

# ANALYSIS OF THE POST-DISASTER RECONSTRUCTION PROCESS FOLLOWING TURKISH EARTHQUAKES, 1999

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## Abstract

Post-disaster housing reconstruction is a process that is the interaction of complex social, technological and economic factors and actions. The process of post-disaster housing reconstruction is comprised of four different periods: The pre-disaster, immediate relief, rehabilitation, and reconstruction periods. The objective of this paper is to briefly define the phases and actions in the process and then to analyze the housing reconstruction implementations following the 1999 Earthquakes in Turkey. With the help of this analysis, the establishment of a multi-disciplinary planning framework for post-disaster housing reconstruction will be simpler to achieve. The analysis would be a first step for realizing a more precise organization plan which omits the frequent mistakes for the implementations in Turkey. In implementations, it was observed that the main problem was the lack of satisfactory actions and policy framework in the pre-disaster phase. Therefore, although the actions in the post-disaster phases seem to be more satisfactory; the implementations following the earthquakes can hardly be called a success.

*Keywords: Post-Disaster Housing; Turkey; Earthquake; Housing Reconstruction*

## INTRODUCTION

Post-disaster housing is defined by United Nations Disaster Relief Coordinator (UNDRO) as "housing policies and applications following a disaster for meeting the urgent, temporary and permanent sheltering needs of the survivors of the disaster" (1982, p.11). The construction of post-disaster housing is a process diverse from the construction of housing in normal times, since the process consists of actions to be realized in times of major crisis in the aftermath of disasters (Quarantelli, 1997; Quarantelli, 2000; Barakat, 2003).

Various architects, designers and other technical actors have mistakenly considered housing only as a product, but it is definitely a process. Therefore post-disaster housing is also a process and the post-disaster dwelling is the product of a "long chain of social, economic, technological, environmental, political and other interactions" (UNDRO, 1982, p. iii). This interaction combines social consciousness, highly developed technology, and economic systems with the participation of the

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affected community (Norton, 1980; UNDRO, 1982; Aysan and Davis, 1993; Barakat, 2003).

## ANALYSIS OF THE POST- DISASTER HOUSING PROCESS

The post-disaster housing reconstruction process consists of four different periods: pre-disaster period, immediate relief period, rehabilitation period and reconstruction period as termed by the UNDRO in 1982. The pre-disaster period is the phase when major policies are decided and database is formed. The immediate relief period is significant for the damage and needs assessments which should be realized directly after the disaster. The rehabilitation period is where all the critical decisions about the detailed implementation plan are made. The construction, implementation and evaluation period of the permanent post-disaster houses is termed the reconstruction period (UNDRO, 1982).

The actions and measures defined in the process also fall into four categories; policy-making, organization, implementation, and evaluation and follow-up (UNDRO, 1982). Actions related to policy-making and various actions about organization are realized in the pre-disaster period and the remaining actions are realized in the post-disaster phases. On the other hand, the process of post-disaster housing is a cycle. Consequently actions, especially the ones in the pre-disaster period and reconstruction period, may overlap. The major accomplishments of the phases in the disaster cycle can be seen in Figure 1.



Figure 1 Post-Disaster Reconstruction Cycle

## **Pre-Disaster Phase**

The pre-disaster phase is undeniably the most important period for the housing reconstruction process. In the pre-disaster phase, vital principles, policies and strategies are determined and organization of the post-disaster housing process is planned. The aim in this period is to determine a policy combining technical, social and economic factors (Davis, 1978; Alexander, 2000; Barakat, 2003; Lewis, 2003). Pre-disaster reconstruction planning has not proved popular because most countries have insufficient resources. Additionally, the psychological need not to talk about death and homelessness before it happens and the avoidance of remembering the previous suffering are significant factors for deficient pre-disaster planning for post-disaster reconstruction (Haas *et al.*, 1977; Alexander, 2004).

### ***Policy-Making Actions at the National Level***

An ideal reconstruction policy should unite social, legal, bureaucratic, technical, and economic dynamics after the natural disaster. Consequently, the most important actions related to policy-making are the analyses of the previous experiences and reconstruction models in the national level. The analysis of current post-disaster housing strategies, current economic models in reconstruction, past disaster implementations in the country, and the analysis of economic, bureaucratic, social and technical factors affecting the process are the main steps for the analysis of the reconstruction models (UNDRO, 1982; HABITAT, 2001; Krueger *et al.*, 2003; Freeman, 2004; Trim, 2004).

