disaster Reconstruction Works in Rural Areas of Turkey

In the context of this study two post-disaster reconstruction works done in different regions of Turkey were examined in order to understand the

phenomenon involved and PDH design strategies of the Turkish Government. The two cases described below were studied by different researchers on different times. The projects chosen as the case studies in this paper belong to the town of Gediz and the provinces of Erzurum and Kars.

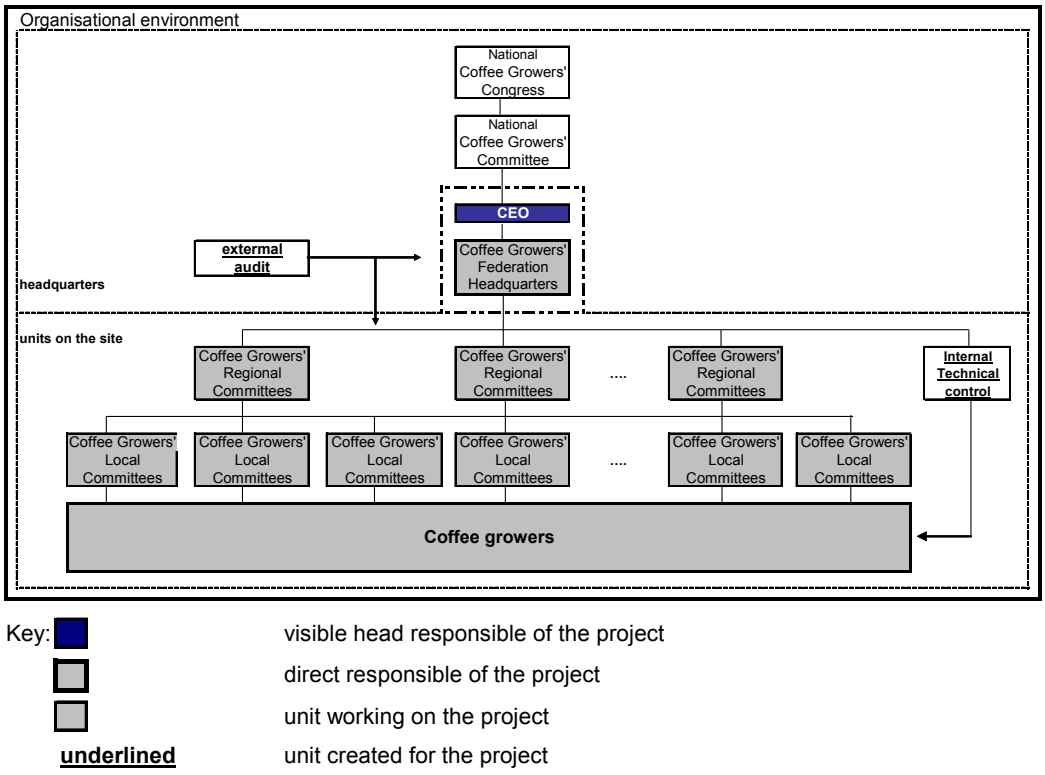

Figure 2.3 CGOs internal organizatinal design.
Source: Lizarralde (2004:223)

a) Case of Gediz Villages

On 28th of March 1970, an earthquake with a magnitude of 7.2 on the Richter Scale occurred in the town of Gediz. 1,086 people were killed, about 3,000 people were injured and more than 14,000 houses in the area were seriously destroyed because of the earthquake. 144 villages, surrounding the town of

Gediz were affected by the disaster. Frances D'Souza conducted a survey in two phases in the earthquake stricken area in order to define what was perceived as recovery in the local, cultural and economic context and to measure recovery in affected communities on 1982 and 1984. After the initial aid, the Ministry of PWS provided a large number of prefabricated houses as a temporary solution to the victims. D'Souza (1986:35-36) states that according to the data obtained through a detailed damage assessment in the area, where economic mainstay was farming, 163 villages were considered to be beyond repair and the rest were categorized either as heavily, moderately or slightly damaged. Housing loans were provided to the villagers according to the damage category of their houses with a payback period of twenty to thirty years without interest by the Turkish Government. Relocation of the villages were recommended in the following cases: villages which had been almost destroyed or thought to be on unsafe sites; villages which had available land nearby suitable for construction of a new settlement and villages where it was thought that relocation would ultimately cost less than rebuilding of the original houses. Furthermore, within seven months after the disaster it was decided to relocate the administrative and marketing centre of Gediz 7 km far from the town.

Ali Günöven conducted a survey in the region in order to find out the level of satisfaction regarding the PDH amongst the villagers in 1977. The author states that the new residential houses in the new settlements, which were built after the earthquake, differ considerably from the traditional buildings. Figure 2.4 shows a traditional house from Gediz while Figure 2.5 shows the post-disaster houses built in the relocated village.

All of the post-disaster houses were single storied with two small bedrooms, a sitting room, a kitchen alcove and a bathroom (Figure 2.5). This division of space makes it impossible to organize family life according to traditional patterns. Also, as the floor space was limited, extended families were forced

to break up. Since the plans of the PDH were different from the spatial organization of the traditional houses, they were unworkable for the villagers. Traditionally, villagers keep their animals on the ground floor and live on the top floor. Since the new houses were single storied, there was no space for animals. As the people could not utilize the heat from animals living under the house the need for fuel went up radically (Günöven, 1977:43). According to Tercan (2001), because of these inconveniences of the PDH, the villagers made some modifications on them. Altered houses and additional buildings have transformed neighbourhood of some villages. This transformation can easily be seen in Figure 2.6.

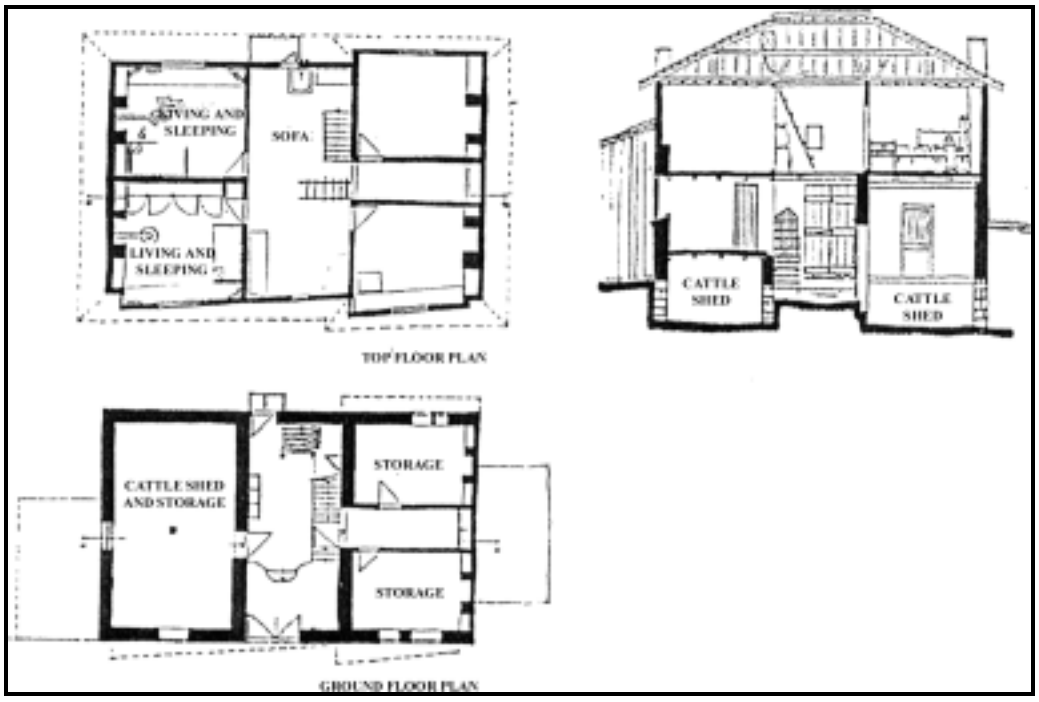

Figure 2.4 A *Traditional House* from Gediz. Source: Acerer (1999:164)

Günöven (1977:43) states that apart from the inadequate space and inappropriate spatial arrangement there were also problems resulting from the use of inappropriate materials. The floor was of unfinished concrete. In a culture where people traditionally sit, eat and sleep on the floor this poses a

major problem. The ground is usually damp and cold, since it is a direct contact with the ground. To protect themselves from the cold floor, some of the villagers have built wooden platforms over the concrete floor.

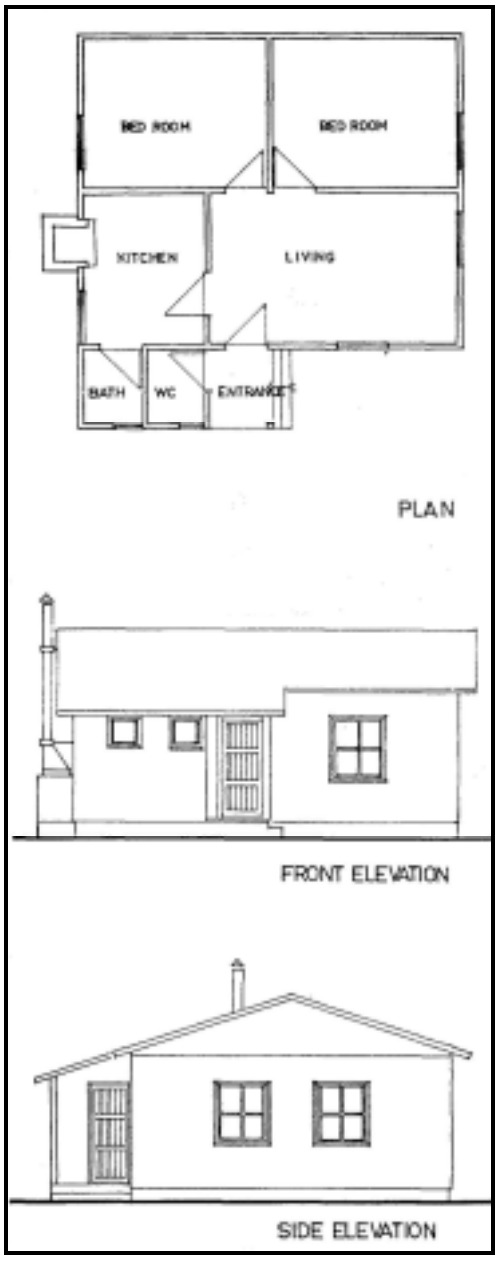

Figure 2.5 Drawings of a PDH built in Gediz.
Source: Acerer (1999:163)

(a)

(b)

Figure 2.6 Transformation of a neighborhood in Muhipler Village:

a- Site plan of the post-disaster housing project, as initiated and controlled by the Ministry of Public Works.
b- Site plan showing the additions and alterations made to the post-disaster housing.

Source: Tercan (2001: 62)

b) Case of Kırkdikme Village, Erzurum

An earthquake with a magnitude of 6.0 on the Richter Scale shook the provinces of Erzurum and Kars on eastern part of Turkey on 30th of October 1983. 1,155 people were killed and 583 were injured due to the earthquake. 147 villages, where economy relied on animal rearing supported by small scale agriculture, were damaged in the region, whereas the city and town centres suffered very little damage. Yasemin Aysan conducted a survey in the area just after the earthquake.

Aysan (1984:20-32) says that after the initial aid the villagers were relocated with the aim of short-term recovery period. While the villagers took shelter in tents, the Governmental housing stock in the area was assessed for provision to them. The Govenmental housing stock included empty social houses, factories' accommodation which was not yet in use, regional boarding schools, high schools offices and temporary prefabricated houses about to be constructed. The villagers were asked through their village leaders, what kind of temporary housing they preferred for the winter. Then they were transported to the temporary housing types they preferred. At the time of the research by Yasemin Aysan no concrete decisions were taken about the type of permanent houses to be built in the area. The same author states that the idea was to build one or two of the prototypes which had been developed by the Ministry of PWS for Eastern Turkey. However, site selection for the permanent reconstruction was almost completed two weeks after the earthquake. The survey for the site selection was done by the geologists and staff from the Ministry of PWS according to the following criteria:

(a) Local Participation: villagers were asked through the village leaders on their preferences for the new locations. New sites proposed by the villagers were close to their existing villages generally.

(b) Land Ownership: the lands which were owned by the Government or village property were the popular ones among the alternative sites. Very few private land, village pasture and agricultural land was considered suitable for reconstruction.

(c) Services: closeness to water resources was considered an important factor if the village was to be relocated far from the existing location. In the villages where there were not many damaged houses, it was decided to relocate the people as close as possible to the rest of the village to benefit from the schools, health centre, if available, not too far from their land.

(d) Topography: Most of the settlements in the affected area were located on steep lands and they were protected from the prevailing winds, snowstorms and floods. Because it was difficult to construct buildings on steep hills, the sites chosen for relocation were the ones with maximum slope of 20°.

(e) Vulnerability: Since the area affected by the earthquake was under threat of landslides and floods, one of the major tasks of the geologists in the team was the examination of sites in terms of their vulnerability to seismicity, landslides and floods (Aysan, 1984:32).

The new village was relocated 4 km.away from its original location. Brick masonry houses were built in the new Kırkdikme Village. Five years after the Erzurum-Kars earthquake a research was conducted in the area by Ahmet Öner Köse in order to find out the level of satisfaction regarding the PDH amongst the villagers (Figure 2.7).

Köse (1988:65-73) states that the villagers who could afford, made alterations to the houses according to their requirements. Some families only altered the functions of the spaces whereas, some added spaces to the

houses besides changing functions of some spaces. For instance the traditional oven in the living room was not used in almost all of the houses and the cattle shed was divided into two spaces for storing and kitchen. The villagers constructed traditional oven in the store room for making bread. Absence of a proper kitchen in the house led people to use part of the space which was planned as the cattle shed, as their kitchen. In addition, some of the occupants enlarged the dimensions of the windows, which were inadequate for natural lighting.

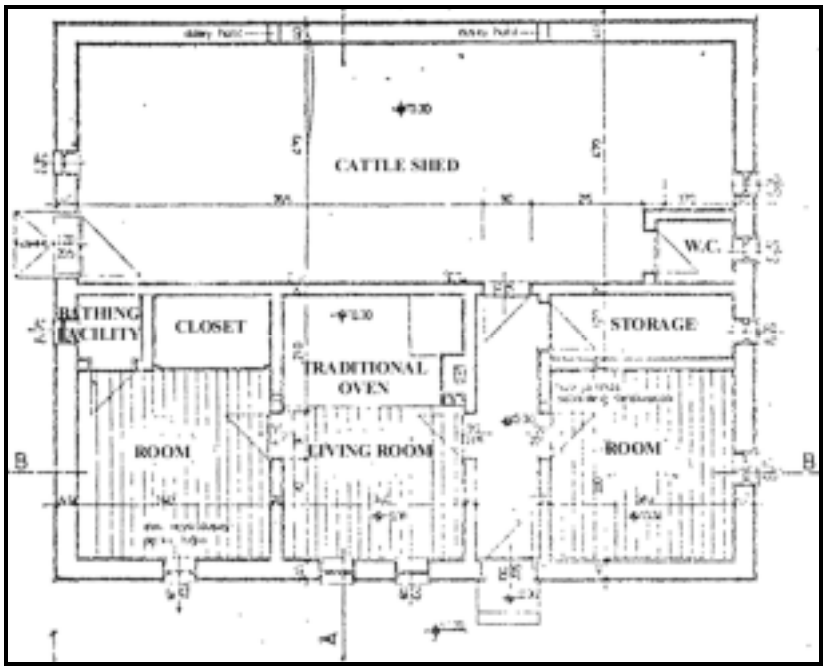

Figure 2.7 Plan of PDH erected in Kırkdikme Village.
Source: Köse (1988:44)

The main means of existence is cattle farming in this region too. 80% of the users altered the cattle sheds and most of them constructed larger ones which improved shelter and health conditions for the animals. Furthermore, 60% of the respondents wanted the cattle sheds to be located on the ground floor of their houses. 93% of the users complained about the location of the W.C. which was in the cattle shed. The bathing facility in a niche in one of the

rooms whose traditional name is “*kerhiz*” was used by the whole family. The villagers suffered from heating problems in post-disaster houses also, since the wrong orientation of the houses affected the houses’ thermal performance. Since the new village had a strict geometrical order and lacked flexibility, the villagers had difficulties in making alterations to the houses, in order to adapt them to their needs (Köse, 1988:66-67,85,91,96,106-107).

CHAPTER 3

MATERIALS AND METHODOLOGY

In this chapter, the materials and method used to carry out the study are presented. First of all, a literature survey was conducted on the post-disaster housing works done in rural areas of Turkey. The research was concentrated on the studies which were based on field surveys done in rural areas where permanent PDH had been constructed. The master thesis prepared by Günöven (1977), Ceylan (1983), Köse (1988), Balta (1998) and Tercan (2001) helped define the research problem. In the light of these studies, it was noted that most of the permanent PDH constructed in rural areas of Turkey, do not meet the needs of the users. Hence, the research undertaken by the author was focused on this problem and the following materials and methods were used in this study.

3.1 Materials

The materials used for this study can be listed as follows:

i. Photographs, which were taken by the author during both the initial visit and the detailed investigation trips to the study areas.
ii. PDH with *Typical Designs* prepared by government agencies henceforth to be referred to as "*Typical Designs*",
iii. Survey of modifications in the PDH with *Typical Designs* carried out in the villages of Çankırı,
iv. Survey of PDH *Custom Designs* in the area,
v. Survey of a *Traditional House* based on photographs and measured (as-is) drawings,

vi. Questionnaire administrated to the beneficiaries in the target area[3],
vii. Interviews with the officials of the GDCA and GDDA at the Ministry of PWS,
viii. Records of the GDDA,
ix. Literature survey about the research domain conducted at libraries of Middle East Technical University, Bilkent University, Gazi University and GDDA in Turkey and Université de Montréal in Canada, the thesis library of YÖK[4], online library of UMI digital dissertations, online papers and the published material obtained from I-Rec Group[5] at Université de Montréal.
x. Field research was conducted and interviews were made by the author for the EERI (Earthquake Engineering Research Institute) research project "A Comparative Study of Earthquake Recovery issues involving the Performance of Buildings of Timber-laced Masonry Vernacular Buildings in Turkey" project under the leadership of Randolph Langenbach which complemented the study conducted for the doctoral research.

Original plans of *Typical Designs* were obtained from the GDCA at the Ministry of PWS. A questionnaire was prepared in the light of information gained through informal interviews with the beneficiaries. The study conducted in the villages of Çankırı revealed that there are three different ways of locating PDH in the region which are;

i. Constructing houses on original lots of the previous ones (Figure 3.1),
ii. Constructing a new settlement close to the old one (Figure 3.2) and
iii. Constructing new settlement far from the old one (Figure 3.3).

[3] The author acknowledges the valuable guidance of Prof. Dr. Yusuf Ziya Özcan from the Department of Sociology at METU, who helped in finalizing the questions and format of the questionnaire.
[4] The Council of Higher Education of the Republic of Turkey.
[5] Information & Research for Reconstruction.

Figure 3.1 PDH in the existing village.

Figure 3.2 New settlement close to the existing village.

Figure 3.3 New settlement far from the existing village.

As there are examples of these three different ways of constructing PDH in Çankırı, research was conducted in the villages listed below.

a) Şabanözü District
   - *Kale Quarter in Gümerdiğin Village*: A new settlement with 18 PDH was constructed approximately half a kilometre away from the old one. There are PDH both with *Typical* and *Custom Designs* in this settlement. Some of the PDH were being used permanently and some were being used seasonally at the time of the research.

b) Orta District
   - *Old and new Yuva Villages*: A new settlement consisting of 58 PDH with *Typical Designs* was constructed next to the old one and only 6 of the PDH were being used permanently, while others were unoccupied at the time of the research. Some of the houses were being used seasonally, while some were vacant because the beneficiaries had refused to move in.
   - *New Elden Village*: A new settlement with 87 PDH with *Typical Designs* was constructed 5 km. far from the old one and only 7 of the PDH were being used permanently, while others were unoccupied at the time of the research. Some of the houses were being used seasonally, while some were vacant because the beneficiaries had refused to move in.
   - *Aşağı Kayı Village*: 4 post disaster houses were constructed on the lots of the demolished houses in the village. There are three PDH with *Typical* and one with *Custom Design* in the village. Two of the PDH with *Typical Designs* and the PDH with *Custom Design* were being used permanently.
   - *New Derebayındır Village*: A new settlement with 42 PDH with *Typical Designs* was constructed next to the old one. Only 7 of the PDH were being used permanently, while others were unoccupied at the time of

the research. Some of the houses were being used seasonally, while some were vacant because the beneficiaries had refused to move in. at the time of the research.

- *Buğuören Village*: 142 PDH, most of which are with *Custom Designs*, were constructed on the lots of the demolished houses in the village. Nearly all of the PDH were being used permanently.
- *Dodurga Village, Naltepe and Hamamönü Quarters*: Totally 186 PDH most of which are with *Custom Designs*, were constructed on the lots of the houses demolished in the village.
- *Kısaç Village*: 19 PDH, some of which are with *Typical* and others are with *Custom Designs* were constructed on the lots of the houses demolished in the village. Most of the houses were being used permanently.
- *Old Ortabayındır Village*: A new settlement with 52 houses, access to which is almost impossible, was constructed 5 km. away from the old one on top of a hill. All of the houses in the new village were empty at the time the author visited the site, therefore, the old village was visited and the owners of the houses were interviewed there.
- *Kalfat Village*: 35 PDH, some of which are with *Typical* and some with *Custom Designs* were constructed on the lots of the houses demolished in four different quarters in the village.