After these analyses, policies and strategies of a reconstruction model at the national level are decided and roles of all the actors involved in the process are planned and defined. Consequently, a national policy and action guideline is defined for post-disaster housing reconstruction in the pre-disaster phase (UNDRO, 1982; HABITAT, 2001).

### ***Organizational Actions at the National Level***

In the pre-disaster period, there are also organizational actions in the national level. Such actions can be listed as; preparation of novel construction systems and by-laws (if needed), the modification of emergency legislation (specifically regarding land-use), providing the technology for the establishment of a nationally consistent system of data collection, preparation of the damage and needs assessment and survey methodology, and training of the local key actors. Organizational actions are the first but fundamental steps to prepare an organizational model for post-disaster housing reconstruction at the regional and local level (Haas *et al.*, 1977; UNDRO, 1982; Aysan and Davis, 1993; Comerio, 1997; HABITAT, 2001; Prestipino, 2004).

### ***Organizational Actions at the Regional and Local Level***

Although policy-making measures are only established at the national level, organizational actions can be realized at the regional and local level as well.

Preparation of a topographical, climatic, economic, social and cultural database related to the region, hazard mapping, evaluation of building and site conditions in regions at risk, revision of the existing plans, preparation of the new and extended city layouts that are for re-modeling as well as for growth, preparation of sample guidelines and training aids for immediate action, training of the staff in the post-disaster teams are the organizational actions to be realized in the pre-disaster period (Haas *et al.*, 1977; UNDRO, 1982; HABITAT, 2001; ITDG, 2004; Akinci, 2004).

### **Immediate Relief Phase**

Many of the actions and measures taken in the immediate relief period are intended to minimize the physical and social destruction, and survivor's psychological trauma. Furthermore, actions and decisions to be realized in this period can greatly influence implementations in the later stage. As for post-disaster reconstruction, the prior tasks of assessment of damage, existing resources and needs should be precise because housing reconstruction decisions are based on these early data (Davis, 1978; Aysan and Davis, 1993; Alexander, 2000). This period usually lasts for approximately two weeks after the disaster event (Haas *et al.*, 1977; UNDRO, 1982). Actions related to post-disaster housing reconstruction in this period are all organizational.

#### ***Organizational Actions at the National Level***

In the immediate relief period, the organizational actions to be held at the national level are the re-establishment of communication and setting up a local database in the crisis center, and coordinating emergency shelter assistance (Aysan and Davis, 1993; HABITAT, 2001).

#### ***Organizational Actions at the Local Level***

Actions related to organization at the local level in the immediate relief period are the distribution of emergency shelters, the assessment the needs of the homeless-, and the damage, and the re-establishment of damaged infrastructure, if essential. Field-work is mostly used for the assessment of damage and needs. It is still the most common data-collection approach; and field workers are more successful in gaining access to people, activities, and information sources than the use of high-technology communication devices, especially in the developing countries (UNDRO, 1982; Aysan and Davis, 1993; Comerio, 1998; HABITAT, 2001; Barakat, 2003).

### **Rehabilitation Period**

Rehabilitation is the time period where all the vital decisions about the detailed implementation plan are made. In this period, the data obtained from damage and needs assessments are analyzed and evaluated, and then the types, structure and quantities of the dwellings, and regions to be implemented are decided (UNDRO, 1982; Alexander 2000; Lewis, 2003). Rehabilitation period lasts for about 45-60 days following the disaster (Haas *et al.*, 1977). Actions in this period are related to organization and implementation.

### ***Organizational Actions at the National Level***

The analysis and evaluation of data obtained from damage and needs assessments is the only action related to organization in the rehabilitation period. On the other hand, this action is extremely significant because the extent of damage and needs are translated into appropriate action.