3.2 Methodology

The study consisted of the following procedure:

i. A literature survey was conducted in order to define the research problem and gain information about rural settlements, disasters, disaster related concepts and post-disaster housing types.

ii. Interviews were made with the officials from the General Directorate of Construction Works and GDDA at the Ministry of Public Works and Settlement several times during the research. Following is the information gained through these interviews:

GDDA Construction Supervision Unit in Orta (This unit is now defunct): An official of this unit was interviewed for the research. This unit supervised and followed the progress of the construction of PDH step by step and sanctioned the amount due to the beneficiaries according to the phases completed in the construction of the houses. The official was interviewed about the details of the reconstruction project; how they checked the construction and paid the loan the beneficiaries, number of finished constructions in each village, which type of PDH were constructed where and the locations of the new settlements *etc*.

Department of Temporary Housing at the GDDA: Head of the department was interviewed about the reconstruction work in Çankırı including information about which organizations did which work and how the money for this project was obtained and used.

Earthquake Research Department at the GDDA: A geologist was interviewed about the criteria according to which decisions were taken as to whether a settlement should be relocated or not after a disaster. In addition, criteria of selecting a new location for reconstruction were discussed with the geologist.

Department of Architectural Projects at GDCA: An Architect from this department was interviewed about the PDH designs constructed in rural areas of Turkey. He was asked whether some modifications were made according to the local requirements of the location or not; and the modifications made for a specific region on the plans of PDH were then discussed.

iii. Initial visit to existing and new settlements

According to the literature cited and interviews done with the officials from the Government, Kale Quarter in Gümerdiğin Village in Şabanözü District and old and new Yuva Villages, New Elden Village, Aşağı Kayı Village, New Derebayındır Village, Dodurga Village and Kalfat Village in Orta District were visited on 10th, 11th and 12th of December 2004 for 3 days under the guidance of an official who had worked for the GDDA Construction Supervision Unit in Orta. During this initial visit, one-to-one interviews were done with the beneficiaries who have shifted to the PDH permanently, with those who refused to live in these houses, those who live in custom designed PDH and those who were not beneficiaries of PDH. Furthermore, modifications done on the *Typical Designs* and the *Traditional House* typology were observed visually and recorded with the help of about 700 photographs taken in the region.

Beneficiaries who have shifted to the PDH permanently were asked about their likes and dislikes about the *Typical Designs* and the *Traditional Houses* in which they used to live before the earthquake, how long had they been using the PDH, whether they made some modifications on the PDH or not. In addition, modifications done were observed visually. Beneficiaries who refused to live in these houses were interviewed about the reasons of refusing the PDH and their likes and dislikes about the traditional houses they lived in. Furthermore, beneficiaries who live in PDH with *Custom Designs* were interviewed about the reasons of rejecting the typical designs and their likes and dislikes about the PDH with *Custom Designs*. Those who were not beneficiaries were also interviewed about their likes and dislikes about their traditional houses and opinions about the PDH in the region.

According to the information gained during this visit it was decided that experiences of the permanent users of the PDH were noteworthy and as it

was possible to see the examples of PDH both with *Typical* and *Custom Designs* and also the three different ways of locating PDH, it was decided to conduct the study in this area. Interviews with the beneficiaries, observations in the area and information gained about the reconstruction work helped draw the outline of the investigation including questionnaires, measuring the PDH with *Custom Designs*, modified PDH with *Typical Designs*, and a *Traditional House* in the region.

In addition three *Traditional Houses*; one in old Yuva Village, one in Dodurga Village and one in Kalfat Village were observed and sketches of the plans of these houses were drawn in order to choose the *Traditional House* which would be measured in detail. Three of the houses had the typical planning of the *Traditional Houses* in the region but as it was possible to see the façades of the four sides and structural system from both outside and inside of the house clearly and it was decided to measure the *Traditional House* in Yuva Village.

iv. Research in existing and new settlements

The research, which lasted for 8 days between 19th to 26th March 2005, was conducted in Kale Quarter in Gümerdiğin Village in Şabanözü District and old and new Yuva Villages, New Elden Village, Aşağı Kayı Village, New Derebayındır Village, Buğuören Village, Dodurga Village, Kısaç Village and Old Ortabayındır Village in Orta District. The research included the following phases:

- Questionnaires (see Appendix A) were administered to the users of the PDH with *Typical* and *Custom Designs* based on the initial interviews,
- Measurement of modified *Typical Designs* were taken and plans were drawn accordingly,

- Measurement of PDH with *Custom Designs* were taken and plans were drawn accordingly,
- Measurement of a *Traditional House* in the region were taken and its plans were also drawn,
- Visual records including photographs and sketches.

Exact number of constructed *Typical Designs* is not available with the GDDA. Furthermore, research reveals that a large number of these houses are unoccupied while some are seasonally occupied. The Government does not possess any records for the number of houses that are occupied permanently or seasonally, or those that stand empty. Although the total number of PDH constructed in the study area was 1,221, the exact number of the projects which are permanently occupied is not known, therefore, a random sample of 90 families was selected for the study. These families were permanent residents since the survey was conducted in the winter months. During summer months however, seasonal occupants can also be contacted but it was not considered to be important for this study. The questionnaire was filled by the following sample.

- 40 permanent residents of the PDH with *Typical Designs* were met during the field trip to the villages and everybody who happened to occupy the PDH at that time was included in the sample.
- As the questionnaires were administrated to 40 permanent residents of PDH with *Typical Designs*, the questionnaire was administered to the same number of permanent users of the PDH with *Custom Designs* in order to compare the data.
- 10 beneficiaries who refused to move to their PDH with *Typical Designs* were met in the study area and the questionnaire was administered to these people.

Data gained through the questionnaires filled by those 80 families who are permanent PDH users was analyzed with the help of statistical tools. The questionnaire was filled by both the users of the PDH with *Custom Designs* and *Typical* ones in order to compare their preferences about these houses. Furthermore, data collected from the questionnaires administered to the 10 beneficiaries who refused to move to their PDH with *Typical Design* was evaluated.

During both the initial visit and the field survey, a total of 1,500 photographs were taken in order to; record the situation in the settlements, characteristics of the region, *Traditional House* types, types of PDH, types of changes in the PDH and interior and exterior details. All these photographs helped while drawing the plans of the *Traditional House*, modified and custom designed PDH.

v. Research at Université de Montréal in Canada

From mid-April until the end of June 2005, research including literature survey about the research subject and guidelines for reconstruction projects and design of PDH was studied at the Université de Montréal in Canada as per the advice of Prof. Colin H. Davidson, the author's mentor at Université de Montréal.

vi. The EERI Research Project

The author is involved in an international research project with architect Randolph Langenbach. This project is focused on the performance of timber framed and masonry infilled buildings (referred to as "*hımış" in* Turkish) during the four earthquakes in Turkey namely the 1999 Kocaeli Earthquake, the 1999 Düzce earthquake, the 2000 Orta (Çankırı) earthquake and 2002 Afyon Çay earthquake. The beneficiaries were interviewed about their likes and dislikes regarding their PDH and interviews were made with the officials

of the Government and Prof. Polat Gülkan from the Department of Civil Engineering at Middle East Technical University about the subject of the project and some of the information gained through these interviews were included in this dissertation. Furthermore, a field survey was conducted including measuring and drawing the structural systems of the timber framed sun brick infilled "*hımış*" structures in Yuva Village of Orta for this research project but this work is not included in this dissertation.

CHAPTER 4

CASE STUDY: POST-DISASTER RECONSTRUCTION PROJECTS IN THE VILLAGES OF ÇANKIRI

In this chapter, at first general information about Çankırı and its villages including geographical, demographical, topographical, climatic, geological and economic characteristics of the region are described. Then, house typology in the region is presented in detail; and the post-disaster reconstruction projects in the villages of Çankırı undertaken after the earthquake occurred on 6th of June 2000, is described. Finally evaluations of housing provision and housing design and the analyses of data obtained from the questionnaires regarding user satisfaction are presented.

4.1 General Information on Çankırı and its Villages

The province of Çankırı lies on the Northern part of Central Anatolia between this region just below the Black Sea Region. Province of Çorum lies on its east, Bolu on the west, Kastamonu and Zonguldak on the north and Ankara on the south of Çankırı. It has a population of 270,355; 129,169 of which represents the rural and 141,186 of represents the urban population according to the census 2000. It can be said that 48% of the population in Çankırı live in rural areas, whereas 52% live in urban centres.

The area of Çankırı is 738,800 km^2. The region has a hilly terrain, which is not appropriate for agricultural activities. Most of the areas of the province are mountains and plateaus, however, there are very few plains in the region. Figures 4.1 and 4.2 show views from a village in Çankırı and Table 4.1 shows distribution of the areas in this region with regard to their type of terrain.

Figure 4.1-2 Views from a village in Çankırı.

Table 4.1 Distribution of the areas in Çankırı with regard to their type of terrain.

TYPE OF THE AREA	Ha	PERCENTAGE (%)
Agricultural areas	236,000	31.9
Forests	204,393	27.6
Pastures	279,154	37.9
Unused and settlement areas	19,253	2.6
TOTAL	738,800	100.0

Source: http://www.cankiri.gov.tr

There are 12 districts and 370 villages in Çankırı and the number of the settlements attached to the villages is 192. The total length of the roads in the villages is 3,108 km, 485 km of which is asphalt and 1,825 km of which is stabilized. The rural area of the province is composed of mountains (61%), low plains (7.7%) and highlands (2.6%).

In this region summers are warm and dry, while winters very cold. The annual average temperature in Çankırı is 11.5 °C; maximum annual average temperature is 23.5 °C and minimum annual average temperature is 23.5 °C in the province. The annual average humidity is 66% in Çankırı, where it is 53% in summer months and 80% in winter months on an average.

Furthermore, the annual rain amount is 397.2 mm. in this province. It rains mostly in spring, however there is very little rain in the summer months. Because of these climatic characteristics only hardy plants and shrubs grow in this region.

The province also lies on the North Anatolian Fault zone, which is why the area suffers frequent minor earthquakes. On the other hand, Çankırı has experienced major earthquakes also. The earthquakes of 1944 and 1949 struck with a magnitude of 7.2, that of 1951 had a magnitude of 6.9, while that of 1953 had a magnitude of 6.1[6] and the most recent major earthquake which struck in 2000 had a magnitude of 5.9 on the Richter Scale. Çankırı is on three different earthquakes zones because of its location. Figure 4.3 shows location of Çankırı on the earthquake zoning map of Turkey.

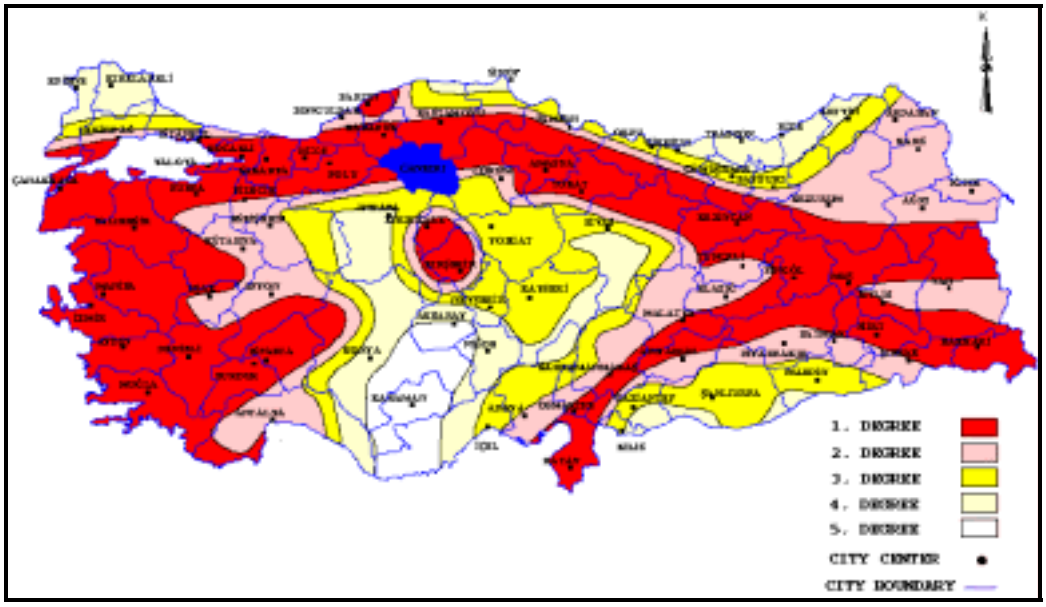

Figure 4.3 Location of Çankırı on the earthquake zoning map of Turkey.
Source: http://www.deprem.gov.tr

[6] http://www.jeomuh.hacettepe.edu.tr

Economy depends on agriculture in the province although, agricultural activities show differences in the northern and southern parts of Çankırı. Ilgaz Mountains on the north are covered with forests and the fort hills on the south of the mountains get very little rain. On these plateaus food grains are planted and animals are reared. Main agricultural products of the region are wheat, barley and beans apart from animal products. Çankırı is a very suitable place for animal rearing because of its natural conditions and wide pastures. There are 115,119 cattle, 143,622 sheep and goats, 1,625,240 poultry and 44,723 bee hives in the region[7].

The traditional way of life is still continuing especially in the villages of Çankırı. For instance there are "*village rooms*" called "*köy odası*" in the villages where men come together. Extended families can also be seen in the villages.

4.2 House Typology in the Study Area

The designs of houses in the various villages of Çankırı do not differ much. The reason for that can be similarity in life style, climate and the geological characteristic of the region. Because of the earthquakes experienced in this area, the workmen who constructed the houses might have taken into consideration this aspect and built timber-framed structures. It is known that timber-framed structures have the ability to respond to and withstand earthquake forces as long as they are constructed according to the norms. In general the houses in this area have a "*sofa*" type plans various configurations of which are given in Figure 2.1. Most of these houses have either central "*sofas*" or outer "*sofas*". These houses are also mostly oriented to the South and their northern sides do not have many openings. These houses open onto a garden and have a panoramic view from the top floor.

[7] http://www.cankiri.gov.tr

Although there are single storied ones, houses in the villages of Çankırı are generally two storied (Figures 4.4 and 4.5). The first floor of a house in rural Çankırı has service spaces such as kitchen and cattle shed and also there is at least one "*winter room*" called the "*kış odası*" on this floor. The first floor is simply planned for daily life activities such as cooking, eating, living and sleeping. The second floor has a splendid view and this floor is used mostly during the summer months and also for entertaining visitors. On the second floor, there is a wide "*sofa*" and the rooms are accessed through this space. Figure 4.6 shows an example of a central "*sofa*" and figure 4.17 shows an example of an outer "*sofa*".

Figure 4.4-5 Houses in the study area.

Figure 4.6 Central "*sofa*".

Each room can cater the daily life activities of the occupants. There are closets in the rooms, which serve for both storing the bedding and bathing activity which is called "*gusül*". The space for bathing in the closet is called "*gusülhane*" in Turkish. Furthermore, there is a fireplace in each room. In addition, there are divans called "*sedir*" in these rooms, which are installed during the construction of the house. Figure 4.7 shows a room in a *Traditional House* with a fireplace, a "*sedir*" and a closet and in "*gusülhane*" can be seen in Figure 4.8.

Figure 4.7 A room of a *Traditional House* with a fireplace , a "*sedir*" and a closet.

Figure 4.8 "G*usülhane*" in the closet.

Construction materials used in *Traditional Houses* in the region are timber, sun-dried brick, plaster, stone, brick, mud and clay tile. There are four types of construction systems in the region:

- Timber-framed structures with masonry infill,
- Composite structures,
- Masonry structures,
- Reinforced concrete structures.

Timber-frame with masonry infill is called "*yeğdane*" in the region. Infill of the timber-frame can be either sun-dried brick or natural stone. For instance, in Yuva Village, nearly all of the timber-frames have sun-dried brick infill, whereas in Ortabayındır Village natural stone infill is commonly used. The reason for that can be abundance of the material in the area. It was observed that due to the earthquake occurred in June of 2000, the amount of damage in Yuva Village was much less than in Ortabayındır Village. The reason for this could have been that in Ortabayındır Village material used for infill was natural stone which did not have a proper tie with the rest of the structure and fell down during the earthquake. A timber-framed structure with sun-dried brick in Yuva Village is seen in Figure 4.9.

Figure 4.9 Timber-framed structure with sun-dried brick infill (Yuva Village).

Composite structures seen in the region have stone masonry first floors and timber-frame with sun-dried brick or natural stone infill second floors. In some houses in Yuva Village three walls of the ground floor excluding the front wall was constructed with stone masonry, whereas the front wall and the top floor was constructed with timber-frame structure with sun-dried brick infill in order to make the front façade look better. Examples of composite structures are seen in Figures 4.10 and 4.11. Although, they are not very common, houses

which have brick masonry and reinforced concrete structures can also be seen in the villages.

Figure 4.10 Composite structure: Stone masonry first floor and timber-frame with sun-dried brick infill (Yuva Village).

Figure 4.11 Composite structure: Stone masonry first floor and timber-frame with stone infill (Ortabayındır Village).

In order to understand spatial requirements and space organization of the *Traditional Houses* in the region, a *Traditional House* in Yuva Village was measured. As seen in Figures 4.14 and 4.16 plans of the house have the spatial organization mentioned above. It is a two storied house with two rooms, a dairy product room, kitchen and cattle shed on the first floor and three rooms, "*sofa*", bathroom and WC on the second floor. There is a fireplace, a "*gusülhane*", a "*sedir*" and closets in each room. Entrance of the house and four of the rooms were oriented to the south, whereas cattle shed, dairy product room, kitchen and one of the rooms were oriented towards the north. Figures 4.12, 4.13, 4.15 and 4.17 show views from inside of the house.

Figure 4.12 View from a room on the first floor.

Figure 4.13 View from a room on the first floor.

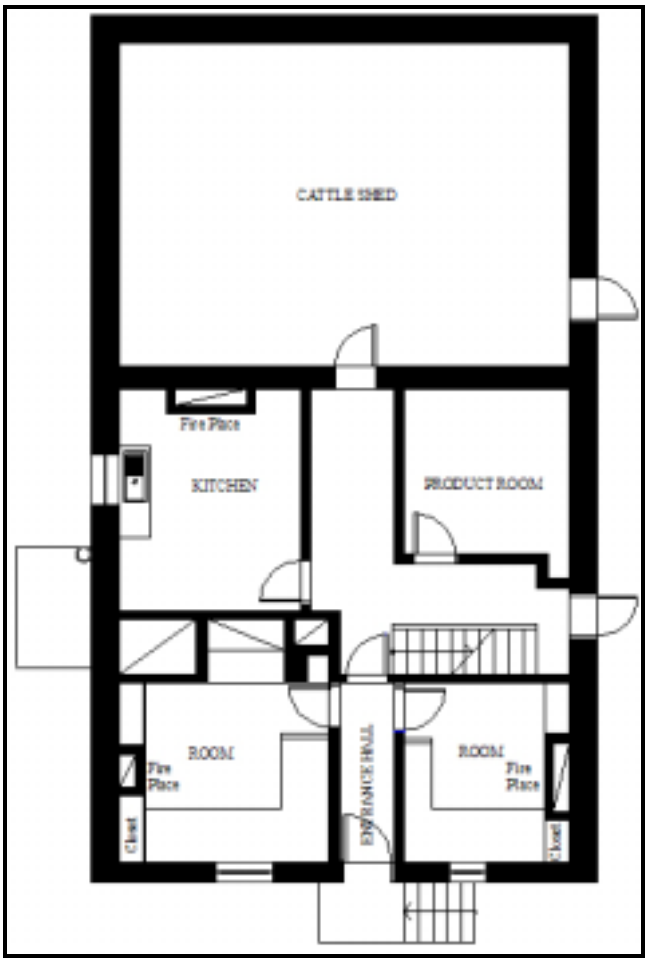

Figure 4.14 First floor plan.

Figure 4.15 View from the entrances of the spaces on the second floor.

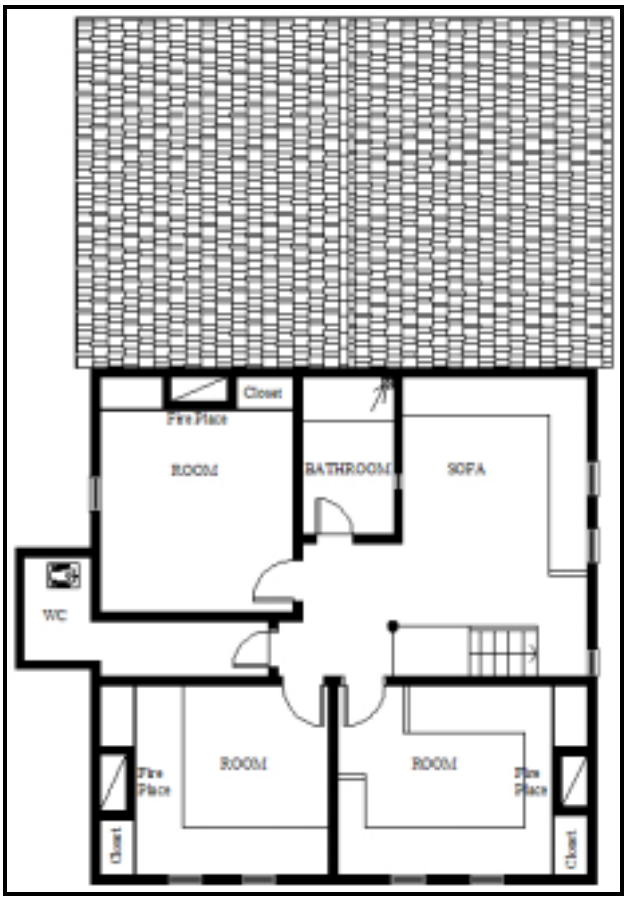

Figure 4.16 Second floor plan.

Figure 4.17 View of the "*Sofa*" on the second floor.

The building has a composite structure: three walls of the ground floor is stone masonry and the second floor and the front wall of the first floor is timber-framed with sun-dried brick infill. The building was constructed on a stone plinth. The flooring and ceiling cladding is timber in all of the living spaces and kitchen, however the floor is made of compacted mud in the dairy product room, bathroom and WC; while in these spaces the ceiling was not finished with timber cladding. The walls were plastered first with mud and then with a layer of lime plaster. Some walls in some of the spaces were painted also. Clay tiles were used for cladding the timber framed roof. Section of the house is seen in Figure 4.18 and southern façade of it is seen in Figure 4.19.

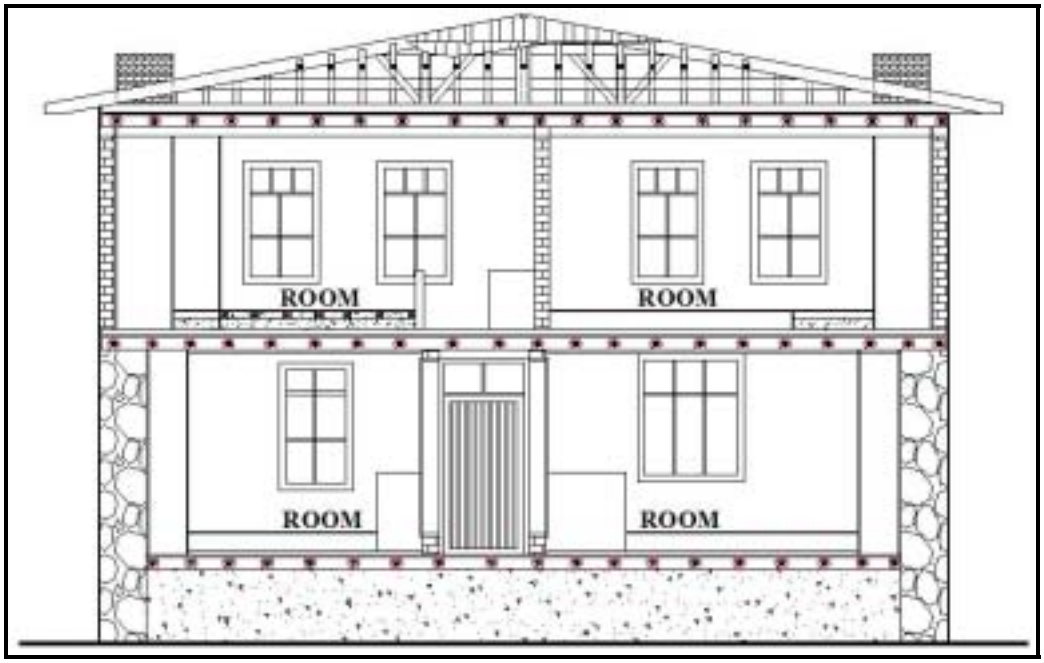

Figure 4.18 Section.

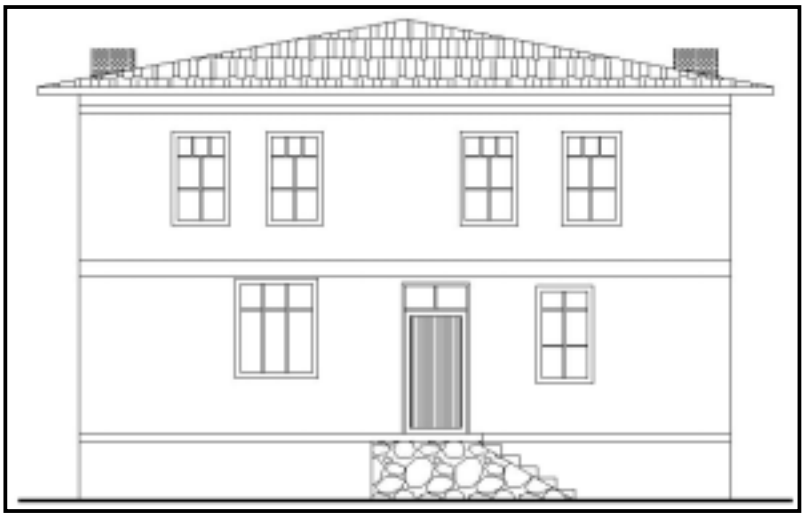

Figure 4.19 Southern façade.

4.3 Post-Disaster Reconstruction Projects in the Villages of Çankırı

On 6th of June 2000 an earthquake of magnitude 5.9 on the Richter Scale shook Orta district in Çankırı and the surrounding villages. Damage was especially concentrated in rural areas consisting of Yuva, Kısaç, Salur, Buğuören, Elden, Dodurga, Ortabayındır, Derebayındır and Tutmaçbayındır Villages of Orta district. Most of the heavily damaged houses were made of masonry and adobe structures with some rubble stones and mud (Demirtaş *et al.*, 2000).

There were 3 casualties and 200 injured[8] due to the earthquake. According to the records of the GDDA, 1,892 houses were demolished or heavily-damaged, 184 were moderately-damaged and 2,440 houses were slightly-damaged. Some of the slightly damaged houses were recorded as heavily damaged in order to provide PDH to the owners of these houses. Government officials mentioned the reasons for doing that as; scarce of indigenous building materials, cost of repair, lack of experts about traditional

[8] http://www.jeomuh.hacettepe.edu.tr/jeoweb/deprem/deprem.htm

construction systems and preferences of the victims about owning new houses to repairing their *Traditional Houses*. According to the regulations, houses of the people who have the right to own a PDH should be demolished. At the time of the field survey, the *Traditional Houses* were not demolished yet.

After the first aid consisting of tent and food distribution, Ministry of PWS initiated reconstruction projects in the area; it was decided to provide permanent post-disaster housing loans for people whose houses were demolished or heavily damaged. In the year 2000, nearly 3,074 € (5,000 YTL) were provided to the victims with a payback period of 20 years without interest[9]. The year after, nearly 3,687 € (6,000 YTL) of housing loans were provided to the beneficiaries who did not get the loan in 2000 under the same conditions.

According to this system 1,221 PDH were constructed in 5 districts of Çankırı. Besides seven new settlements, five of which are in Orta and two in Şabanözü districts, some of the PDH were constructed in the existing villages. As mentioned in Chapter 3, some of the new settlements are far from the existing ones, while some are close to the existing villages (Figures 4.20 and 4.21). Table 4.2 shows the numbers of villages/quarters, new settlements and PDH in Çankırı. The GDDA Construction Supervision Unit in Orta[10], which does not exist anymore, was established for the reconstruction project in Orta District and the surrounding villages. This unit had the responsibilities of approving the *Custom Designs*, checking the works going on in the area and paying the loan to the victims according the completed stages of constructions.

[9] Records of General Directorate of Disaster Affairs, 2001
[10] Afet İşleri Genel Müdürlüğü Orta İnşaat Kontrol Amirliği

Figure 4.20 New settlement far from the existing village.

Figure 4.21 New settlement close to the existing village.

Table 4.2 Number of villages/quarters, new settlements and PDH in Çankırı.

District	No of villages/ quarters	No of new settlements	No of PDH
Çerkeş	16	0	98
Atkaracalar	3	0	4
Şabanözü	19	2	210
Orta	30	5	908
Bayramören	1	0	1

Source of statistics: GDDA

Three different *Typical Designs* of permanent post-disaster housing, an example of which is seen in Figure 4.22 below, were prepared by a private firm for the area. However, the beneficiaries who did not like any of these three types had the option to get their houses designed professionally. These designs had to be approved by the GDDA Construction Supervision Unit in Orta in order to check their earthquake resistance and also avail of the house building loan. This study revealed that beneficiaries who chose to construct *Typical Designs* also do not like them after they started to live in them.

Figure 4.22 PDH with *Typical Design.*

In addition, beneficiaries were responsible for hiring builders to construct their houses. The loan provided by the Government was not enough for constructing a house, so the beneficiaries covered the rest of the costs by themselves. The constructions began in the year 2000 and most of the beneficiaries started living in the houses by 2002. Flow chart of the reconstruction process based on the reconstruction projects in the Çankırı villages can be seen in Figure 4.23.

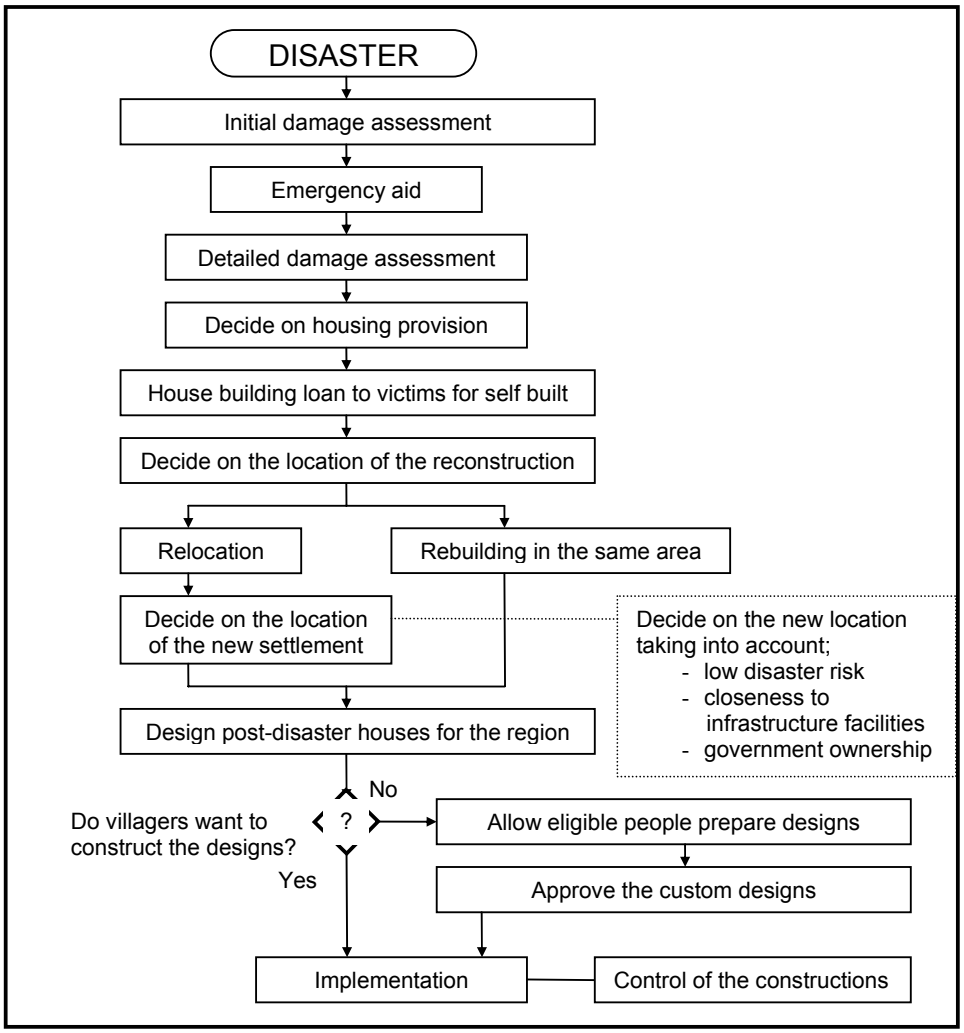

Figure 4.23 Flow chart of the reconstruction project.

The reconstruction process, which has the following organizational set up giving an overview of the partners in it, depends on whether the project will be located in a new area or not and whether the beneficiaries want to implement official design or custom made designs (Figure 4.24).

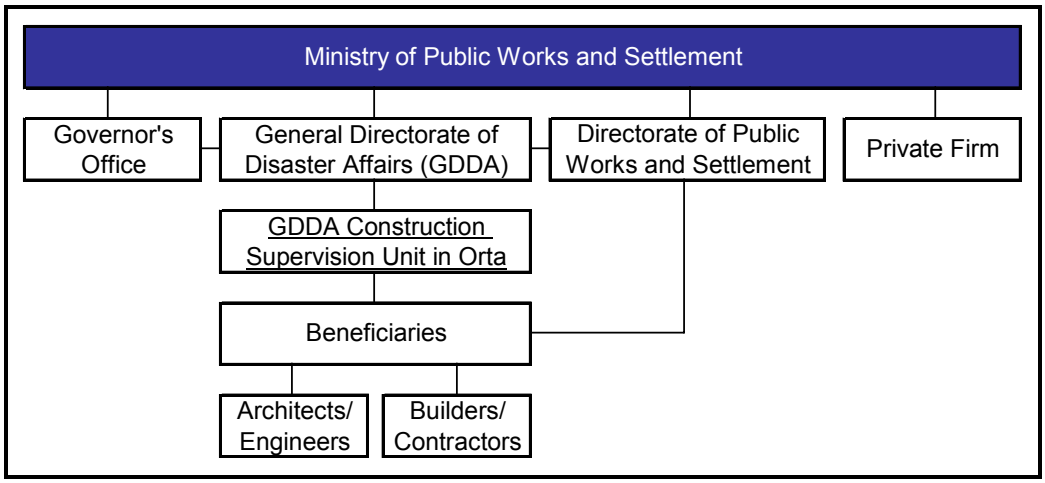

Figure 4.24 Organizational set up of the reconstruction project.

As mentioned before, the process was initiated and controlled by the Ministry of PWS while then the GDDA, the Governor's office, Directorate of Public Works and Settlement, the GDDA Construction Supervision Unit in Orta, a private firm, builders, designers and the beneficiaries all participated in the project. The private firm, who designed the PDH, communicated only with the Ministry of PWS at the beginning of the project. The beneficiaries had contacts with the GDDA Construction Supervision Unit in Orta and when this unit was disbanded Directorate of Public Works and Settlement took over the responsibilities of the unit. The designers and builders hired by the beneficiaries interacted with them only.

The various partners in the house building process each have a specific role to play. Their responsibilities and roles are outlined in Table 4.3.

Table 4.3 Matrix showing the organizations and operations of the reconstruction project.

	Government authorities	Private Firm	Beneficiaries
Damage assessment	■, ▲		
Decision on housing provision	■, ▲		
Collection of information on possible locations disasters	■, ▲		
Providing house building loan	■, ▲		
Taking decision on relocating or rebuilding in the same area	■, ▲		
Taking decision on the location of the new settlement	■, ▲		
Design of PDH	■	▲	
Custom design of PDH	■		▲
Approve of the *Custom Designs*	■, ▲		
House building phase	■		▲
Control of the constructions	■		

Key: ■ Organizer of the whole or part of the project ▲ participant in the project

4.3.1 Evaluation of Housing Provision

The PDH with *Typical Designs* which are seen in the Figures 4.32, 4.38 and 4.43 are 84.81 m^2, 103.75 m^2 and 75.68 m^2 single storey brick masonry buildings. Exact number of constructed *Typical Designs* is not available with the GDDA. Furthermore, research reveals that a large number of these houses are unoccupied while some are seasonally occupied. The

Government does not possess any records for the number of houses that are occupied permanently or seasonally, or stand empty.

As mentioned above there are custom designed houses in the region which are in general single storied brick masonry buildings. These PDH were designed in two different ways: some beneficiaries hired architects to design houses for themselves. In this case, the beneficiary had the chance to discuss the design with the architect and get a plan which is appropriate to his/her way of life. Consequently these beneficiaries are highly satisfied with the planning of their house. On the other hand, a builder hired an architect to design a few types of PDH for the beneficiaries in a village, he did not bill the villagers for design services but he got the job for building the PDH instead. In this case, villagers did not discuss the design with the architect, but the builder who has some opinions about the way of life of the users, without doing an investigation, discussed the design with the architect. It can be said that some of the villagers are satisfied with the planning of these PDH, while some are not. Percentage of satisfaction with the PDH with *Typical* and *Custom Designs* are given in Section 4.2.3.

It was observed that in the visited new settlements most of the PDH are with *Typical Designs*, whereas most of the PDH in existing villages are with *Custom Designs*. In Figure 4.25 a PDH with *Custom Design*, which was constructed on the lot of the previous house is shown. Since, service spaces of cattle shed, straw shed and place for making bread still exist on the lot, the beneficiaries go on using these spaces (Figure 4.26). Plans of two PDH with *Custom Designs* in the region are shown in Figures 4.27 and 4.28.

Figure 4.25 A PDH with *Custom Design* on the lot of the previous house.

Figure 4.26 Existing service spaces on the lot.

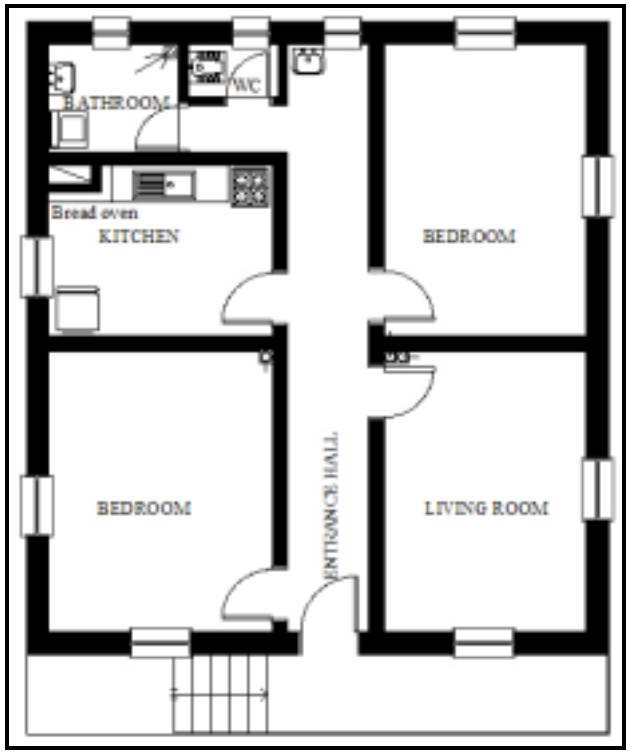

Figure 4.27 Plan of a PDH with *Custom Design* (84 m^2) - the builder hired an architect to design this house.

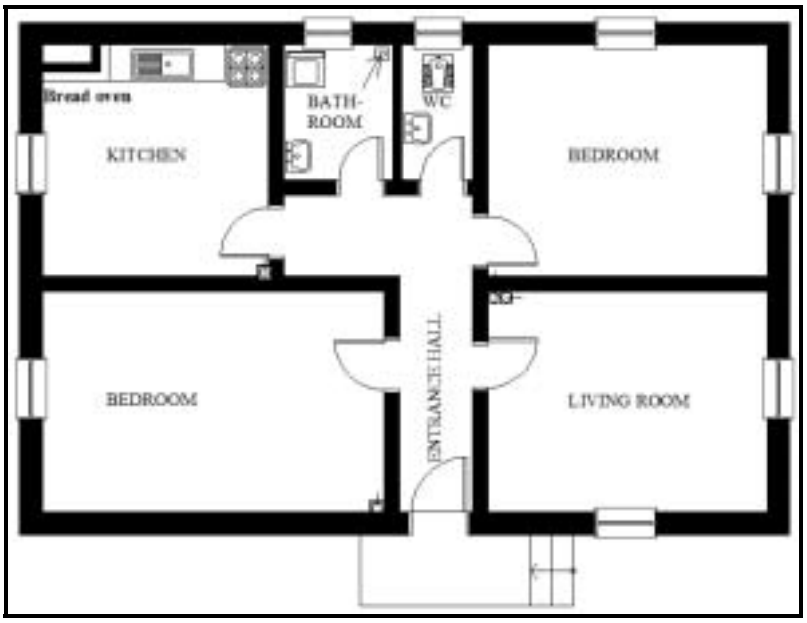

Figure 4.28 Plan of a PDH with *Custom Design* (103 m^2) - the beneficiary hired an architect to design this house.

4.3.2 Evaluation of Housing Design

It was observed that users altered the PDH with *Typical Designs* in order to adapt them to their way of life. They made modifications in the plans, changed the functions of spaces and added some spaces to the houses. In this section modifications on the PDH with *Typical Designs* are evaluated according to the measurements, visual observation of these houses, data obtained from the questionnaires and the photographs taken. Positive and negative aspects of the *Typical Designs* and the new settlements are also evaluated according to the data obtained from the questionnaires and observations made in the region.

4.3.2.1 Evaluation of Modifications on the PDH with *Typical Designs*

It was observed that the permanent users of *Typical Designs* modified their houses in order to adapt them to their way of life. They changed the plans of

the houses, changed the functions of the spaces and/ or added spaces to them. Figures 4.29, 4.30 and 4.31 show examples of these houses.

Figure 4.29 A modified PDH with *Typical Design* - Type 1 (84 m^2).

Figure 4.30 A modified PDH with *Typical Design* - Type 2 (103 m^2).

Figure 4.31 A modified PDH with *Typical Design* - Type 3 (75 m^2).

Modified PDH with *Typical Designs* were measured and the questionnaires were administered to the users. The modifications listed below were revealed according to the measurements, visual observation of the houses and the information gained through the questionnaire filled by each user of the measured houses and photographs taken.