### ***Actions Related to the Implementation at the National Level***

In the rehabilitation period, the types, systems and numbers of the permanent post-disaster dwellings and regions to be implemented are decided in the national level. Preparation of a detailed plan about the production of housing, developing and maintaining a list of manufacturers and suppliers, training and communication with the actors involved in the production and construction of dwellings are realized at this period. In the later stages of the process, modifications in the plan and systems are made using the feedback from the local community (UNDRO, 1982; Lewis, 2003; Barakat, 2003; ITDG, 2004).

### ***Actions Related to the Implementation at the Local Level***

In this period, provision of the information about the post-disaster housing process to the community, presenting a model house or plan for evaluation of the community, training of the actors and local labor in the community involved, and the construction of the infrastructure of the site are the actions to be implemented at the local level. Additionally, there may be the distribution of temporary shelters or core shelters according to the type of the post-disaster housing project chosen in the rehabilitation phase. Besides the governmental actions, donated temporary shelters are distributed by NGO's and some spontaneous temporary shelters are built by the local people at this level (UNDRO, 1982; HABITAT, 1989; Aysan and Davis, 1993).

### **Reconstruction Period**

The construction and implementation period of the permanent post-disaster houses is called the reconstruction period. In contrary to popular belief, this period does not end with the handover of the houses to the survivors of the disaster. The activities for the evaluation of the dwellings fall into this period, as well as the first period of the post-disaster reconstruction cycle, namely preparing for the next pre-disaster period, as mentioned before. The reconstruction period can last between two and four years depending on the resources of the affected community (Haas *et al.*, 1977; UNDRO, 1982; HABITAT, 2001; Barakat, 2002).

### ***Actions Related to the Implementation at the National Level***

Even though the construction of the houses is realized at the local level, the control of the implementation process and the preparation of an evaluation document for the

project are the actions related to implementation at the national level in the reconstruction period.

### ***Actions Related to the Implementation at the Local Level***

In the reconstruction period, all the actions in the construction of houses, from the transportation of the building materials to the settlement of the survivors to the buildings, are related to implementation in the local level (Barakat, 2003; ITDG, 2004). The permanent dwellings may be self-constructed by the community (or the NGO's in the country) with support from the local government, disaster insurance systems or the low-interest loan programs (Comerio, 1998; Kreutner *et al.*, 2003).

### ***Actions Related to Evaluation and Follow-up***

Evaluative actions help the creation of basic data which outlines program objectives, the philosophies behind them, a brief history of the personal involved and the details of the implementation phase, and the immediate and long-term impacts. Creation of such basic data is a necessity for the establishment of flexible feedback model of post-disaster action for future disasters. Evaluation and follow-up actions are carried out by the project personal no less than every 6 months while the project is being implemented so that necessary additions and modifications can be possible. In 3-5 years after the end of the project, a final evaluation of long-term impacts should be prepared by professionals who are independent from the project. (Norton, 1980; UNDRO, 1982; Guha-Sapir & Lechat, 1986; Lizzarelde, 2002; Akinci, 2004).

The summary of all the actions, their levels and all the actors involved in the post-disaster housing reconstruction process can be seen in Table 1.

Table 1 Analysis of Post-Disaster Housing Process

<b>Time Period</b>	<b>Level</b>	<b>Actions</b>	<b>Actors</b>
Pre-Disaster Period	National	<b>Policy Making</b> Analyses Decision of the policies Role planning Action guideline	National Government, Disaster Managers, Local Architects/Engineers, Multi-Disciplinary Experts
		<b>Organizational</b> New construction systems Hazard-mapping Emergency legislation Assessment methodology Training of local figures	N. Government, Disaster Managers, Local Architects/Engineers, Multi-Disciplinary Experts, Private Sector
	Local	<b>Organizational</b> Regional database Sample guidelines	Local Multi-Disciplinary Experts, Disaster Managers, Community