1. Modified PDH with *Typical Design* - Type 1 (84.81 m^2)

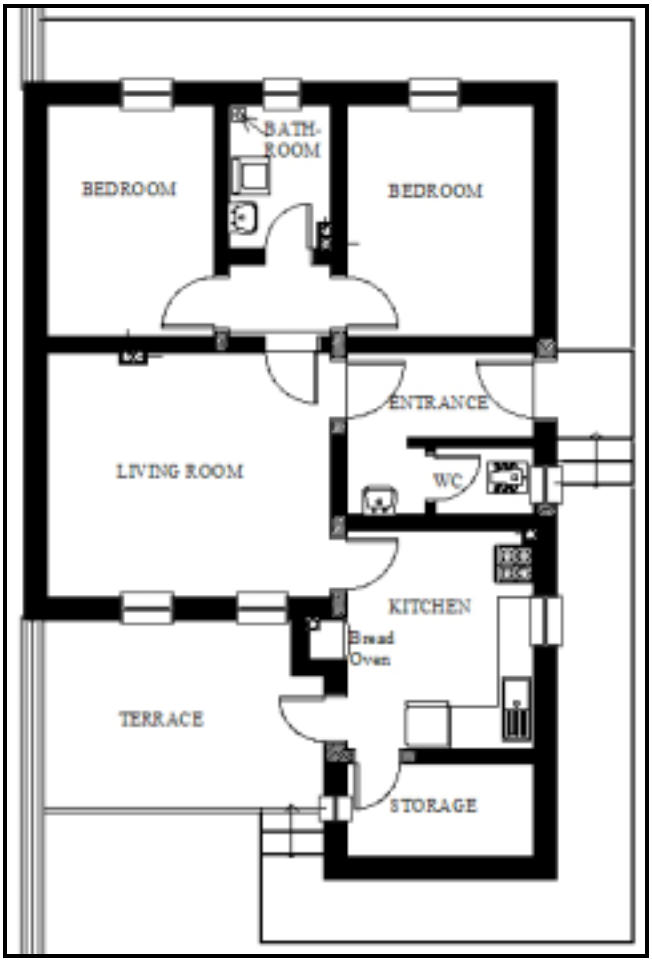

Figure 4.32 Original Plan of the PDH with *Typical Design* - Type 1 (84.81 m^2)
Source: Archives of the Ministry of PWS

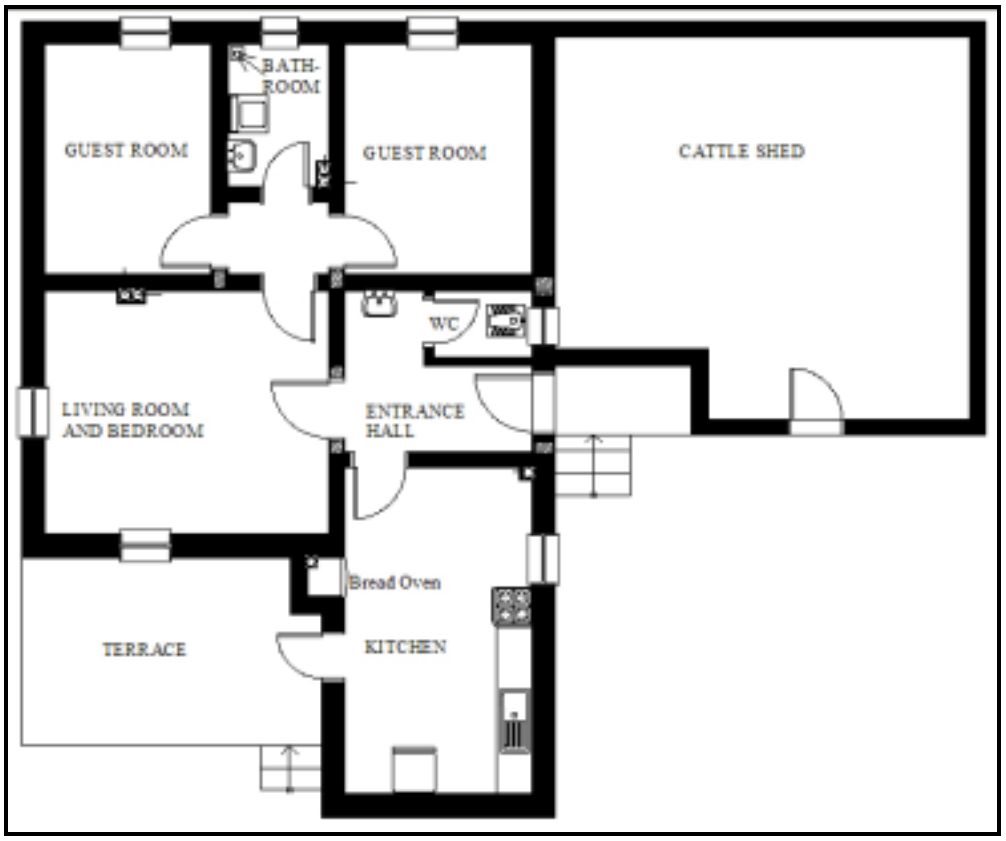

Figure 4.33 Modified Plan of the PDH with *Typical Design* in Gümerdiğin Village, Kale Quarter - Type 1 (84.81 m^2)

A. Following modifications were made in the **plans** of PDH by the owners:

i. Location of a window was changed and a small window was not constructed,
ii. Locations of the WC and the sink were changed in the entrance hall,
iii. Entrance of the kitchen was shifted,
iv. The wall between the kitchen and the store room was not constructed (Figure 4.34),
v. Locations of the main door of the house and the door opening to the living room from the entrance were changed,
vi. A roof was built over the terrace.

Figure 4.34 Kitchen of the PDH.

B. Following modification was made in the **function** of a space in the PDH by the owners:

   Living room is used as both a living room and a bedroom.

C. Following is the **space added** to the PDH by the owners:

   Cattle shed (Figure 4.35).

Figure 4.35 Added cattle shed.

D. Following are modifications the owners **would like to make** in their PDH if they could afford to:

i. Construct a bigger cattle shed as the one they made is not large enough for their animals,
ii. Construct a straw shed next to the house, although it is nearly impossible because there is not enough space for extensions on the lot,
iii. Add a window to the kitchen wall.

2. Modified *Typical Design* - Type 1 (84.81 m2)

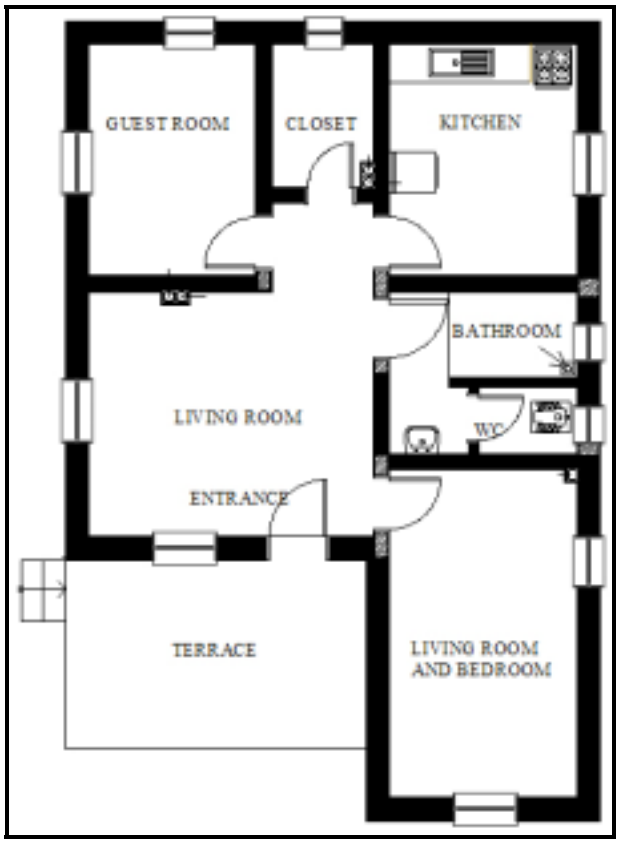

Figure 4.36 Modified Plan of the PDH with *Typical Design* in Gümerdiğin Village, Kale Quarter - Type 1 (84.81 m^2)

A. Following modifications were made in the **plans** of PDH by the owners:

i. Entrance of the house was moved to the terrace,
ii. Entrance hall was converted into a bathroom (Figure 4.37),

iii. The door between the living room and the small corridor was not installed,
iv. The wall between the kitchen and the store room was not constructed,
v. Kitchen combined with the store room is used as a living space and a bedroom,
vi. Entrance hall has been converted into a bathroom,
vii. Locations and the sizes of the windows were changed,
viii. The bread oven in the kitchen space was not built and this room is now being used as living room-cum-bedroom.

Figure 4.37 Bathroom which was converted from the entrance hall.

B. Following modifications were made in the **functions** of the spaces in the PDH by the owners:

i. Space for bathroom is used as a store room,
ii. One of the bedrooms in the original plan is used as the kitchen,
iii. Living room is used for both living and sleeping.

C. Following is the modification the owners **would like to make** in their PDH if they could afford to:

Replace the flooring with wooden parquet.

3. Modified PDH with *Typical Design* - Type 2 (103.75 m^2)

Figure 4.38 Original Plan of the PDH with *Typical Design*-Type 2 (103.75 m^2)
Source: Archives of the Ministry of PWS

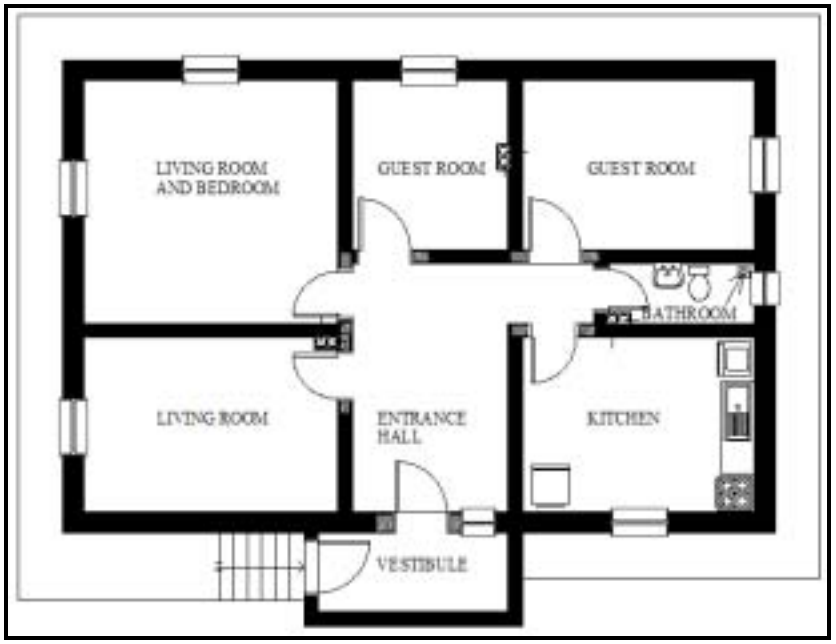

Figure 4.39 Modified Plan of the PDH with *Typical Design* in Yuva Village - Type 2 (103.75 m^2)

A. Following modifications were made in the **plans** of the PDH by the owners:

   i. Sizes of the spaces were changed,
   ii. WC was not constructed,
   iii. The corridor was extended and connected to the entrance hall by moving the partition wall of the living room back that all the rooms could be entered from the corridor rather than the living room (Figure 4.40),
   iv. The wall between the kitchen and the store room was omitted,
   v. The bread oven in the room now being used as the living room was not constructed,
   vi. Sizes and locations of the windows were changed.

Figure 4.40 Extended corridor.

B. Following modifications were made in the **functions** of the spaces in typical PDH plans by the owners:

   i. The store room was added to the kitchen and is being used for living room,
   ii. Bathroom is used as both bathroom and WC,
   iii. One of the bedrooms in the original plan is used as the kitchen,
   iv. Living room in the plan is used as guest room,

v. Room in the plan is used both for sleeping and living (Figure 4.41).

Figure 4.41 Room used for sleeping and living.

C. Following is the **space added** to the PDH by the owners:

An entrance vestibule was added, as the entrance of the house was exposed to strong winds (Figure 4.42).

Figure 4.42 Added vestibule.

D. Following are modifications the owners **would like to make** in their PDH if they could afford to:

i. Constructing a shed to store wood,
ii. Add a window on the other wall of the kitchen,

iii. Add another wall to the kitchen wall to make it thicker, because it is very difficult to keep it warm.

4. Modified PDH with *Typical Design* - Type 3 (75.68 m^2)

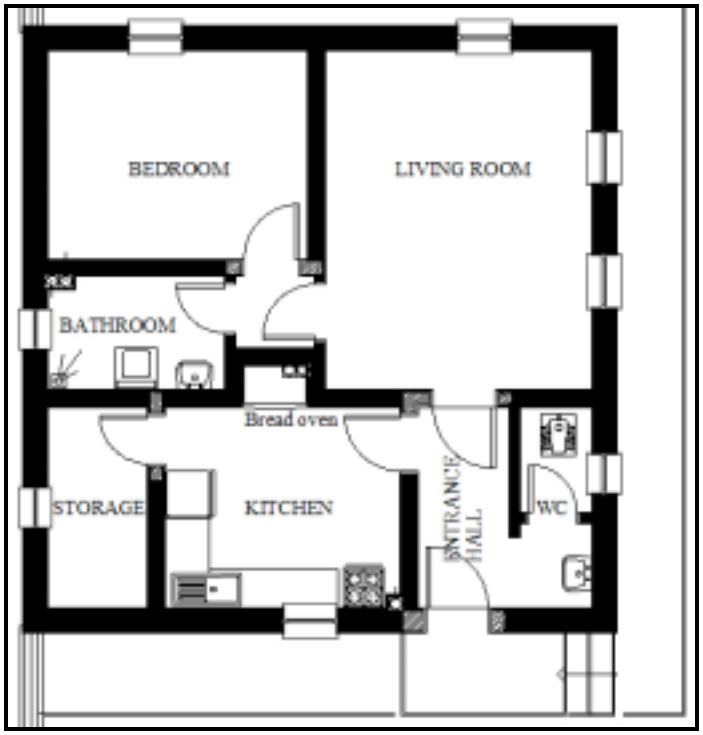

Figure 4.43 Original Plan of the PDH with *Typical Design* - Type 3 (75.68 m^2)
Source: Archives of the Ministry of PWS

A. Following modifications were made in the **plans** of the PDH by the owners:

i. The wall between the kitchen and the store room was omitted,
ii. The door between the living room and the small corridor was not installed,
iii. The bread oven in the room now being used for kitchen, bedroom and living room was not constructed.

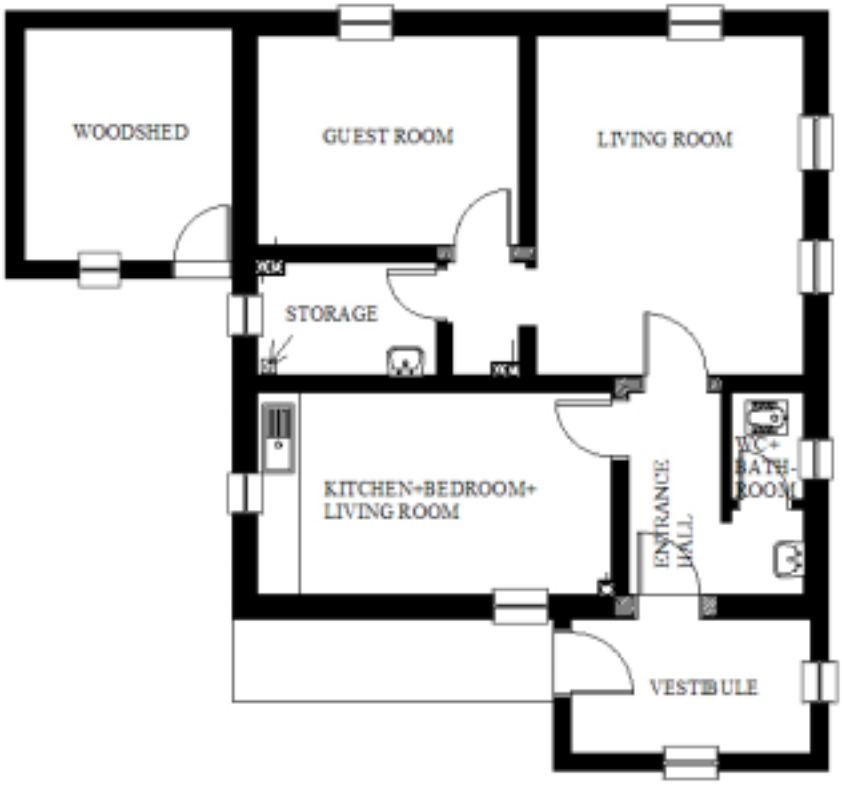

Figure 4.44 Modified plan of the PDH with *Typical Design* in Elden Village - Type 3 (75.68 m^2)

B. Following modifications were made in the **functions** of the spaces in typical PDH plans by the owners:

   i. Store room was added to the space designed as the kitchen and this room is then being used for cooking, sleeping and living altogether. The beneficiaries state that the other rooms are not exposed to sunlight[11], so they use this one space for three different functions,
   ii. The WC is used for both bathing and toilet use,
   iii. The bathroom is used for storage.

[11] Sunlight here is understand as both daylight and solar heat source by the interviewers

C. Following are the **spaces added** to the PDH by the owners:

i. An entrance vestibule was added, as the entrance of the house was exposed to strong winds (Figure 4.45),
ii. A storage shed was added to store wood (Figure 4.45).

Figure 4.45 Added storage and vestibule.

D. Following are modifications the **owners** would like to make in their PDH if they could afford to:

i. Replacing the flooring with wooden parquet,
ii. Constructing a cattle shed and straw house,
iii. Changing the location of the WC at the back of the house from its present location next to the entrance for more privacy.

4.3.2.2 Positive and Negative Aspects of "*Typical Designs*" and New Settlements

This research revealed that most of the beneficiaries refused to move to the new settlements; whereas, most of the new houses (PDH) constructed on their original locations are being used. All of the new settlements visited consist of, *Typical Designs*", but both PDH with *Typical Designs* and *Custom*

Designs can be seen in the villages where new houses were constructed on their original lots.

The users of PDH with the *Typical Designs* were asked about their likes and dislikes concerning the PDH and the *Traditional Houses* they used to live in before the earthquake. When discussing user satisfaction with regard to the *Typical Designs*, it can be said that users in the new settlements are satisfied with 'ease of cleaning and maintaining' the houses, whereas, they are not satisfied with the planning, location, orientation, heating, lot size and/or humidity of the houses. On the other hand, they liked the planning, location, orientation, heating, lot size and humidity factors of the *Traditional Houses*, but they found it difficult to clean and maintain these houses hence it was a cause for dissatisfaction. Table 4.4 below lists the factors which beneficiaries in new the settlements mentioned when they were asked to define those aspects of the PDH and their previous houses, which they liked best or disliked the most. These evaluations correspond to the scoring of the factors of *Traditional Houses* and the PDH with *Typical Designs* which were analysed in the Section 4.2.3 and shown in Table 4.14.

Table 4.4 Likes and dislikes of permanent users of the PDH with *Typical Designs* pertaining to these houses and their *Traditional Houses*.

	Planning	Location	Orientation	Cleaning & maintenance ease	Heating	Lot size	Humidity
PDH with *Typical Designs*	●	●	●	■	●	●	●
Traditional Houses	■	■	■	●	■	■	■

Key: ■ like ● dislike

Factors shown in Table 4.4, which are considered important by the beneficiaries, are described in more detail as following:

a. *Planning:* The beneficiaries insist that planning of the PDH with *Typical Designs* are not appropriate to their way of life. They complain about the location of the rooms; for instance, they want the entrance of the houses and living rooms to be on the same side of the house as they want to see people approaching their houses. They do not want the WC to be accessible from the entrance hall because of lack of privacy.

b. *Location:* The beneficiaries living in new settlements claim that new location is difficult to reach, exposed to strong winds and not suitable for the animals.

c. *Orientation:* Some of the new settlements were constructed in such a way that PDH are exposed to strong wind, hence the users had to add vestibules for protection. New Yuva Village is an example of this type of re-settling.

d. *Cleanliness:* Beneficiaries claim that it is easy to clean the new houses constructed with contemporary materials. On the other hand, it was difficult to clean and maintain the previous houses made of traditional materials especially since the walls and floors were mud rendered.

e. *Heating:* Beneficiaries stated that it was easy to keep their previous houses warm in winter but, now they are facing with difficulties in keeping their PDH warm.

f. *Lot size*: Beneficiaries owning animals complain about the lot size of the PDH because there is not enough space for constructing a cattle shed and a straw shed on the lot. A beneficiary in Kale Quarter, Gümerdiğin Village claims that he had to sell his 150 sheep because there was not enough space to construct a cattle shed for all of these animals. He added one to the house which can shelter 4 cows only and constructed a straw shed far from the house to which access is difficult and tiring.

As mentioned before, questionnaires were administered to the 10 beneficiaries who refused to inhabit the PDH with *Typical Designs*, but their data was not included in the analysis. The reason is that 10 cases were not considered enough for doing a statistical analysis, therefore answers are evaluated separately in this chapter. Following are the reasons of the refusal to inhabit the PDH in new settlements which were derived from the questionnaires;

- Distance between the new settlements and the old ones,
- New settlements are difficult to reach due to the distance from the villages and/or lack of proper roads,
- There is not enough space for a cattle shed and a straw shed on the lot,
- Beneficiaries can not afford to construct cattle sheds and straw sheds,
- New settlements are not suitable for the animals,
- *Typical Designs* are not suitable for an extended family,
- Construction of the PDH is not finished because of the contractor's default.

Beneficiaries faced difficulties because of the re-settlement method. At the time of research, beneficiaries were inhabiting their damaged houses or they were staying in the cattle sheds in some villages, especially in old Ortabayındır Village. As, some builders got the money from the beneficiaries and ran away without finishing the construction of the PDH. Beneficiaries can not afford to continue with the construction. Additionally according to the regulations they had to demolish their *Traditional Houses* to be counted as beneficiaries of the PDH and they got the loan from the Government. These beneficiaries were very disappointed and helpless because of the situation they were in.

This event brings to mind a question about whether it is true to leave villagers most of whom are old and ignorant to hire builders to construct their PDH. During the reconstruction studies the builders who live in this region and surrounding cities of Çankırı learned that the beneficiaries will be getting loans from the Government so they took advantage of this information and cheated the villagers out of their money. In addition, the beneficiaries were not consulted by the Government about construction procurement which created this problem.

4.3.3 Data Analysis

As the exact number of the *Typical Designs* which are permanently occupied are not known, a random sample of 80 families, 40 of whom live in PDH with *Typical Designs* in new settlements and the rest live in PDH with *Custom Designs* which were constructed on the lots of previous houses, were selected for the research. Questionnaires were filled by the permanent users and data was analyzed with the help of statistical tools. The questionnaires were filled by both the users of the PDH with *Custom Designs* and *Typical Designs* in order to compare the likes and dislikes pertaining to these houses.

Percentages of the likes and dislikes pertaining to planning of the houses: 82.5% of the users of the PDH with *Typical Designs* are unsatisfied, 10% are neutral and 5% are satisfied with the planning of their PDH. However, 15% of the users of the PDH with *Custom Designs* are unsatisfied, 32.5% are neutral and 52.5% are satisfied with the plans of their houses. Here, the users of PDH with *Custom Designs* means both the beneficiaries who hired architects themselves and those who hired builders who had *Custom Designs* prepared by architects. When asked about planning of the *Traditional Houses* in which they used to live before the earthquake, 100% of the users of PDH with *Typical Designs* mentioned that they were satisfied with the planning of their *Traditional Houses*. In addition, 95% of the users of the custom designed

houses were satisfied and 5% were not satisfied with the plans of their *Traditional Houses*.

Percentages of the modifications made on the houses: It can be said that 100% of the users of the PDH with *Typical Designs* made changes on their houses, whereas, 50% of the users of the custom designed houses made any changes. The modifications made also show differences; 98% of the users of the *Typical Designs* modified the plans of their houses, 80% changed functions of the spaces and 90% added spaces to the houses. On the other hand, only 10% of the users of the custom designed houses changed the plans, 10% changed the functions of the rooms and 90% added spaces to the houses. Here by changing the function of the spaces it is meant that, users either did not construct some partion walls or changed the sizes of the rooms by shifting the party wall; while of some simply switched the functions of the rooms. On the other hand, all of the home owners omitted the wall between the kitchen and the store room to make it into a larger room.

Percentages of the willingness to make changes in the houses: When asked about their willingness to make changes in the houses, 95% of the users living in *Typical Designs* mentioned that they would like to make modifications if they could afford to. In addition, 70% of the beneficiaries mentioned that they would like to make certain changes inside their houses; for instance changing the locations of the internal walls or replacing the flooring with wooden parquet; 35% of the beneficiaries want to change the locations of the windows and 65% want to add spaces to their houses. Answers of the people who live in the PDH with *Custom Designs* show differences in this respect. 82.5% of the users of the custom designed houses want to make changes in their houses; 45.5% want to make these changes by replacing the flooring with wooden parquet, 15% want to change their windows or add more windows and 85% want to construct additional storeys on their houses. It can be concluded that users of the PDH with *Typical Designs* want to make changes parallel to their needs as the houses

do not satisfy them, whereas most of the users of the PDH with *Custom Designs* want to make changes in order to add value to their property even though these houses meet most their needs when compared to *Typical Designs*.

It is a fact that a house should meet the psychological, physical and economic needs of the users. In this study psychological factors are considered to be dependent on the human comfort factors which consist of heating, sunlight, location of the house, cleaning and maintenance ease, well equipped kitchen and proper bathroom. Physical factors are considered to be planning of the house as well as the settlement, and location of PDH / TH and presence of cattle and straw sheds are considered indicators of satisfaction levels of economic factors. Beneficiaries were asked to evaluate the psychological, physical and economic factors of the PDH they live in and the *Traditional Houses* they used to live in before the earthquake. They were asked to evaluate these factors on a Likert scale of 3 (1: unsatisfactory, 2: neutral and 3: satisfactory).

A) Single factor ANOVA tests

Single factor ANOVA tests were used to find out whether there are significant differences among the opinions of the users with regards to the human comfort, physical and economic factors of PDH with *Typical Designs* and *Traditional Houses*. Results of the ANOVA tests are shown below

i. ANOVA for human comfort factors

To evaluate the human comfort factors data pertaining to user satisfaction levels with the *Typical Designs* and *Traditional Houses* in terms of heating, sunlight, cleaning and maintenance ease, well equipped kitchen and proper bathroom were grouped, and the two categories were compared. Single factor ANOVA for human comfort factors of *Typical Designs* and *Traditional Houses* was conducted according to the null hypothesis:

H_o: $\bar{X}_1=\bar{X}_2$ (α= 0.05) that there was no significant difference between the groups.

Raw data of the evaluations are seen in Table B.1 and as seen in Table 4.5 below the calculated F value of 31.87522 is greater than the critical F value of 3.963472. Thus, the null hypothesis was rejected with 95% confidence. In other words, satisfaction level of the beneficiaries with respect to human comfort factors (i.e. heating, sunlight, cleaning and maintenance ease, well equipped kitchen and proper bathroom) in *Traditional Houses* and PDH with *Typical Designs* differs, and this difference is attributed to the higher average scores of the *Traditional Houses*. In short, *Typical Designs* were not as popular as the *Traditional Houses*.

Table 4.5 ANOVA for human comfort factors.

Groups	*Count*	*Sum*	*Average*	*Variance*		
Human comfort Factors TH	40	77	1.925	0.789103		
Humn comfort Factors TD	40	114	2.85	0.284615		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	17.1125	1	17.1125	31.87522	2.56E-07	3.963472
Within Groups	41.875	78	0.536859			
Total	58.9875	79				
Ho is rejected with 95% confidence						

ii. ANOVA for physical factors

To evaluate the physical factors data pertaining to user satisfaction levels with the *Typical Designs* and *Traditional Houses* in terms of planning of the houses as well as the settlements were grouped and the two categories were compared. Single factor ANOVA for physical factor of *Typical Designs* and *Traditional Houses* was conducted according to the null hypothesis:

H_o: $\bar{X}_1=\bar{X}_2$ (α= 0.05) that there was no significant difference between the groups.

Raw data of the evaluations are seen in Table B.2 and as seen in Table 4.6 below the calculated F value of 216.6241 is greater than the critical F value of 3.963472. Thus, the null hypothesis was rejected with 95% confidence. In other words, satisfaction level of the beneficiaries with respect to planning of the houses as well as the settlements for the *Traditional Houses* and PDH with *Typical Designs* differs and this difference is attributed to the higher average scores of the *Traditional Houses* i.e. physical factors of *Typical Designs* were not as popular.

Table 4.6 ANOVA for physical factors.

Groups	*Count*	*Sum*	*Average*	*Variance*		
Physical F. TH	40	234	5.85	0.284615		
Physical F. TD	40	125	3.125	1.086538		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	148.5125	1	148.5125	216.6241	3.23E-24	3.963472
Within Groups	53.475	78	0.685577			
Total	201.9875	79				
Ho is rejected with 95% confidence						

iii. ANOVA for economic factors

Economy of the target population is dependent on cattle farming, hence the distances the beneficiaries would have to cover in order to breed cattle and also provision of shelter for their animals becomes important. For this reason, location of PDH / TH and presence of cattle and straw sheds are considered indicators of satisfaction levels of economic factors. Single factor ANOVA for economic factors of *Typical Designs* and *Traditional Houses* was conducted according to the null hypothesis:

H_o: $\bar{X}_1=\bar{X}_2$ (α= 0.05) that there was no significant difference between the groups.

Raw data of the evaluations are seen in Table B.3 and as seen in Table 4.7 below the calculated F value of 125.407 is greater than the critical F value of 3.963472. Thus, the null hypothesis was rejected with 95% confidence. In other words, satisfaction level of the beneficiaries with respect to location of PDH / TH and presence of cattle and straw sheds differs and this difference is attributed to the higher average scores of the *Traditional Houses* i.e. economic factors of *Typical Designs* were not as popular.

Table 4.7 ANOVA for economic factors.

Groups	*Count*	*Sum*	*Average*	*Variance*		
Economic F. TH	40	223	5.575	0.558333		
Economic F. TD	40	110	2.75	1.987179		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	159.6125	1	159.6125	125.407	6.63E-18	3.963472
Within Groups	99.275	78	1.272756			
Total	258.8875	79				
Conclusion: Ho is rejected with 95% confidence						

iv. ANOVA for differences amongst the PDH with *Typical Designs* and *Custom Designs* with respect to their plans

To evaluate the user satisfaction levels with the planning of *Typical Designs* and *Custom Designs* the two categories were compared. Single factor ANOVA for planning factor of the two types of PDH was conducted according to the null hypothesis:

H_o: $\bar{X}_1=\bar{X}_2$ (α= 0.05) that there was no significant difference between the groups.

Raw data of the evaluations are seen in Table B.4 and as seen in Table 4.8 below the calculated F value of 67.78206 is greater than the critical F value of 3.963472. Thus, the null hypothesis was rejected with 95% confidence. In other words, satisfaction level of the beneficiaries with respect to planning of the PDH with *Typical* and *Custom Designs* differs and this difference is attributed to the higher average scores of the custom designed house i.e. *Typical Designs* were not as popular.

Table 4.8 ANOVA for planning of the PDH with *Typical Designs* and *Custom Designs.*

Groups	*Count*	*Sum*	*Average*	*Variance*		
Planning T.D.	40	48	1.2	0.266667		
Planning C.D.	40	95	2.375	0.548077		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	27.6125	1	27.6125	67.78206	3.33E-12	3.963472
Within Groups	31.775	78	0.407372			
Total	59.3875	79				
Ho is rejected with 95% confidence						

v. ANOVA for total satisfaction scores for the PDH with *Typical Designs* and *Custom Designs*

To evaluate the user satisfaction levels with all the factors; namely construction materials, construction systems, heating, sunlight, planning, cleaning and maintenance ease, location of the house, well equipped kitchen and proper bathroom, evaluations of the users of PDH with *Typical Designs* and *Custom Designs* were grouped and the two categories were compared. Raw data of the evaluations of the users with regard to *Typical Designs* are seen in Table B.6 and raw data with regards to *Custom Designs* is seen in Table B.8. Single factor ANOVA for evaluations of the above mentioned factors was conducted according to the null hypothesis:

H_o: $\bar{X}_1=\bar{X}_2$ (α= 0.05) that there was no significant difference between the groups.

As seen in Table 4.9 below the calculated F value of 45.6776 is greater than the critical F value of 3.963472. Thus, the null hypothesis was rejected with 95% confidence. In other words, satisfaction level of the beneficiaries with respect to the total scores for the PDH with *Typical* and *Custom Designs* differs and this difference is attributed to the higher average scores of the PDH with *Custom Designs* houses i.e. *Typical Designs* were not as popular.

Table 4.9 ANOVA for total satisfaction scores.

Groups	*Count*	*Sum*	*Average*	*Variance*		
Sum CD	40	955	23.875	4.778846		
Sum TD	40	761	19.025	15.81987		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	470.45	1	470.45	45.6776	2.26E-09	3.963472
Within Groups	803.35	78	10.29936			
Total	1273.8	79				
Ho is rejected with 95% confidence						

vi. ANOVA for satisfaction scores with regards to *Traditional Houses* as evaluated by both the users of the PDH with *Typical Designs* and *Custom Designs*

To evaluate the user satisfaction levels pertaining to *Traditional Houses* with the factors: construction materials, construction systems, heating, sunlight, planning, cleaning and maintenance ease, location of the house, well equipped kitchen and proper bathroom, evaluations of the users of both types of PDH were grouped, and the two categories were compared. Raw data with regards to *Traditional Houses* are seen in Tables B.5 and B.7.

Single factor ANOVA for evaluations of the above mentioned factors was conducted according to the null hypothesis:

H_o: $\bar{X}_1=\bar{X}_2$ (α= 0.05) that there was no significant difference between the groups.

As seen in Table 4.10 below the calculated F value of 2.714394 is less than the critical F value of 3.963472. Thus, the null hypothesis was accepted with 95% confidence. According to the results of this ANOVA and the previous one, it can be said that user satisfaction levels with regards to *Typical Designs* and *Custom Designs* show differences, whereas satisfaction levels of the users of the two types of PDH pertaining to *Traditional Houses* do not. i.e. they both feel that on the whole *Traditional Houses* were better than the new PDH.

B) T-tests with regards to PDH with *Typical Designs* constructed in different settlements

T-tests were used to find out whether there are significant differences among the opinions of the users of the PDH with *Typical Designs* located in different settlements. To evaluate the human comfort, physical and economic factors, evaluations of the users who live in the PDH constructed in the existing villages, in the PDH in new settlements far from the old villages and in new settlements close to the old villages were grouped and the categories were compared. Results of the three t-tests are described below, whereas the rest are presented in Appendix C.

Table 4.10 ANOVA for satisfaction scores with regards to *Traditional Houses*.

Groups	*Count*	*Sum*	*Average*	*Variance*		
Sum TH -CD users	40	1043	26.075	23.35321		
Sum TH -TD users	40	981	24.525	12.05064		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	48.05	1	48.05	2.714394	0.10347	3.963472
Within Groups	1380.75	78	17.70192			
Total	1428.8	79				
Ho is accepted with 95% confidence						

i. T-test for human comfort factors with regards to PDH constructed in the existing villages and in the new settlements far from the old villages

To evaluate the human comfort factors, data pertaining to user satisfaction levels with *Typical Designs* constructed in the existing villages and in the new settlements far from the old villages were grouped and the two categories were compared. T-test for evaluations of the above mentioned factors was conducted according to the null hypothesis:

H_o: $\bar{X}_1=\bar{X}_2$ ($\alpha= 0.05$) that there was no significant difference between the groups.

As seen in Table 4.11 the calculated t value of 3.27352042 is greater than the critical t value of 1.713871517. Thus, the null hypothesis was rejected with 95% confidence. In other words, satisfaction level of the beneficiaries with respect to human comfort factors (i.e. heating, sunlight, cleaning and maintenance ease, well equipped kitchen and proper bathroom) of the PDH constructed in the existing villages and in the new settlements far from the

old villages differs and this difference is attributed to the higher mean scores of the PDH constructed in the existing villages i.e. PDH constructed in the new settlements far from the old villages were not as popular.

Table 4.11 T-test for human comfort factors with regards to PDH constructed in the existing villages and in the new settlements far from the old villages.

	Human comfort F. TD- in the existing village	*Human comfort F. TD- far from the old village*
Mean	12.5	9.777777778
Variance	2	7.947712418
Observations	8	18
Hypothesized Mean Difference	0	
df	23	
t Stat	3.27352042	
P(T<=t) one-tail	0.00166802	
t Critical one-tail	1.713871517	
P(T<=t) two-tail	0.003336039	
t Critical two-tail	2.068657599	
Ho is rejected with 95% confidence		

ii. T-test for physical factors with regards to PDH constructed in the new settlements far from the old villages and in the ones close to the old villages

To evaluate the physical factors in terms of planning of the houses as well as the settlements, data pertaining to user satisfaction levels with *Typical Designs* constructed in the new settlements far from the old villages and in the ones close to the old villages were grouped and the two categories were compared. T-test for evaluations of the above mentioned factors was conducted according to the null hypothesis:

H_o: $\bar{X}_1=\bar{X}_2$ (α= 0.05) that there was no significant difference between the groups.

As seen in Table 4.12 the calculated t value of 0.705564365 is less than the critical t value of 1.708140745. Thus, the null hypothesis was accepted with

95% confidence. In other words, satisfaction level of the beneficiaries with respect to the physical factors of the PDH constructed in the new settlements close to the existing villages and the ones in the new settlements far from the old villages do not differ.

Table 4.12 T-test for physical factors with regards to PDH constructed in the new settlements far from the old villages and in the ones close to the old villages.

	Physical F. TD-far from the old village	*Physical F. TD-close to the old village*
Mean	2.944444444	2.714285714
Variance	0.64379085	0.989010989
Observations	18	14
Hypothesized Mean Difference	0	
df	25	
t Stat	0.705564365	
P(T<=t) one-tail	0.243491025	
t Critical one-tail	1.708140745	
P(T<=t) two-tail	0.486982051	
t Critical two-tail	2.059538536	
Ho is accepted with 95% confidence		

iii. T-test for economic factors with regards to PDH constructed in the new settlements far from the old villages and in the ones close to the old villages

As mentioned before, location of PDH and presence of cattle and straw sheds are considered indicators of satisfaction levels of economic factors. To evaluate the economic factors, data pertaining to user satisfaction levels with *Typical Designs* constructed in the new settlements far from the old villages and in the ones close to the old villages were grouped and the two categories were compared. T-test for evaluations of the above mentioned factors was conducted according to the null hypothesis:

H_o: $\bar{X}_1=\bar{X}_2$ (α= 0.05) that there was no significant difference between the groups.

As seen in Table 4.13 the calculated t value of 1.81551522 is greater than the critical t value of 1.699126996. Thus, the null hypothesis was rejected with 95% confidence. In other words, satisfaction level of the beneficiaries with respect to the economic factors of the PDH constructed in the new settlements far from the old villages and in the ones close to the old villages differs.

Table 4.13 T-test for economic factors with regards to PDH constructed in the new settlements far from the old villages and in the ones close to the old villages.

	Economic F. - TD far from the old village	*Economic F. - TD close to the old village*
Mean	2.722222222	2
Variance	1.859477124	0.769230769
Observations	18	14
Hypothesized Mean Difference	0	
df	29	
t Stat	1.81551522	
P(T<=t) one-tail	0.03989942	
t Critical one-tail	1.699126996	
P(T<=t) two-tail	0.079798841	
t Critical two-tail	2.045229611	
Ho is rejected with 95% confidence		

According to the results of the t-tests, it can be said that human comfort and physical factors pertaining to PDH constructed in the new settlements do not differ, whereas economic factors pertaining to PDH constructed in the new settlements far from the old villages and in the ones close to the old villages differ. Furthermore, human comfort, physical and economic factors pertaining to PDH constructed in the existing villages and PDH constructed in the new settlements far from the old villages differ. Similarly, human comfort, physical

and economic factors pertaining to PDH constructed in the existing villages and PDH constructed in the new settlements close to the old villages differ.

C) Analysis of the scoring of the beneficiaries with regards to the *Traditional Houses* and the PDH

The average of the score for all the factors with regard to PDH (with *Typical Designs*, *Custom Designs*) and *Traditional Houses* were evaluated. The total score being 3.0; scores equal to and greater than 2.5 are considered positive and those less than 2 are considered negative, while those in between are neutral (Table 4.14). It can be said that users of the PDH with *Typical Designs* liked such aspects of the *Traditional Houses* heating, sunlight, planning, location and cattle sheds, whereas they did not like lack of proper bathrooms and difficulty in cleaning and maintaining the houses. On the other hand, the opposite was true for their PDH. In addition, users of the PDH with *Custom Designs* liked such aspects construction materials, construction systems, heating, sunlight, planning, location and cattle sheds with regards to the *Traditional Houses*. On the other hand, they were unhappy about the lack of proper bathrooms. On the other hand, they liked such aspects of their PDH as construction systems, sunlight, cleaning and maintenance ease, location, well equipped kitchen and proper bathroom; but they did not like the factors of heating and absence of cattle sheds.

Table 4.14 Average scores of the beneficiaries with regard to the *Traditional Houses* and the PDH.

Factors	Scores of the users of the PDH with TD with regard to		Scores of the users of the PDH with CD with regard to	
	TH	PDH with TD	TH	PDH with CD
Construction materials	2.20	2.18	2.65	2.13
Construction system	2.20	2.33	2.78	2.58
Heating	2.98	1.30	2.65	1.50
Sunlight	2.85	1.60	2.90	2.50
Planning of the house	3.00	1.20	2.90	2.38
Cleaning & maintenance ease	1.78	2.83	2.43	3.00
Location of the house	2.85	1.93	3.00	3.00
Well equipped kitchen	2.25	2.33	2.40	3.00
Proper bathroom	1.70	2.53	1.75	2.90
Cattle sheds	2.73	0.83	2.63	0.90

Key: : Positive : Negative : Neutral TH: *Traditional House* TD: *Typical Design* CD: *Custom Design*

CHAPTER 5

RESULTS AND DISCUSSION

This study is focused not only on appropriate design of PDH but also their provision to the beneficiaries. The reason for such a comprehensive study and preparation of the guidelines is aimed at improving PDH in rural areas of Turkey. The study revealed that the failure of PDH to satisfy the beneficiaries lay both in their provision and planning strategies. For that reason, taking into consideration the negative and positive aspects of the reconstruction project in the villages of Çankırı, a research based on a provision model including strategic planning and organizational design of the reconstruction works was performed. Furthermore, an investigation was made into a PDH design methodology which included performance and functional specifications of PDH and design of systems approach, for rural areas of Turkey under the guidance of Prof. Colin H. Davidson at Université de Montréal in Canada. In this chapter the guidelines studied, which can lead to designing PDH appropriate to the life styles of the users, are presented.

The literature survey about the subject, and this study conducted in the villages of Çankırı, revealed that there is mostly a high level of dissatisfaction with the design of PDH in rural areas of Turkey. It is observed that instantaneous decisions about post-disaster reconstruction works including different types of PDH have been made immediately within a short period of time. Detailed investigations for the design of PDH were not undertaken in the disaster stricken areas and this lead to user dissatisfaction on the whole. In this chapter, strategic planning of permanent reconstruction projects, including pre- and post-disaster works and the organizational design of these projects are proposed in order to improve the success rates of PDH projects. Furthermore, in the strategic planning steps for design of PDH, which can lead to designing PDH appropriate to the life styles of users are proposed.

5.1 Strategic Planning of Post-Disaster Reconstruction Works in Rural Areas

The proposed strategic planning model includes two phases; pre- and post-disaster works which are presented in detail as follows:

a) *Strategic Planning Including Pre-Disaster Works*: Turkey being prone to frequent disasters, especially earthquakes, it is vital to formulate a mitigation plan which should be dependent on and inclusive of risk assessment and vulnerability analysis, taking measures against probable disaster(s), developing provision strategy and the steps for design of PDH. In this regard, three steps are proposed for design of PDH.

Firstly, an investigation should be conducted to collect information needed for design of PDH; such as house typology and user profile in the region; and climatic and topographical conditions in the area where the PDH are to be built. Secondly functional and performance specifications of the PDH should be defined and finally the systems approach for PDH should be designed. Detailed information about these steps is given in Section 5.3.

Pre-disaster works which are shown in Figure 5.1 will help to determine whether there is a risk of disaster(s) in a region and whether the area and the houses are vulnerable to the probable disaster(s) or not. This should be done so that measures can be taken in order to minimise the risk and the vulnerability of the area and/or the buildings. If there is a probability of demolition or severe damage to the houses in the region then steps should be taken to determine the design criteria for PDH beforehand. This will help to produce housing designs which are appropriate to the life styles of the users in a comparatively shorter time.