Immediate Relief Period	National	<b>Organizational</b> Assistance of coordination Communication center	Disaster Managers, National Government
	Local	<b>Organizational</b> Emergency shelter assistance Needs assessment Damage assessment	Disaster Managers, Architects/Engineers, Multi-Disciplinary Experts, Volunteers, NGO's, Donor Countries, Local Military, Community
Rehabilitation Period	National	<b>Organizational</b> Analysis of damage and needs assessment	N. Government, Disaster Managers, Local Architects/Engineers, Multi-Disciplinary Experts,
		<b>Implementation</b> Decision of dwelling Contacting manufacturers Modifications of dwellings	N. Government, Disaster Managers, Architects/Engineers, Private Sector, Community
	Local	<b>Implementation</b> Shelter assistance Model house/plans Training of actors Infrastructure construction	N. Government, Architects/Engineers, Private Sector, NGO'S, Donor Countries, Community
Reconstruction Period	National	<b>Implementation</b> Controlling construction Evaluation document	N. Government, Architects/Engineers, Private Sector
	Local	<b>Implementation</b> Construction of site The handover of buildings <b>Evaluation &amp; Follow-Up</b>	Architects/Engineers, Private Sector, Local Government, Multi-Disciplinary Experts

## POST-DISASTER HOUSING RECONSTRUCTION FOLLOWING THE TURKISH EARTHQUAKES, 1999

On August 17th 1999, an earthquake with a magnitude of 7.4 and epicenter under Izmit Bay, destroyed the whole Eastern Marmara Region, Turkey. The earthquake caused the death of 18,373 people and the injury of 48,901 more, according to the official data. Furthermore, a great number of people were reported to be missing. Besides the loss of lives, the earthquake caused damage to or demolished 96,808 houses, the homes of estimated 800,000 inhabitants. This earthquake caused the biggest and widest damage in the history of Turkish disasters (Gulhan & Guney, 2001; Karaesmen, 2002).

After the Marmara Earthquake, supplying the post-disaster housing for earthquake victims was planned in three phases; tent cities for urgent settlement, prefabricated houses for temporary use and permanent houses for permanent settlement. Three months after this disaster, another earthquake in Bolu with a magnitude of 7.2 occurred in Turkey. Following these two earthquakes, 162 tent cities, 44,107 prefabricated houses and 40,665 permanent dwellings were constructed in total (Bozkurt, 2001; Karaesmen, 2002).

## **The Analysis of the Post-Disaster Housing Reconstruction Following the Turkish Earthquakes, 1999**

Following the Turkish Earthquakes of 1999, a total of approximately 44,000 permanent dwellings were built, as mentioned before. For such large-scale reconstruction, the process of post-disaster housing became significant for success of the reconstruction. Consequently, the analysis of the process is important for the evaluation of the reconstruction following the Turkish Earthquakes in 1999.

### ***Pre-Disaster Period***

The pre-disaster phase, as has been mentioned, is the most significant phase since all of the decisive actions related to policy making at the national level should be realized before the disaster event. In spite of this ideal situation, the policy making actions at the national level was narrowly realized before the earthquakes in 1999.

Following the previous disasters, the analyses and evaluations of post-disaster related material were written in various universities, associations and private or government related institutions, accessible only in their own records or libraries and accessible only to the specialists or researchers. As an example, the evaluations of the economic models for funding the housing reconstruction were present only in the economic departments of the concerned universities and institutions, unfortunately not accessible to the community. Furthermore, the analysis of the previous disasters in Turkey focused on the technical and economic factors ignoring the social factors (Sey, 1999; Akinci, 2004; TR Ministry, 2004).

The establishment of a guideline that explains the major steps in post-disaster housing reconstruction is important for determining a post-disaster housing policy at the national level. Since there were no detailed guidelines before the earthquakes of 1999, the national policy-making decisions which should mostly have been realized in pre-disaster period was comprehended in the immediate relief phase in a situation of chaos and with the pressure of time (Sey, 1999; Balamir, 2001).

The success of the organizational actions in the pre-disaster period is mostly dependent to the success of the analyses in the same period. Consequently, the organizational actions at the national level were scarcely realized except the training of the key figures. Sample assessments and surveys were already present but they were not seriously modified according to the feedback from the recent disaster experiences. On the other hand, organizational actions at the national level were realized to an advanced degree. The regional database formed was only accessible in the local universities and institutions. Consequently, time-consuming re-gathering of this database became a vital issue in the immediate relief period (Sey, 1999; TR Ministry, 2004).