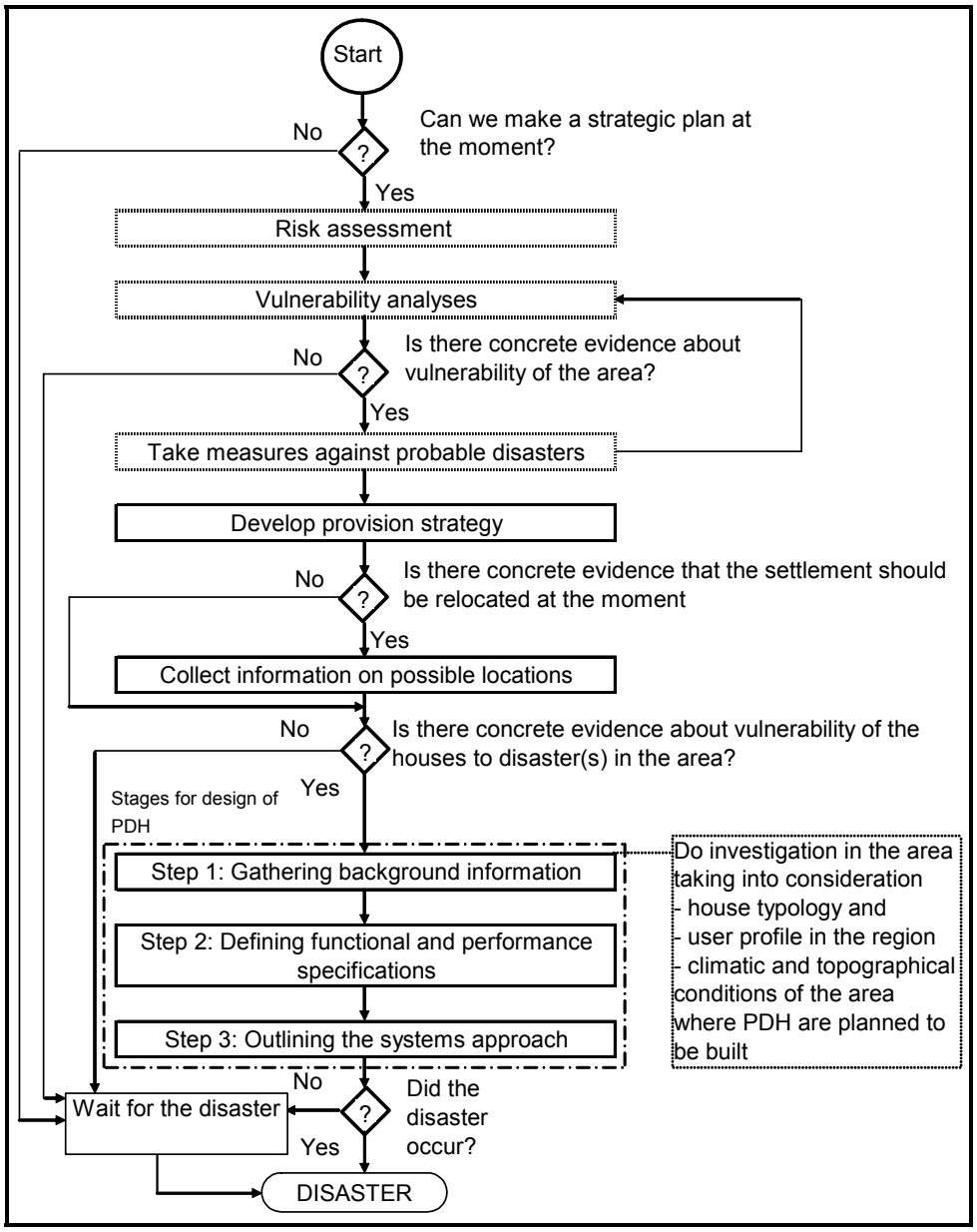

Figure 5.1 Proposed strategic planning including pre-disaster works.

b) *Strategic Planning Including Post-Disaster Works*: The phases are determined according to the phases completed during the pre-disaster works. Questions are asked to get information about whether some of the phases included in the pre-disaster works are completed, and if completed whether they need to be updated or not. The post-disaster works are determined

according to the answers to these questions. Furthermore, this research revealed that lack of user participation in the decision-making process lead to a high level of dissatisfaction with the PDH. Hence, this finding was taken into consideration while preparing the strategic planning.

In addition, although relocating the settlement is not proposed in this study, if it is a must for the reconstruction project, selection criteria for the new location is proposed. In case relocating the settlement is unavoidable some more selection criteria are added to the existing ones. Selection criteria of the government for new locations are: low disaster risk, closeness to infrastructure facilities and government ownership; Additional selection criteria proposed are; preferences of the beneficiaries, closeness to the old village, easy access, having acceptable weather conditions and suitability for animals. The additional criteria will help reduce the resistance of people to relocation.

In addition, post-disaster works include design of PDH according to the previous 1st and 2nd and/or 3rd steps completed. If the third step was not completed before the disaster, there is no need to go on to the 3rd one as it will be time consuming; instead information gathering stage should be started. According to the information collected about the eligible people in terms of; number of extended families, number of unit families, number of people and families going to live in a house, whether the beneficiaries possess animal or not *etc.*, the design stage is started. Designers should discuss the designs with the potential users in order to meet the needs of the beneficiaries. Finally, it would be useful to get feedback on the project to find out the negative and positive aspects of the reconstruction project and the designs of the PDH. Figure 5.2 shows proposed strategic planning including post-disaster works. The first four steps out of eighteen of the strategic planning was adapted from the strategic and procurement planning proposed by Johnson *et al.* (2005) which is presented in Figure 2.2.

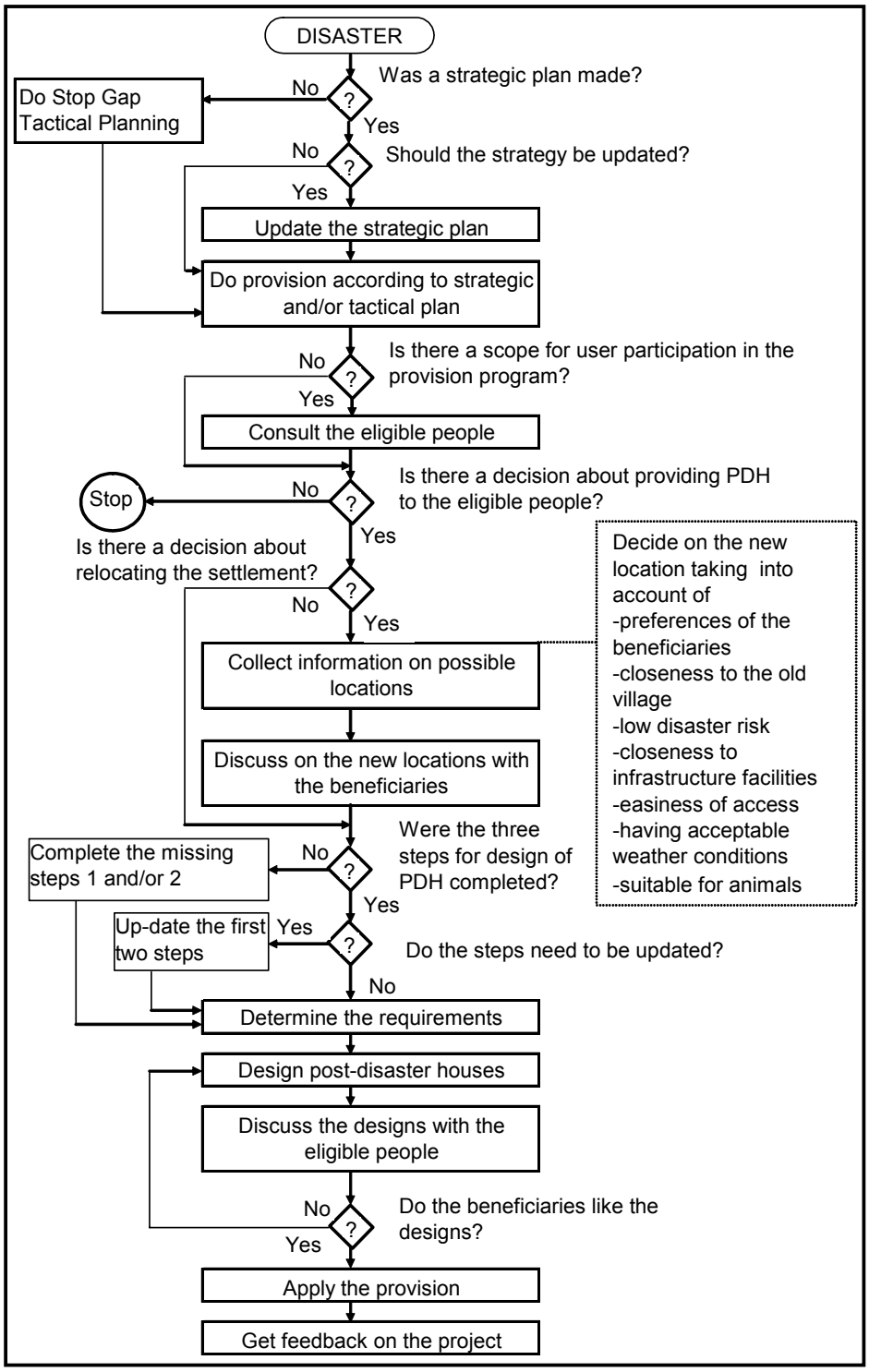

Figure 5.2 Proposed strategic planning including post-disaster works.

5.2 Organizational Design of the Reconstruction Works

This research also revealed that inadequate interaction among the organizations involved in the reconstruction project and the beneficiaries lead to a high level of dissatisfaction with the PDH. Post-disaster reconstruction works in rural areas of Turkey are initiated, controlled and undertaken by Government authorities. Officials of these authorities claim that there is no time for them to do detailed/ comprehensive research for the reconstruction projects, consequently rehabilitation works are done without understanding user needs, the geography of the area etc. Sometimes private firms are involved in a part of the project, as for example in the reconstruction project in Çankırı villages, but detailed investigations are not undertaken by these firms either.

This research proposes that other organizations such as NGOs, universities and/or private firms can be involved in the reconstruction projects as the organizers and/or they can participate in the operations. Furthermore, direct interaction between the beneficiaries and all the organizations involved in the project is proposed.

In short, the proposal for the reconstruction works depends on pre-disaster works as well as post-disaster ones; timely user participation in decision making process; professional guidance to the beneficiaries; and involvement of different professional groups in the projects as organizers or participants. Figure 5.3 shows the proposed organizational chart and Table 5.1 represents the various participants of proposed strategic planning. Both the figure and the table were discussed with the officials from the Ministry of Public Works and Settlement and they were modified accordingly.

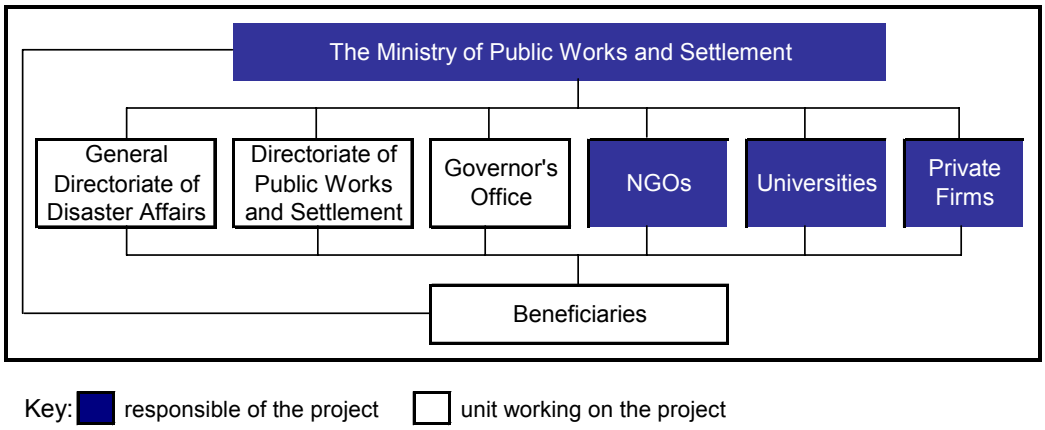

Figure 5.3 Proposed organizational chart.

5.3 Guidelines for Design of PDH

Sometimes instead of designing PDH in accordance to the specific requirement of the disaster stricken area, typical designs prepared by the Ministry of Public Works and Settlement were constructed. At other times PDH were designed specifically for the area but without doing initial investigations as to the requirements of the area. In general, both the ways of planning PDH were not successful from the point view of the beneficiaries. This study revealed that detailed investigation should be undertaken in order to design PDH appropriate to the life-style of the users. Following stages were determined important in this regard:

i. Gathering background information,
ii. Defining functional and performance specifications,
iii. Outlining the systems approach,
iv. Determining the requirements,
v. Designing the PDH.

Table 5.1 Matrix showing the various participants of proposed strategic planning.

	Government authorities	Universities	NGO's	Private Firms	Beneficiaries
Risk assessment	■	■, ▲	■, ▲	■, ▲	
Vulnerability analyses	■	■, ▲	■, ▲	■, ▲	
Taking measures against probable disasters	■	■, ▲	■, ▲	■, ▲	▲
Development of provision strategy	■				
Collection of information on locations	■				
Doing Provision	■		■, ▲	■, ▲	▲
Works for design of PDH	■, ▲	■, ▲	■, ▲	■, ▲	▲
Up-date of strategic planning	■				
Collection of information about beneficiaries	■, ▲	■, ▲	■, ▲	■, ▲	▲
Design of PDH	■, ▲	■, ▲	■, ▲	■, ▲	▲
Discussion of the designs with beneficiaries	■, ▲	■, ▲	■, ▲	■, ▲	
Implementation	■	■, ▲	■, ▲	■, ▲	▲
Control of the constructions	■, ▲	■, ▲	■, ▲	■, ▲	

Key: ■ Organizer of the whole or part of the project ▲ participant in the project

Those stages for design of PDH are explained in more detail in the following paragraphs:

Stage 1: There should be an investigation in the area taking into consideration:

a. House typology: Information about house typology including planning and spatial requirements, building materials, construction technique of the houses can be gathered by observing and measuring the traditional buildings in the region.

b. User profile: This includes daily life activities of the target group, their family structure and their economic main-stay (e.g. agriculture or animal husbandry). This information can be gathered with the help of interviews with the local people. For example, following is the list of the daily life activities and the spaces needed with regards to such activities in the study area:

   - There are extended as well as unit families in the region. There is at least one room needed for each family in the houses of the extended families.
   - Some of the local people's livelihood depends on seasonal farming. They sell their produce immediately after harvesting. Hence special spaces depending on livelihood are not needed for these people in their houses.
   - People making their living on animal rearing feed their animals thrice a day and milk them twice a day. They water the animals three times a day. These people need straw and cattle sheds and a place to wash their hands after looking after the cattle, before entering the house. Furthermore a cold space called "dairy product room" is needed in the house to store milk and cheese.
   - The villagers make their own bread. Thus, bread oven is needed in the kitchen of the house for this activity.

c. Information about climatic and topographical conditions of the area where PDH are planned to be built should be gathered with the help of related documents and observations in the area. Table 5.2 shows an example of the information that needs to be gathered in order to define functional and performance specifications of the PDH, to be constructed in the region.

Stage 2: Defining functional and performance specifications of the PDH:

Functional specifications depend on the information collected about house typology and user profile in the region. These specifications will help prepare performance specifications also. Followings are the planning criteria in the traditional houses in the villages of Çankırı most of which should be taken into consideration while planning PDH in the area. These criteria were identified on the basis of information gathered from the rural population of Çankırı during the field trip:

a. Rooms are oriented to the South in order to provide adequate sunlight in these spaces for health and solar heating purposes,
b. House entrance is oriented to the South in order to prevent the entrance of the house from strong wind and dust blown by the wind.
c. Fire place is provided in all of the rooms for cooking and making bread, since each room may be occupied by a separate family unit.
d. Entrance of the house and the living room are on the same side in order to allow occupants to see people approaching the house.
e. WC is far from the entrance and living spaces for privacy.
f. Dairy product room is oriented to the North in order to keep the space cold and prevent the milk and cheese stored in the room from spoiling.

Table 5.2 Information gathered in order to define functional and performance specifications of the PDH.

No	Province	No of districts	No of the Villages	Geographical Region*	Earthquake Zones	Climatic Region	Total Population	Rural population	Urban Population	Family Type		Sources of income				House typology				building materials available locally
										Unit	Extended	Animal Rearing	Agriculture	Pension	Other	Sofa Type**	No of storeys	Construction technique***	Building materials****	
1	Çankırı	12	370	1	1,2,3	3	270,355	129,169	141,186	●	●	●	●	●		2,3	1,2	5	1,2,3,4,6	3

*Geographical Region : 1: Central Anatolia, 2: Marmara Region, 3: Ege Region, 4: Mediterranean Region, 5: Black Sea Region, 6: South East Anatolian Region, 7: East Anatolian Region.

**Sofa type : 1: Inner, 2: central 3: outer sofa.

***Construction Technique: 1: Timber masonry, 2: stone masonry, 3: brick, briquette etc. masonry, 4: adobe masonry, 5: timber framed with masonry blocks infill, 6: timber-frame and wood-lath siding,7: composite structures.

****Building Materials : 1: Timber, 2: stone, 3: brick, 4: sun-dried brick, 5: blocks, 6: mud.

g. There is enough space for a cattle shed which is big enough for sheltering all the animals that the user possesses and a straw house on the lot.
h. For extended families there is at least one bedroom for each family in the house.

Performance specifications will help the designer while taking decisions regarding the construction materials, construction system, planning and spatial requirements of the PDH. Based on the above mentioned information, following are the performance specifications of PDH for rural areas of Çankırı. Most of the specifications were prepared according to the findings of the field survey. Some of the specifications were prepared in the light of the reasons of refusal of the new settlements, while some were prepared according to likes and dislikes of the users about the PDH. As mentioned before, a house is not different from a PDH except for the construction speed. Thus, rest of the specifications were prepared taking into consideration the specifications that a house should have.

Site should:

1. be suitable for building housing,
2. not bear high disaster risk,
3. not be exposed to strong wind,
4. be easy to reach,
5. be big enough for facilities, such as mosque and school, required in a village,
6. be close to existing infrastructure facilities in order to make the construction cheaper and easier,
7. be suitable for the animals owned by the villagers

Lot should:

be big enough to facilitate the necessary buildings for the house such as stable, straw house, woodshed *etc*.

Exterior Envelope should:

1. allow entry of sunlight in the living spaces,
2. provide a cool space for dairy product storage as the product will not spoil,
3. provide visual control of house entrance,
4. provide privacy,
5. provide appropriate indoor air quality,
   - amount of fresh air per person should be 0.9 dk/m^3 in living rooms and 0.4 dk/m^3 in bedrooms[12],
6. provide protection against rain and snow,
7. prevent from vandalism and unwanted entry to the house,
8. provide protection against undesirable animals such as snakes, rats *etc.*
9. prevent entry of insects.

Structural System should:

1. provide resistance against probable disasters such as earthquakes and land slides,
2. be stable and durable.

Interior Partitions should:

1. provide maximum sound pressure level of 35 dBA in the bedrooms, 60 dBA in the living rooms and 70 dBA in the service spaces such as kitchen and bathroom during the day[13],
2. provide privacy in the bedrooms and bathroom(s).

Orientation should

1. provide adequate daylight in the spaces where it is desirable,
2. protect the building from wind and undesirable sunlight,
3. provide easy pedestrian access to the building from the main road,
4. provide easy vehicular access to the building from the main road.

[12] http://saglik.tr.net/cevre_sagligi_kapali_ortam.shtml
[13] http://www.cevreorman.gov.tr/gurultu_00.htm

Surfaces should:

be smooth and easy to maintain.

Stage 3: Outlining the systems approach for PDH:

A region's being vulnerable to disaster(s) does not necessarily mean that there will be an earthquake and people will become homeless. It is difficult and also time consuming to design PDH before the disaster because detailed information pertaining to the number of beneficiaries and requirements are not known. For instance, information about eligible families is needed in order to decide whether the PDH should be designed for extended families and/or unit families.

A modular approach can be adopted before the disaster where spaces/rooms are designed according to the number of occupants as separate modules. These modules can be brought together easily with the help of CAD (Computer Aided Design) software to produce PDH according to the requirements of different sized families. For example, a bedroom module can be pre-designed for a single person, couple, three or more family members. Similarly living room can also be standardized.

Designing the systems approach before the disaster is proposed in order to shorten the time that will be consumed for design after the disaster occurs. On the other hand, once disaster has struck the need to design the systems approach becomes redundant and it becomes necessary to go on to the following stages which are determining the requirements and designing the PDH.

Stage 4: Determining the requirements about eligible people:

After disaster occurs, information is gathered in the area about loss of life and property. While this information is being documented and questioning the

disaster victims by survey in the area, it is possible to collect information that would be necessary in order to provide PDH as per their needs.

Stage 5: Design of PDH:

When the first three steps are completed, PDH for an area can be designed in a shorter time and also in accordance with the needs of the people. If these steps are completed before the disaster then the modules can be brought together according to the family type and the number of family members. Design stage can be completed according to the decisions taken by the designer about the building materials, construction systems, spatial requirements and planning of the PDH. Following are considered important while taking these decisions:

- Disaster resistance: Since these houses are designed to be constructed in disaster prone areas, the probable and/or occurred disaster(s) should be taken into consideration in the design stage.
- Fast production: PDH should be constructed as fast as possible in order to provide houses to the homeless people. Construction technologies, building materials and/ or spatial organization of the houses can be determined in order to increase speed of the production phase.
- Low cost: Economic disabilities in a society may increase due to disaster(s). Thus, cost of house production after a disaster becomes important.
- Easy to build: Owner participation leads to cheaper construction, user satisfaction, improve of morale of the victims and social interaction among the victims.
- Flexibility: Flexible designs can be adapted to the needs of the users which may change in time. For instance, a unit family with 3 children may become an extended family in 10 years time.