### ***Immediate Relief Period***

All the actions in the immediate relief period should ideally be organizational. Conversely, some policy-making actions such as deciding the national strategy for the post-disaster housing and re-gathering of the local database were also realized in this period, as mentioned before. In this period, it was decided that post-disaster housing reconstruction was to be three-phased, and temporary and permanent dwellings were to be constructed via contractors. The financial method chosen for reconstruction was a combination of international aid and limited support of the government by the help of the long-term loans (World Bank, 1999; Eroglu, 2000; Balamir, 2001; Kruetner *et al.*, 2003).

Organizational actions in the national level such as the establishment of a crisis center have been successfully realized immediately especially after the Bolu Earthquake. Relatively rapid distribution of tents, mobile kitchens, and mobile sanitary facilities proved to be a success for the crisis center. On the other hand, shortage of tent stocks, low-quality fabric and the absence of a tent city settlement plan before the earthquake were major problems (Eroglu, 2000; Bozkurt, 2001).

The organizational local actions were mostly field assessments. The assessments of the damage were performed by teams of experts from disciplines of civil engineering, architecture and geology (Eroglu, 2000). The assessments of various needs were also done by teams of doctors, psychologists, sociologists, architects and volunteers. The assessment of realized by State Institute of Statistics was significant for the determining the preferences of the temporary settlements by the survivors and the approximate number of the temporary units to be built (State Institute of Statistics, 1999; World Bank, 1999). Damage and needs assessments could be evaluated as successful applications of the housing reconstruction process.

### ***Rehabilitation Period***

Critical national level decisions such as the decision of types, systems, and numbers of the dwellings and the design of the dwellings and site plans are completed in the rehabilitation period. In order to translate needs into appropriate action, the analysis and evaluation of data obtained from local field assessments. In Turkey, this evaluation was indeed realized. Alas, many of the actions that help to analyze these needs, to be done in the pre-disaster period, were also to be realized in this period. Thus, lack of time caused misinterpretation of the needs for various decisions. As an example, the local data such as land, soil, climate and scenic conditions, and socio-cultural characteristics of the community were neglected in the designs because of the time pressure. It was decided that all buildings have three floors and all units are composed of two rooms and a living room; and net usage areas are 63-87-107 m<sup>2</sup> (Bozkurt, 2001; Oztekin, 2003; Akinci, 2004).

Besides decisions of design, other national level actions related to implementation such as preparation of a detailed plan about the production of housing, bidding of the dwelling construction, training of the key figures, communication with the actors were

realized successfully in the appropriate time frame. In contrast, model plans were not prepared and feedback from the community and experts was not provided for possible modifications (Bozkurt, 2001; Balamir, 2001; Oztekin, 2003; Akinci, 2004).

The local actions in this period are all related to implementation. Information about the post-disaster housing process accessible to the community, especially related to the legal and economic factors, were provided in time. Education of the key figures was successful compared to the previous disasters. There were minor mistakes regarding the quality of the construction of the infrastructure but the major mistakes in this period were observed to be the low construction quality of the temporary units (Figure 2) and the lack of community participation in the local decisions (Gumus, 2000; Bozkurt, 2001; Baradan, 2002; Oztekin, 2003; Akinci, 2004).

### ***Reconstruction Period***

The reconstruction period is significant because the products (housing units) of the process that are open to evaluation and criticism are constructed during this period. In Turkey, the control of the implementation has been realized rather successfully in the national level but the preparation of a sample evaluation plan has not been successful. Evaluation plans undeniably have been prepared but not by the actors in the implementation such as national government and/or contractors.

The actions related to construction of the housing sites realized in the local level following the Turkish earthquakes of 1999, are the transportation of the building materials to the construction area, and the actual construction of the units, site facilities and social environment. The construction quality and earthquake safety of the permanent buildings were observed to be satisfactory compared to the temporary units (Figure 3). On the other hand, the regional priorities and needs were not taken into consideration, as mentioned before (Oztekin 2003; Akinci, 2004; Gulkan, 2005)



Figure 2 Temporary shelters in Izmit  
(Baradan, 2002, p. 93)



Figure 3 Permanent Shelters in Kocaeli  
(Eroglu, 2000, p.123)