In summary, the proposal for design of PDH depends on completion of most of the works for design before the disaster occurs; design according to the needs of the area and the beneficiaries; and user participation early in the decision making process. Just as there are acceptable standards for the design of specific buildings such as offices, hotels, hospitals etc., there should be standards set for design of PDH in rural areas also. For example certain spaces must be provided in a school building no matter what its capacity, while the number of classrooms may differ. In the same way some special spaces are required in rural houses which must be provided in order to make the daily life of a rural family viable. These special spaces can be the core of the PDH and should be designed in accordance to the specifications and needs of the vulnerable areas. On the other hand, the number of rooms in the house can be added according to the requirements of the beneficiaries. The core should be designed for expandability and changeability so that it can answer to the varying needs of the beneficiaries even later on.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

In this chapter the conclusions reached at the end of the study regarding *Traditional Houses*, PDH with *Typical Designs* and *Custom Designs* and new settlements are presented. In addition, certain recommendations and suggestions for further studies are also made.

6.1 Conclusions

This study revealed that PDH with *Typical Designs* and the *Traditional* Houses in the region show differences with regard to spatial arrangements, building materials and construction techniques. For instance, PDH with *Typical Designs* are single storied brick masonry structures, whereas *Traditional Houses* are generally two storied timber-framed or composite structures including stone masonry first floors and timber-framed second floors. In PDH with *Typical Designs*, entrances of the houses and the service spaces such as kitchen and storage are on the same side of the house and, in general, oriented towards the North: However in *Traditional Houses* service spaces are generally oriented to the North and entrances of the houses and the living spaces are located on the South. At the end of the study the following conclusions were arrived at:

1. *Traditional Houses in the villages are better equipped to answer the local needs:*

Since there are extended families in the region, each room in a *Traditional House* is arranged in such a way that it can serve all the daily life activities of a single family such as sleeping, cooking, eating and bathing. In addition, since the villagers make their own bread, the fireplace in the kitchen serves for this activity.

Economy is dependent on agriculture and animal rearing in the study area. There are cattle sheds and dairy product rooms on the first floors of the houses. The spaces in the houses are arranged in such a way that, living spaces are oriented to the South in order to make use of solar heating. Building materials are the easily available ones in the region and the construction techniques are in accordance with the seismicity of the area. According to the scores of the beneficiaries regarding to *Traditional Houses,* it is can be said that the users like the aspects heating, sunlight, planning, location and cattle sheds, however they do not like cleaning and maintaining their previous houses and lack of proper bathrooms in them.

2. *PDH with Typical Designs do not meet the needs of the users:*

There is a high level of dissatisfaction with the design of PDH with *Typical Designs* constructed in the villages. The average score of 1.2/3 for planning of the *Typical Designs* can be considered as an indication of dissatisfaction. Permanent users of the PDH modified these houses in order to adapt them to their life style. They modified the spatial organizations of the houses, changed the functions of the spaces and added spaces to them. It is concluded that users do not like the aspects heating, sunlight, planning, location and cattle sheds, however they like cleaning and maintaining the houses and proper bathrooms in them.

3. *PDH with Custom Designs are closer to the user needs*:

The average score of 2.4/3 for planning of the *Custom Designs* reveals a high level of satisfaction. The users of the PDH with *Custom Designs* liked such aspects of their PDH as construction systems, sunlight, planning, cleaning and maintenance ease, location, well equipped kitchen and proper bathroom; but they did not like the factors of heating and absence of cattle sheds.

4. *Some beneficiaries who refused to move to new settlements, preferred to construct PDH on the lots of their previous houses:*

In Turkey, if there is a need to construct PDH, generally, disaster stricken rural settlements are relocated to a different location. The reason is that it is difficult to provide large-enough lots to the beneficiaries as there are more than one owners of the damaged property and it is not easy to allot one PDH to multiple claimants. There are multiple owners because mostly, these houses are inherited by the siblings in a family or there are extended families in a *Traditional House*, each of whom are the beneficiaries of a PDH. A literature survey related to the topic and this research revealed that relocating a settlement creates many problems. Main problem is that people refuse to move to the new settlements and this leads to most of the PDH standing empty. This research reveals that in the villages of Çankırı nearly all of the PDH constructed on their original lots are used permanently, whereas most of the PDH in new settlements are empty. It can be said that beneficiaries refuse to move to a new settlement. The Turkish Government provided loans without interest to 1221 beneficiaries in the villages of Çankırı to be paid back in 20 years time. However, most of the houses constructed stand empty.

Furthermore, in the site selection teams there are neither architects nor planners; selection is done by the geologists only. Thus, the main criterion for site selection is disaster vulnerability of the lands. It should be noted that relocating a settlement which is in an earthquake prone zone, 4 or 5 km away does not necessarily mean that the new location is not prone to earthquakes.

It is also vital to mention that it is not enough to create a new settlement by building houses only. There is also need for at least a mosque, and a health centre in every village. Schools are important need too although there may not be any schools in the existing villages. In addition, V*illage Rooms* "*Köy Odası*" is another common building that is used by the villagers, and is an essential part of the daily life of the male population.

6.2 Proposed Guidelines for Post-disaster Reconstruction Works and Design of PDH

The failure of PDH to satisfy the beneficiaries lay both in their provision and planning strategies. Thus, guidelines for post-disaster reconstruction works and design of PDH are proposed in this dissertation.

Guidelines for post-disaster reconstruction works includes strategic planning including pre- and post-disaster works and organizational design of the operations. Pre-disaster works will help to determine whether there is a risk of disaster(s) in a region and whether the area and the houses are vulnerable to the probable disaster(s) or not. This should be done so that measures can be taken in order to minimise the risk and the vulnerability of the area and/or the buildings. If there is a probability of demolition or severe damage to the houses in the region then steps should be taken to determine the design criteria for PDH beforehand.

The phases in the post-disaster works are determined according to the phases completed during the pre-disaster works. Questions are asked to get information about which some of the phases included in the pre-disaster works are completed, and if completed whether they need to be updated or not. The post-disaster works are determined according to the answers to these questions. Furthermore, although relocating the settlement is not proposed in this study, if it is a must for the reconstruction project, selection criteria for the new location is proposed.

In case relocating the settlement is unavoidable some more selection criteria are added to the existing ones. Selection criteria of the Government for new locations are: low disaster risk, closeness to infrastructure facilities and government ownership. Additional selection criteria proposed are; preferences of the beneficiaries, closeness to the old village, easy access,

having acceptable weather conditions and suitability for animals. The additional criteria will help reduce the resistance of people to relocation.

Since post-disaster reconstruction works in rural areas of Turkey are initiated, controlled and undertaken by Government authorities, organizational design of the operations proposes that other organizations such as NGOs, universities and/or private firms can be involved in the reconstruction projects as the organizers and/or they can participate in the operations. Furthermore, direct interaction between the beneficiaries and all the organizations involved in the project is proposed. In short, the proposal for the reconstruction works depends on pre-disaster works as well as post-disaster ones; timely user participation in decision making process; professional guidance to the beneficiaries; and involvement of different professional groups in the projects as organizers or participants.

The proposal for design of PDH depends on completion of most of the works for design before the disaster occurs, design according to the needs of the area and the beneficiaries and user participation early in decision making process. Since PDH were not successful from the point view of the beneficiaries in the study area following stages for design are proposed in order to be able design PDH appropriate to the life-style of the users; (i) gathering background information, (ii) defining functional and performance specifications, (iii) outlining the systems approach, (iv) determining the requirements, (v) designing the PDH. If a region and the buildings in the area are vulnerable to disaster(s) completing the first three steps before the disaster is proposed. Then it would be easier and would take less time to complete the designs after the disaster. If the third step was not completed before the disaster there is no need to go on to the 3rd one as it will be time consuming; instead information gathering stage should be started.

6.3 Recommendations for Future Studies

A model for post-disaster reconstruction works and design of PDH is proposed in this dissertation. Future studies can be focused on design approaches for specific regions. This approach can include the following factors:

- Disaster resistance
- Fast production
- Low cost
- Easy to build
- Flexibility

Construction materials, systems and detailing appropriate for the PDH are not specified in this study as they were not within the framework of the research. These can be studied separately in order to complete design stage.

Furthermore, strategic planning including pre-disaster works can be done for all regions of Turkey. As long as the design stages of PDH or at least the first step of gathering background information is completed, a data base for the rural houses in different regions of Turkey can be developed. This information would be useful while taking decisions on vulnerability of these houses, taking measures against probable disasters such as strengthening the buildings or relocating the settlement, and design of PDH for the area.

In addition, similar investigations can be done in rural areas where PDH were constructed in order to reveal negative and positive aspects of the reconstruction projects completed as well as the design of the PDH in these areas. The model proposed for reconstruction works and design of PDH in this dissertation can be developed according to the findings of further investigations.

REFERENCES

Acerer, S. 1999. *Afet Konutları Sorunu ve Deprem Örneğinde İncelenmesi*. Unpublished master's thesis, İTÜ, İstanbul.

Akünal, S. 1986. *Proposal for an Alternative Post-Earthquake Housing and Contribution of this Alternative Case to the Existing Condition*. Unpublished master's thesis, METU, Ankara.

Atakuman, Y. 1995. *Earthquake Preparedness as Related to Victimization and Threat*. Unpublished master's thesis, METU, Ankara.

Aysan, F. Y. 1984. The Erzurum-Kars Earthquake of Eastern Turkey (1983); in: *Disasters* 8.1:22-32.

Aytun, A. 1973. Earthquake Safety of Rural Housing in Turkey; in: the Proceedings of *CENTO Scientific Programme Symposium on Rural Housing.* Ankara: State Institute of Statistics: 116-132.

Balta, E. 1998. *Earthquake and Social Change: The Case of Dinar.* Unpublished master's thesis, METU, Ankara.

Barakat, S. 2003. Housing Reconstruction After Conflict and Disaster; in: *Humanitarian Practice Network Paper*, Publish-on-Demand Ltd London, No. 43.

Benson, C. and Clay, E. J. *Disasters, Vulnerability and the Global Economy.*

Blakie, P., T Cannon, I. Davis and B. Wisner. 1994. *At Risk: Natural Hazards, People's Vulnerability and Disasters*. New York: Routhedge.

Candan, B. 1993. *Kırsal Konutlar*. Unpublished master's thesis, Atatürk University, Erzurum.

Ceylan, F. 1983. *Evaluation of Post-Earthquake Long Term Housing Activities in the Rural Areas of Turkey- With a Case Study From Gediz.* Unpublished master's thesis, METU, Ankara.

Cimrin, E. 1996. *Traditional "Yayla" Houses in the Vicinity of Alanya.* Unpublished master's thesis, METU, Ankara.

Coburn, A. W., Spence, R.J.S and Pomonis, A. 1994. *Vulnerability and Risk Assessment.* Cambridge Architectural Research Limited, Cambridge. 2nd Edition.

Cole, P. M. S. 2003. *An Empirical Examination of the Housing Recovery Process Following Disaster*. Unpublished Ph.D. thesis, Texas A&M University.

Demiröz, G. 1996. *A Research on Long-Term Effects of State Resettlement Projects in Vernacular Settings in Rural Areas: The Case Of Yüzüncü Yıl, Mudurnu.* Unpublished master's thesis, METU, Ankara.

Demirtaş R. , Iravul Y., Erkmen C., Baran B. Yaman M., Baykal M., Kılıç T. *Haziran 2000 Orta (Çankırı) Depremi Raporu*. Afet İşleri Genel Müdürlüğü, Ankara.

D'Souza, F. 1986. Recovery Following the Gediz Earthquake: A Study of Four Villages of Western Turkey; in: *Disasters* 10.1: 35-52.

El-Masri, S. and Tipple, G. 2002. Natural Disaster, Mitigation and Sustainability: The Case of Developing Countries; in: *International Planning Studies,* 7.2: 157-175.

Erdik, M. 1995. Istanbul emergency Action Plan; in: *Informal Settlements, Environmental Degradation, and Disaster Vulnerability the Turkey Case Study*, The International decade for Natural disaster Reduction (IDNDR), World Bank, Washington D.C.

Günay, R. 1998. *Tradition of the Turkish House and Safranbolu Houses.* İstanbul: Güzel Sanatlar Matbaaası A.Ş.

Günöven, A. 1977. *Earthquake Related Activities in Turkey with Special Reference to 1970 Gediz Earthquake*. Unpublished master's thesis, METU, Ankara.

Gürsu, H. 1986. *Design Recommendations for Temporary Pneumatic Structures in Design Areas.* Unpublished master's thesis, METU, Ankara.

Hacettepe Üniversitesi Jeoloji Mühendisliği Bölümü, http://www.jeomuh.hacettepe.edu.tr, accessed in July 2005.

Johnson, C., Lizarralde G. and Davidson, C. H. 2005. Reconstruction in developing countries- A Case for Meta-Procurement; in the Proceedings of *International Symposium on Procurement Systems The Impact of Cultural Differences and Systems on Construction Performance*. Las Vegas, NV: 87-95.

Köse, A. 1988. *Afet Konutlarinin Kullanıcı Sistemine Uygunluğunun Araştırılması.* Unpublished master's thesis, Gazi University, Ankara.

Lau, J. 1998. *Helter Shelter: Housing Disaster Survivors, the Vancouver Model.* Unpublished master's thesis, Dalhouise University, Nova Scotia.

Lizarralde, G. 2004. *Organizational System and Performance of Post-Disaster Reconstruction Projects*. Unpublished Ph.D. thesis, Université de Montréal, Montreal.

NTSC (National Science and Technology Council Committee). 2003. *An Interim Report of the Subcommittee on disaster Reconstruction*.

Onat, A. T. 1992. *An Investigation of Vernacular Architecture and a Proposal for a New Neighborhood Unit in Gaziantep.* Unpublished master's thesis, METU, Ankara.

Ören, S. 1996. *Traditional Urfa Dwellings: an Investigation of Part of the Old Town Center.* Unpublished master's thesis, METU, Ankara.

Perez-Lugo, M. D. P. 2003. *Vulnerability to Natural Disasters and the Mass Media*. Unpublished Ph.D. thesis, The State University of New Jersey, New Brunswick, New Jersey.

Renee Pearce, L. D. 2000. *An Integrated Approach for Community Hazard, Impact, Risk and Vulnerability Analysis: HRV*. Unpublished Ph.D. thesis, The University of British Colombia, Vancouver.

Sağlık, http://saglik.tr.net/cevre_sagligi_kapali_ortam.html, accessed in May 2005.

Şahinkaya, R. 1973. The Living Function Analysis of Dwelling in Some of the Rural Areas in Turkey; in the Proceedings of *CENTO Scientific Programme Symposium on Rural Housing.* Ankara: State Institute of Statistics: 37-46.

Şengün, H. 1996. *Trabzon İli'nde Afet Konutu Uygulamaları (Kamu Yönetimi Açısından).* Unpublished thesis, TODAIE, Ankara.

T.C. Bayındırlık ve İskan Bakanlığı Afet İşleri Genel Müdürlüğü Deprem Araştırma Dairesi, http://www.deprem.gov.tr, accessed in March 2004.

T.C. Çankırı Valiliği, http://www.cankiri.gov.tr, accessed in July 2005.

T.C. Çevre ve Orman Bakanlığı, http://www.cevreorman.gov.tr/gurultu_00.htm, accessed in May 2005.

Tercan, B. 2001. *Post Earthquake Relocation Process in Yalova.* Unpublished master's thesis, METU, Ankara.

Toker, A. 1994. *Çankırı ve Çevresinin Fiziki Coğrafyası*. Unpublished master's thesis, Gazi University, Ankara.

Topuz, A. 1998. *Çankiri İli Tarim İşletmelerinde Optimal Üretim Planlarına Göre İşletme Sermayesi İhtiyaçlarının Saptanması Üzerine Bir Araştırma*. Unpublished Ph.D. thesis, Ankara University, Ankara.

Tosun, V. 1983. *Environmental Forces that Influence Form in Vernacular Architecture A Case Study in the Eastern Black Sea Region*. Unpublished master's thesis, METU, Ankara.

Turan, M. and Cengizkan, A. 1983. An Ecological Study of Three Housing Types In a Rural Environment Prone to Disaster; in: *Socio-Architectural Aspects of Housing in Earthquake-Prone Areas of Turkey*, The Scientific and Technical Research Council of Turkey Building Research Institute.

APPENDIX A

QUESTIONNAIRE

Anket No: …… ...../ ...../ 2005

1. Köyün adı : .....
2. Hane Numarası: .....
3. Şu anda 1) Afet konutunda oturuyorum [26. soruya kadar cevaplanacak]
   2) Afet konutu verildi ama oturmuyorum [1-18, 27-32 arası sorular cevaplanacak ve 19. sorudaki tablonun a kolonu doldurulacak]
4. Yaş: .....
5. Cinsiyet: Kadın ( ), Erkek ( )
6. Geçiminizi neyle sağlıyorsunuz? Çiftçilik ( ), Hayvancılık ( ), Emekli ( ), Diğer ( ).....
7. Vasıtanız var mı? Evet ( ), Hayır ( )
   Modeli: Traktör ( ), Otomobil ( ), Kamyon ( ), At Arabası ( )
8. Geleneksel konutta yaşayan kişi sayısı: .....
   Aile Yapısı: Çekirdek aile ( ), Büyük aile ( ) .....
9. Geleneksel konutla ilgili bilgiler:
   Kat sayısı : .....
   Oda sayısı: .....
   Alt kat: ..... Üst kat: .....
   Taşıyıcı sistemi: Kerpiç dolgulu hımış ( ), Taş yığma üzeri kerpiç dolgulu hımış ( ), Taş yığma üzeri taş dolgulu hımış ( ) Diğer ( ) .....
10. Geleneksel konuttaki ahır durumu: Var ( ), Yok ( )
    Konumu: Evin zemin katında ( ), Eve bitişik ( ), Evden ayrı bir yapı ( )
    Taşıyıcı sistemi: Taş yığma ( ), Kerpiç yığma ( ), Kerpiç dolgulu hımış ( ), Diğer ( ).....
11. Geleneksel konutu kim yapmıştı? Bilmiyorum ( ), Kendim ( ), Usta ( ), Diğer ( ).....
12. Geleneksel konut şu anda ne durumda? Kullanılıyor ( ) ....., Boş ( ), Yıkıldı ( )
13. Geleneksel konutun en çok sevdiğiniz yanları:
    .....
14. Geleneksel konutun en çok şikayet ettiğiniz yanları:
    .....
15. Ne kadar zamandır bu evde oturuyorsunuz?: .....
16. Depremden sonra evinizde yaşayan aile ve birey sayısında değişiklik oldu mu?
    Evet ( ), Hayır ( )
    Nedeni?:.....

17.Sahip olduğunuz hayvanlar:

	Hayvan Türü	Sayısı
Büyükbaş		
Küçükbaş		
Kümes		

18.Yemeğinizi çoğunlukla nerede pişiriyorsunuz?

Fırın ( ), Ocak ( ), Tandır ( ), Soba ( ), Başka ( ).....

19.Afet konutu ve/ veya geleneksel konut ile ilgili düşünceleriniz nelerdir?

	a				b			
	Geleneksel konut				Afet konutu			
	Hiç Memnun Değil	İdare eder	Çok memnun	Yok	Hiç Memnun Değil	İdare eder	Çok memnun	Yok
1. Yapı malzemeleri								
2. Yapım sistemi								
3. Depreme dayanıklılık								
4. Isınma								
5. Güneş görme								
6. Odaların yerleri								
7. Pencerelerin büyüklüğü								
8. Temizlik/bakım kolaylığı								
9. Komşuluk ilişkileri								
10. Evin yeri								
11. Kat sayısı								
12. Oda sayısı								
13. Düzenli mutfak								
14. Uygun banyo								
15. Ahır								
16. Genel olarak								

20.Evinizde değişiklik yaptınız mı? Evet ( ), Hayır ( )

Ev içi ( ):.....

Cephe ( ):.....

Ekler ( ):.....

21.İmkanınız olsaydı evinizde değişiklik/ daha fazla değişiklik yapar mıydınız?

Evet ( ), Hayır ( )

Ev içi ( ): .....

Cephe ( ): .....

Ekler ( ):.....

22.Elinizde olsa nasıl bir evde yaşamak isterdiniz?

Taşıyıcı sistemi: Betonarme ( ), Ahşap karkas ( ), Tuğla, briket vb. yığma ( ),

Diğer ( ).....

Kat sayısı : .....

Oda sayısı: .....

Alt kat: ..... Üst kat: .....

23.Afet konutunda kaç kişi yaşıyorsunuz? .....

Aile yapısı: Çekirdek aile ( ), Büyük aile ( ) .....

24.Afet konutunun en çok beğendiğiniz yanları:

.....

25.Afet konutunun en çok şikayet ettiğiniz yanları:

.....

26.Şu anda depremden önceki evinizde yaşıyor olmayı tercih eder miydiniz?

Evet ( ), Hayır ( )

27.Hiç afet konutunda oturdunuz mu? Evet ( ), Hayır ( )

28.Şu anda afet konutunda oturan var mı? Evet ( ), Hayır ( )

Cevabınız evet ise kim oturuyor?: .....

29.Neden afet konutunu kullanmıyorsunuz?

Afet konutu ailemizdeki herkesi barındırmaya yetmediği için ( ),

Toprağıma uzak olduğu için ( ),

Afet konutunu güvenli bulmadığım için ( ),

Bu evde kullandığım bazı mekanlar afet konutunda olmadığı için ( ), Ahır ( ), Kiler ( ), Depo ( ), Diğer ( )

Yeni yerleşim bölgesi hayvan yetiştirmek için uygun olmadığı için ( ),

Afet konutu için ayrılmış olan parsel yetiştirdiğim hayvanları barındıracak büyüklükte ahır yapmaya yetmediği için ( )

Diğer ( ) .....

30.Şu anda afet konutunda oturuyor olmayı tercih eder miydiniz? Evet ( ), Hayır ( )

Neden?: .....

31.Afet konutlarının beğendiğiniz yanları nelerdir?

.....

32.Afet konutlarının beğenmediğiniz yanları nelerdir?

.....

APPENDIX B

DATA GROUPED FOR ANOVA

Table B.1 Raw data of the human comfort factors

Case	heating		sunlight		cleaning& maintenance ease		well equipped kitchen		proper bathroom		Sum	
	TH	TD	TH	TD	TH	TD	TH	TD	TH	TD	TH	TD
1	3	1	3	2	1	3	3	3	1	3	10	13
2	3	3	3	3	3	3	3	3	1	3	14	14
3	3	1	3	1	1	3	2	1	1	1	12	5
4	3	1	3	1	2	2	2	1	1	1	13	4
5	3	1	3	1	1	3	2	3	1	3	10	11
6	3	1	3	2	1	3	2	3	1	3	10	12
7	3	1	3	2	1	1	1	3	1	3	10	9
8	3	1	3	1	1	3	2	3	1	2	12	8
9	3	1	3	1	1	3	1	2	2	3	11	9
10	3	5	3	1	1	2	3	3	3	3	13	14
11	2	1	3	1	1	3	1	3	1	3	8	11
12	3	2	3	1	2	3	1	3	1	3	10	12
13	3	1	3	3	3	3	1	3	1	3	13	11
14	3	3	3	3	3	3	3	3	1	3	13	15
15	3	1	3	2	1	3	1	3	1	3	9	12
16	3	1	3	2	2	1	2	2	1	1	13	5
17	3	1	3	2	1	3	2	2	1	1	12	7
18	3	1	3	2	1	3	3	3	1	3	10	13
19	3	1	3	1	3	3	2	2	3	1	15	7
20	3	2	3	3	2	3	2	2	2	3	12	13
21	3	2	3	3	2	3	2	2	2	3	12	13
22	3	1	1	1	3	3	3	1	3	1	15	5
23	3	1	3	1	3	3	3	1	3	3	17	7
24	3	1	3	1	1	3	2	3	1	3	12	9
25	3	1	2	2	1	3	3	3	2	3	11	12
26	3	1	3	1	3	3	3	1	3	3	17	7
27	3	1	3	1	1	3	2	3	1	3	12	9
28	3	1	3	1	3	3	3	1	3	3	17	7
29	3	1	2	2	1	3	3	3	2	3	11	12
30	3	1	3	1	1	3	2	3	1	3	12	9
31	3	1	3	1	2	2	2	1	1	1	13	4
32	3	2	3	3	2	3	2	2	2	3	12	13
33	3	1	3	2	1	3	3	3	1	3	10	13
34	3	1	3	1	3	3	2	2	3	1	15	7
35	3	1	3	1	3	3	3	1	3	3	17	7
36	3	1	2	2	1	3	3	3	2	3	11	12
37	3	1	3	1	3	3	2	2	3	1	15	7
38	3	1	3	1	3	3	3	1	3	3	17	7
39	3	1	2	2	1	3	3	3	2	3	11	12
40	3	1	3	1	1	3	2	3	1	3	12	9

TH: *Traditional House* TD: *Typical Design*

Table B.2 Raw data of the physical factors

Case	Planning of the house		Planning of the settlement		Sum	
	TH	TD	TH	TD	TH	TD
1	3	1	1	2	4	3
2	3	2	3	2	6	4
3	3	1	3	1	6	2
4	3	1	3	1	6	2
5	3	1	3	3	6	4
6	3	2	3	3	6	5
7	3	2	3	2	6	4
8	3	1	3	1	6	2
9	3	1	3	2	6	3
10	3	3	3	3	6	6
11	3	1	3	3	6	4
12	3	1	3	3	6	4
13	3	2	3	1	6	3
14	3	1	3	3	6	4
15	3	1	3	3	6	4
16	3	3	3	1	6	4
17	3	1	3	1	6	2
18	3	1	1	2	4	3
19	3	1	3	2	6	3
20	3	1	3	3	6	4
21	3	1	3	3	6	4
22	3	1	3	1	6	2
23	3	1	3	1	6	2
24	3	1	3	1	6	2
25	3	1	3	3	6	4
26	3	1	3	1	6	2
27	3	1	3	1	6	2
28	3	1	3	1	6	2
29	3	1	3	3	6	4
30	3	1	3	1	6	2
31	3	1	3	1	6	2
32	3	1	3	3	6	4
33	3	1	1	2	4	3
34	3	1	3	2	6	3
35	3	1	3	1	6	2
36	3	1	3	3	6	4
37	3	1	3	2	6	3
38	3	1	3	1	6	2
39	3	1	3	3	6	4
40	3	1	3	1	6	2

TH: *Traditional House* TD: *Typical Design*

Table B.3 Raw Data of the Economic Factors

Case	Transportation		Cattle Sheds		Sum	
	TH	TD	TH	TD	TH	TD
1	1	2	3	1	4	3
2	3	2	0	0	3	2
3	3	1	3	0	6	1
4	3	1	3	1	6	2
5	3	3	2	1	5	4
6	3	3	2	1	5	4
7	3	2	2	1	5	3
8	3	1	3	1	6	2
9	3	2	2	2	5	4
10	3	3	3	0	6	3
11	3	3	3	3	6	6
12	3	3	3	1	6	4
13	3	1	3	1	6	2
14	3	3	3	1	6	4
15	3	3	3	3	6	6
16	3	1	3	0	6	1
17	3	1	3	0	6	1
18	1	2	3	1	4	3
19	3	2	3	3	6	5
20	3	3	3	0	6	3
21	3	3	3	0	6	3
22	3	1	3	0	6	1
23	3	1	3	0	6	1
24	3	1	2	1	5	2
25	3	3	3	0	6	3
26	3	1	3	0	6	1
27	3	1	2	1	5	2
28	3	1	3	0	6	1
29	3	3	3	0	6	3
30	3	1	2	1	5	2
31	3	1	3	1	6	2
32	3	3	3	0	6	3
33	1	2	3	1	4	3
34	3	2	3	3	6	5
35	3	1	3	0	6	1
36	3	3	3	0	6	3
37	3	2	3	3	6	5
38	3	1	3	0	6	1
39	3	3	3	0	6	3
40	3	1	2	1	5	2

TH: *Traditional House* TD: *Typical Design*

Table B.4 Raw Data for the planning of *Typical Designs* and *Custom Designs*

Case	Planning	
	TD	CD
1	1	2
2	2	2
3	1	2
4	1	2
5	1	3
6	2	3
7	2	3
8	1	3
9	1	2
10	3	2
11	1	2
12	1	2
13	2	2
14	1	2
15	1	3
16	3	2
17	1	1
18	1	1
19	1	1
20	1	1
21	1	2
22	1	2
23	1	3
24	1	3
25	1	3
26	1	3
27	1	3
28	1	3
29	1	3
30	1	3
31	1	3
32	1	3
33	1	3
34	1	3
35	1	3
36	1	3
37	1	3
38	1	3
39	1	1
40	1	1

TD: *Typical Design* CD: *Custom Design*

Table B.5 Raw data of the evaluations of the users of the PDH with *Typical Designs* pertaining to *Traditional Houses*

Case	Construction materials	Construction system	Heating	Sunlight	Planning of the house	Cleaning & maintenance ease	Location of the house	Well equipped kitchen	Proper bathroom	Cattle sheds	Sum
1	1	1	3	3	3	1	1	3	1	3	20
2	3	3	3	3	3	3	3	3	1	0	25
3	1	1	3	3	3	1	3	2	1	3	21
4	1	1	3	3	3	2	3	2	1	3	22
5	1	1	3	3	3	1	3	2	1	2	20
6	1	1	3	3	3	1	3	2	1	2	20
7	1	1	3	3	3	1	3	1	1	2	19
8	1	1	3	3	3	1	3	2	1	3	21
9	1	1	3	3	3	1	3	1	2	2	20
10	3	3	3	3	3	1	3	3	3	3	28
11	3	3	2	3	3	1	3	1	1	3	23
12	3	3	3	3	3	2	3	1	1	3	25
13	2	2	3	3	3	3	3	1	1	3	24
14	3	3	3	3	3	3	3	3	1	3	28
15	3	3	3	3	3	1	3	1	1	3	24
16	2	2	3	3	3	2	3	2	1	3	24
17	1	1	3	3	3	1	3	2	1	3	21
18	1	1	3	3	3	1	1	3	1	3	20
19	3	3	3	3	3	3	3	2	3	3	29
20	1	1	3	3	3	2	3	2	2	3	23
21	1	1	3	3	3	2	3	2	2	3	23
22	3	3	3	1	3	3	3	3	3	3	28
23	3	3	3	3	3	3	3	3	3	3	30
24	3	3	3	3	3	1	3	2	1	2	24
25	3	3	3	2	3	1	3	3	2	3	26
26	3	3	3	3	3	3	3	3	3	3	30
27	3	3	3	3	3	1	3	2	1	2	24
28	3	3	3	3	3	3	3	3	3	3	30
29	3	3	3	2	3	1	3	3	2	3	26
30	3	3	3	3	3	1	3	2	1	2	24
31	1	1	3	3	3	2	3	2	1	3	22
32	1	1	3	3	3	2	3	2	2	3	23
33	1	1	3	3	3	1	1	3	1	3	20
34	3	3	3	3	3	3	3	2	3	3	29
35	3	3	3	3	3	3	3	3	3	3	30
36	3	3	3	2	3	1	3	3	2	3	26
37	3	3	3	3	3	3	3	2	3	3	29
38	3	3	3	3	3	3	3	3	3	3	30
39	3	3	3	2	3	1	3	3	2	3	26
40	3	3	3	3	3	1	3	2	1	2	24

Table B.6 Raw data of the evaluations of the users pertaining to the PDH with *Typical Design*

Case	Construction materials	Construction system	Heating	Sunlight	Planning of the house	Cleaning & maintenance ease	Location of the house	Well equipped kitchen	Proper bathroom	Cattle sheds	Sum
1	3	3	1	2	1	3	2	3	3	1	22
2	3	3	3	3	2	3	2	3	3	0	25
3	3	3	1	1	1	3	1	1	1	0	15
4	2	3	1	1	1	2	1	1	1	1	14
5	3	3	1	1	1	3	3	3	3	1	22
6	3	3	1	2	2	3	3	3	3	1	24
7	3	3	1	2	2	1	2	3	3	1	21
8	3	3	1	1	1	3	1	3	2	1	19
9	3	3	1	1	1	3	2	2	3	2	21
10	2	2	5	1	3	2	3	3	3	0	24
11	2	2	1	1	1	3	3	3	3	3	22
12	3	3	2	1	1	3	3	3	3	1	23
13	3	3	1	3	2	3	1	3	3	1	23
14	3	3	3	3	1	3	3	3	3	1	26
15	3	3	1	2	1	3	3	3	3	3	25
16	3	3	1	2	3	1	1	2	1	0	17
17	3	3	1	2	1	3	1	2	1	0	17
18	3	3	1	2	1	3	2	3	3	1	22
19	1	1	1	1	1	3	2	2	1	3	16
20	2	2	2	3	1	3	3	2	3	0	21
21	2	2	2	3	1	3	3	2	3	0	21
22	1	1	1	1	1	3	1	1	1	0	11
23	1	1	1	1	1	3	1	1	3	0	13
24	2	3	1	1	1	3	1	3	3	1	19
25	2	2	1	2	1	3	3	3	3	0	20
26	1	1	1	1	1	3	1	1	3	0	13
27	2	3	1	1	1	3	1	3	3	1	19
28	1	1	1	1	1	3	1	1	3	0	13
29	2	2	1	2	1	3	3	3	3	0	20
30	2	3	1	1	1	3	1	3	3	1	19
31	2	3	1	1	1	2	1	1	1	1	14
32	2	2	2	3	1	3	3	2	3	0	21
33	3	3	1	2	1	3	2	3	3	1	22
34	1	1	1	1	1	3	2	2	1	3	16
35	1	1	1	1	1	3	1	1	3	0	13
36	2	2	1	2	1	3	3	3	3	0	20
37	1	1	1	1	1	3	2	2	1	3	16
38	1	1	1	1	1	3	1	1	3	0	13
39	2	2	1	2	1	3	3	3	3	0	20
40	2	3	1	1	1	3	1	3	3	1	19

Table B.7 Raw data of evaluations of the users of the PDH with *Custom Designs* pertaining to *Traditional Houses*

Case	Construction materials	Construction system	Heating	Sunlight	Planning of the house	Cleaning & maintenance ease	Location of the house	Well equipped kitchen	Proper bathroom	Cattle sheds	Sum
1	3	3	3	3	3	2	3	3	1	2	26
2	3	3	3	3	3	2	3	3	1	2	26
3	3	3	3	3	3	2	3	3	1	2	26
4	3	3	3	3	3	2	3	3	1	2	26
5	1	2	1	3	3	1	3	1	1	3	19
6	1	2	1	3	3	1	3	1	1	3	19
7	1	2	1	3	3	1	3	1	1	3	19
8	1	2	1	3	3	1	3	1	1	3	19
9	3	3	3	3	3	3	3	3	3	3	30
10	3	3	3	3	3	3	3	3	3	3	30
11	3	3	3	3	3	3	3	3	3	3	30
12	3	3	3	3	3	3	3	3	3	3	30
13	3	3	3	3	3	3	3	3	3	3	30
14	3	3	3	3	3	2	3	3	1	2	26
15	1	2	1	3	3	1	3	1	1	3	19
16	3	3	3	3	3	3	3	3	3	3	30
17	3	3	3	3	3	3	3	3	1	3	28
18	3	3	3	3	3	3	3	3	1	3	28
19	3	3	3	3	3	3	3	3	1	3	28
20	3	3	3	3	3	3	3	3	1	3	28
21	1	1	1	1	1	1	3	1	1	1	12
22	1	1	1	1	1	1	3	1	1	1	12
23	3	3	3	3	3	3	3	3	3	3	30
24	3	3	3	3	3	3	3	3	3	3	30
25	3	3	3	3	3	3	3	3	3	3	30
26	3	3	3	3	3	3	3	3	3	3	30
27	3	3	3	3	3	3	3	3	3	3	30
28	3	3	3	3	3	3	3	3	3	3	30
29	3	3	3	3	3	3	3	3	3	3	30
30	3	3	3	3	3	3	3	3	3	3	30
31	3	3	3	3	3	3	3	1	1	3	26
32	3	3	3	3	3	3	3	1	1	3	26
33	3	3	3	3	3	3	3	1	1	3	26
34	3	3	3	3	3	3	3	1	1	3	26
35	3	3	3	3	3	3	3	3	1	3	28
36	3	3	3	3	3	3	3	3	1	3	28
37	3	3	3	3	3	3	3	3	1	3	28
38	3	3	3	3	3	3	3	3	1	3	28
39	3	3	3	3	3	1	3	2	2	0	23
40	3	3	3	3	3	1	3	2	2	0	23

Table B.8 Raw data of the evaluations of the users pertaining to the PDH with *Custom Designs*

Case	Construction materials	Construction system	Heating	Sunlight	Planning of the house	Cleaning & maintenance ease	Location of the house	Well equipped kitchen	Proper bathroom	Cattle sheds	Sum
1	1	2	3	3	2	3	3	3	3	2	25
2	1	2	3	3	2	3	3	3	3	2	25
3	1	2	3	3	2	3	3	3	3	2	25
4	1	2	3	3	2	3	3	3	3	2	25
5	2	3	3	3	3	3	3	3	3	2	28
6	2	3	3	3	3	3	3	3	3	2	28
7	2	3	3	3	3	3	3	3	3	2	28
8	2	3	3	3	3	3	3	3	3	2	28
9	3	3	1	2	2	3	3	3	3	0	23
10	3	3	1	2	2	3	3	3	3	0	23
11	3	3	1	2	2	3	3	3	3	0	23
12	3	3	1	2	2	3	3	3	3	0	23
13	3	3	1	2	2	3	3	3	3	0	23
14	1	2	3	3	2	3	3	3	3	2	25
15	2	3	3	3	3	3	3	3	3	2	28
16	3	3	1	2	2	3	3	3	3	0	23
17	2	2	1	1	1	3	3	3	3	1	20
18	2	2	1	1	1	3	3	3	3	1	20
19	2	2	1	1	1	3	3	3	3	1	20
20	2	2	1	1	1	3	3	3	3	1	20
21	3	3	1	2	2	3	3	3	1	2	23
22	3	3	1	2	2	3	3	3	1	2	23
23	2	3	1	3	3	3	3	3	3	1	25
24	2	3	1	3	3	3	3	3	3	1	25
25	2	3	1	3	3	3	3	3	3	1	25
26	2	3	1	3	3	3	3	3	3	1	25
27	3	3	1	2	3	3	3	3	3	1	25
28	3	3	1	2	3	3	3	3	3	1	25
29	3	3	1	2	3	3	3	3	3	1	25
30	3	3	1	2	3	3	3	3	3	1	25
31	2	2	1	3	3	3	3	3	3	0	23
32	2	2	1	3	3	3	3	3	3	0	23
33	2	2	1	3	3	3	3	3	3	0	23
34	2	2	1	3	3	3	3	3	3	0	23
35	1	2	1	3	3	3	3	3	3	0	22
36	1	2	1	3	3	3	3	3	3	0	22
37	1	2	1	3	3	3	3	3	3	0	22
38	1	2	1	3	3	3	3	3	3	0	22
39	3	3	1	3	1	3	3	3	3	0	23
40	3	3	1	3	1	3	3	3	3	0	23

APPENDIX C

RESULTS OF T-TESTS WITH REGARDS TO PDH WITH *TYPICAL DESIGNS* CONSTRUCTED IN DIFFERENT SETTLEMENTS

Table C.1. T-test for human comfort factors with regards to PDH constructed in the existing villages and in the new settlements close to the old villages.

	Human comfort F. - TD in the existing village	*Human comfort F. - TD close to the old village*
Mean	12.5	10.5
Variance	2	1.653846154
Observations	8	14
Hypothesized Mean Difference	0	
df	14	
t Stat	3.296311824	
P(T<=t) one-tail	0.002650522	
t Critical one-tail	1.761310115	
P(T<=t) two-tail	0.005301044	
t Critical two-tail	2.144786681	
Ho is rejected with 95% confidence		

Table C.2. T-test for human comfort factors with regards to PDH constructed in the new settlements far from the old villages and in the ones close to the old villages.

	Human comfort F. - TD far from the old village	*Human comfort F. - TD close to the old village*
Mean	9.777777778	10.5
Variance	7.947712418	1.653846154
Observations	18	14
Hypothesized Mean Difference	0	
df	25	
t Stat	-0.965393281	
P(T<=t) one-tail	0.171797194	
t Critical one-tail	1.708140745	
P(T<=t) two-tail	0.343594388	
t Critical two-tail	2.059538536	
Ho is accepted with 95% confidence		

Table C.3. T-test for physical factors with regards to PDH constructed in the existing villages and in the new settlements far from the old villages.

	Physical F. - TD in the exiting village	*Physical F. - TD far from the old village*
Mean	4.25	2.944444444
Variance	0.785714286	0.64379085
Observations	8	18
Hypothesized Mean Difference	0	
df	12	
t Stat	3.566766268	
P(T<=t) one-tail	0.001937675	
t Critical one-tail	1.782287548	
P(T<=t) two-tail	0.003875351	
t Critical two-tail	2.178812827	
Ho is rejected with 95% confidence		

Table C.4. T-test for physical factors with regards to PDH constructed in the existing villages and in the new settlements close to the old villages.

	Physical F. - TD in the existing village	*Physical F. - TD close to the old village*
Mean	4.25	2.714285714
Variance	0.785714286	0.989010989
Observations	8	14
Hypothesized Mean Difference	0	
df	16	
t Stat	3.737228883	
P(T<=t) one-tail	0.000897762	
t Critical one-tail	1.745883669	
P(T<=t) two-tail	0.001795523	
t Critical two-tail	2.119905285	
Ho is rejected with 95% confidence		

Table C.5. T-test for economic factors with regards to PDH constructed in the existing villages and in the new settlements far from the old villages.

	Economic F.- TD in the existing village	*Economic F. - TD far from the old village*
Mean	4.125	2.722222222
Variance	1.839285714	1.859477124
Observations	8	18
Hypothesized Mean Difference	0	
df	14	
t Stat	2.43011377	
P(T<=t) one-tail	0.014568289	
t Critical one-tail	1.761310115	
P(T<=t) two-tail	0.029136579	
t Critical two-tail	2.144786681	
Ho is rejected with 95% confidence		

Table C.6. T-test for economic factors with regards to PDH constructed in the existing villages and in the new settlements far from the old villages.

	Economic F. - TD in the existing village	*Economic F. - TD close to the old village*
Mean	4.125	2
Variance	1.839285714	0.769230769
Observations	8	14
Hypothesized Mean Difference	0	
df	10	
t Stat	3.981497291	
P(T<=t) one-tail	0.001297341	
t Critical one-tail	1.812461102	
P(T<=t) two-tail	0.002594681	
t Critical two-tail	2.228138842	
Ho is rejected with 95% confidence		

CURRICULUM VITAE

PERSONEL INFORMATION

Surname, Name: Dikmen, Neşe
Nationality: Turkish Republic (TC)
Date and Place of Birth: 03.06.1976, Antalya
Marital Status: Married
email: nesedikmen@yahoo.com

EDUCATION

Degree	Institution	Year of Graduation
MA	Hacettepe University Interior Design	2001
BA	Anadolu University Architecture	1999
High School	Antalya Anatolian Technical High School	1994

WORK EXPERIENCE

Year	Place	Enrollment
2002-Present	METU Department of Architecture	Research Assistant
2001-2002	Fırça & Palet İç Mimari Dekorasyon	Architect
2000-2001	Teknik Ltd Proje Danışmanlık Hizmetleri	Architect
1997 July-August	Gözde Mimarlık	Intern Architecture Student

FOREIGN LANGUAGES

Advanced English

MAIN AREAS OF INTEREST

Visual perception factors in design, traditional houses, permanent post-disaster houses and post-disaster reconstruction projects.