The evaluative actions in the reconstruction period offer constructive feedback for future projects. Project personal evaluated the units during and at the end of the project, however, the results have not been gathered as a published report. A report

which outlines the program objectives and the brief history of the implementation phase and the personnel have indeed been published by the Ministry of the Public Works and Settlement but the evaluations of the project were not included in the report. Then again, there were numerous reports, articles and books evaluating the various phases of the post-disaster reconstruction process. Although, they mostly focused on the technical evaluations, there were social evaluations that centered on the survivor's needs as well. Those evaluations became a feedback for disaster managers and they were definitely used for the preparations of the future disasters (Crisis Management Center; 2000; TR Ministry of Public Works and Settlement, 2004).

### **General Evaluation of the Post-Disaster Housing Reconstruction Process Following the Turkish Earthquakes, 1999**

Post-disaster housing reconstruction following the Marmara and Bolu Earthquakes of 1999 was the largest-scale reconstruction in Turkey. Consequently, the success of the project was significantly connected with the successful organization the process of reconstruction. When we analyzed the process, it was observed that almost all of the mistakes in the permanent housing reconstruction were caused by the lack of preparation in the pre-disaster period.

The scattered distribution of the disaster-related material in the country, and the absence of a post-disaster plan that defines the reconstruction process were two major problems in the pre-disaster period. As a result, most of the policy-making and organizational actions to be accomplished in the pre-disaster period were established in the immediate relief phase and even in the rehabilitation phase. There was an urgent need for sheltering the homeless; the main aim of the project became to shelter as many people as possible in the shortest possible time with no consideration of the land use qualifications, different compositions of the families or the regional needs and interests of the community. If there had been an organizational plan for the post-disaster reconstruction before the earthquakes, then the mistakes mostly caused by the pressure of time especially in the immediate relief and rehabilitation periods could have been omitted. Consequently, this analysis shows that the pre-disaster actions in the process of post-disaster housing are the most vital.

The most productive phase of the reconstruction process following the Turkish earthquakes of 1999 was the evaluation stage in the reconstruction period. With the attention of the media and the community, the policy of "learning to live with the earthquake" was accepted in the national level. Implementations towards strengthening all kinds of disaster-related organizations started following these earthquakes. The accomplishment of the natural hazards information database, including GIS database and hazard mapping; the establishment of a wide-ranging disaster communication and management center, disaster insurance system, the revision of disaster legislation, the search for new construction systems for earthquake safety are among organizational actions to be realized after the Turkish Earthquakes in 1999.

## CONCLUSION

Post-disaster housing reconstruction is definitely a process. This process is affected by legal, bureaucratic, and social factors as well as by economic and technical factors. Consequently, post-disaster dwelling is the product of this process of relations and it cannot be evaluated independently from this process. In order to comprehend the achievements or failures in a post-disaster housing reconstruction program, the actions in the pre-disaster, immediate relief and rehabilitation periods should be appraised as well as the post-disaster dwelling itself.

With this aim, the analysis of the housing reconstruction process following the Turkish Earthquakes in 1999 was realized and reported in this paper. After the analysis, we can conclude that the most important period in the post-disaster housing reconstruction is the pre-disaster period. The main problems in this period could be stated as the deficiency of actions and measures and the lack of an organizational framework. Although the actions in the post-disaster periods were analyzed to be more satisfactory; the implementations following the earthquakes can hardly be called "successful". Consequently, we can assume that the analyses and the preparation of an organizational framework are the fundamental actions for a continuous success in the establishment of a national post-disaster housing reconstruction policy in the country.

Before the Marmara and Bolu earthquakes in 1999, the evaluations and analyses were mostly focused on the product with a technology-biased view in Turkey. Following the earthquakes, however, the focus of the research shifted to the various phases of the process. Among all those valuable analyses, the analysis of the process itself is more significant for defining an organizational framework. Being one of the few examples of such research in the country, this paper significantly centered on the whole process. The analysis defined in this paper is actually a summary of findings. In a more thorough analysis, the process should be evaluated with all of its actions in various time periods and implicating the actors involved in the process. Consequently, this analysis is actually a first step for realizing a more precise framework and organization plan which omits the frequent mistakes for the future implementations.

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