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Lessons Learned From the Process of Housing Recovery after the 2003 Bam Earthquake in Iran

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Abstract

On 26th December 2003, the ancient City of Bam, in southeastern of Iran, was hit by the worst earthquake over the last decades, resulting in some 30000 dead, 20000 injured and left a greater number of homeless. The devastating 6.6 magnitude quake struck at 5.28 a.m. local time, an hour at which almost all of the city's 80000 residents were in bed on the Muslim day of rest. The catastrophe leveled more than 80% of city to the ground. In addition, Bam's historical landmark – a giant medieval fortress complex of towers, domes and walls, all made of mud-brick – was totally destroyed. This Citadel (Arg-e Bam) was one of the wonders of Iran's Cultural Heritage.

According to Bam Sustainable Development Manifesto, the task of providing permanent shelter during the reconstruction phase was to make the survivors as independent of government aid as possible. It was aimed to encourage the householders to take an active part in the further relief process. Thus, it was announced that 'the responsibility of rebuilding was for the homeless, over the reconstruction period'. In practice, this task was coordinated by the Housing Foundation (H.F.) and a number of private engineering and architectural firms, trying to solve shelter problems as they saw fit. This meant that each firm put into practice specific approaches as appropriate by establishing a consultation process with householders. Another contributing factor was the individual technical and financial capacities of householders. Such methods for providing shelter increased the survivors' abilities to actively participate in the process of reconstruction. However, paperwork process was a major obstacle on the way of operations.

Keywords: community participation, Bam Earthquake, reconstruction, designers and contractors, Housing Foundation.

1. Introduction

Earthquakes, as natural events, have been part of the world since the dawn of time. Their occurrence is inevitable. However, an earthquake becomes a disaster when it strikes the man-made environment, such as buildings, roads, lifelines and crops. In contrast to the natural environment, the man-made environment needs disaster management. Governments of each country are responsible for disaster management in local, state and regional levels. Disaster management is divided in to two sections, entitled: pre-disaster planning and post-disaster recovery. While pre-

disaster planning has three phases, including preparedness, mitigation and prevention, the stages of post-disaster recovery are relief and rescue, rehabilitation and reconstruction. All of these phases are defined in the "Cycle from Relief to Development" which are related by time and function to all types of emergencies, and each involves different skills.

The earthquake response phase includes activities that take place during or after an earthquake, which is designed to provide emergency assistance for victims, providing shelters and repairing lifelines network to stabilize the situation and reduce the probability of secondary damages (for instance, gas network to prevent secondary damages or shutting off contaminated water supply, etc.) (Blaikie 1994). In this regard, shelter provision, both temporary and permanent, in rehabilitation and reconstruction phases are the most important activities in helping homeless population.

Since Iran is an earthquake-prone country and has experienced a number of devastating earthquakes over the past decades, The Iranian Government has developed a strategy to meet the needs of disaster victims by undertaking a participatory approach in rebuilding damaged areas. In this regard, community based approach is utilized in order to response shelter needs in more effective ways.

1.1 Study context

Many governments and relief agencies assume that the post-earthquake period can be operated by a 'series of short-term quick fix projects' (Barakat 1993). In other words, long-term solutions are often sacrificed to short-term fixes. Despite the fact that countries such as Iran have always suffered severe earthquakes, evidence shows that housing reconstruction programs have often not met the people's physical or spiritual needs. It appears that the provision of shelter as only a physical construction, and not in a wider social and cultural context, has not corresponded to people's requirements. In other words, 'the environment cannot be made safer by technical means only' (Blaikie *et al* 1994: 219). A review of the past four decades of implemented housing reconstruction projects in Iran reveals that the houses provided in new settlements have only been partially successful in meeting the peoples' rebuilding needs (Razani 1984, Parsa 1985, Rafyie & Niroomand 1983-86, Zargar 1988, Fallahi 1996).

Analytically-based social studies of the housing of affected communities after earthquakes have generally been less studied than technical issues. This deficiency is consistent with the view of several scholars, who have stressed the importance of periodical assessments of the impact of post-disaster reconstructions and of monitoring the occupiers' attitudes towards their dynamic reconstructed environments (Aysan 1987). There are several reasons for holding this view: firstly, the degree of potential ability of people to provide for themselves is not fully recognized; secondly, the potential complementarily between the skills of individuals and public resources is not well established; thirdly, the significance of the process of shelter provision to strengthen the operational links between the management of physical provision and long-term development, has not been firmly established; finally, the interrelations and transitions between the different stages of post-earthquake housing provision are not well determined (Aysan & Oliver 1987: 5, Cuny 1992: 146, Habitat 1994: 20).

A preliminary review of the literature draws attention to a number of important questions in post-earthquake housing programs, including:

> How successful are the investigations into safe buildings? How suitable are the permanent houses that are provided by the government or agencies for the accommodation of the homeless? To what extent are the resettlement projects acceptable by the people they house? Do the houses provided meet the needs of their occupiers? If they are built to be safe in future disasters do they remain safe? (Aysan & Oliver 1987: 4-5)

The importance of these issues continues to be discussed, with an emphasis on community involvement in post-earthquake housing as *a central element in recovery* (Habitat 1994: 2, Kronenburg 1995: 19).

1.2 Methodology

The study analyses the process of providing shelter in a zone with 100% damage around the City of Bam in Kerman Province. Access to all reconstructed settlements was somewhat limited due to restrictions of time, cost, and climatic conditions; however, outcomes deemed to be significant were attained.

A combined research methodology has been used. This is derived, firstly, from a review of both Iranian and international literature, indicating the degree of involvement of recipient individuals in rebuilding; secondly, from a field study aimed at recording participation and satisfaction of the survivors in the provision of shelter, as well as an examination of housing policies applied in practice, in the case of Bam, and the type of dwelling process in use. To obtain information for both the analysis and the examination, the following methods were used:

- a review of bibliographical sources and documents;
- the undertaking of unstructured interviews with policy makers and researchers involved in the process of sheltering after the earthquake;
- the carrying out of a field survey
- direct personal observation and informal communication.

2. Iran and vulnerability

Iran is extremely vulnerable to natural disasters, particularly earthquakes. On the Global Seismic Hazard Map, the country stands out as one of the most earthquake prone areas in the world. Due to its position in the Alpine-Himalayan mountain system, earthquakes are a regular occurrence in Iran, which is crossed by two major fault lines. Historical data suggests the occurrence of a major earthquake every 2-3 years in the country. In the 20th century alone, 20 major earthquakes claimed more than 140000 lives, destroyed several villages and cities and caused extensive economic damage to Iran (Fallahi 1996). As a result, there is no area of this country has been impervious to earthquake waves.

A review of 'A history of Persian earthquakes' (Ambraseys & Melville 1982), shows that Iran has repeatedly suffered major earthquakes. Also, the total number of earthquakes identified for the period between 600 AD and 1979 AD amounts to over 6000. In deed, Iranian people have frequently experienced several losses of property and life in one generation. The available reports describe mostly technological or geological aspects of those earthquakes, and little attention has been given to identifying the long-term impacts of post-earthquake reconstructions (Moinfar 1969, Berberian 1979, Ambraseys & Melville 1982).

2.1 Post earthquake reconstruction programs in Iran

The small body of available reports and information relating to past reconstruction experiences in Iran does not allow the overall results to be evaluated in a meaningful way; however, it is generally believed that some lessons drawn from them reveal a number of common mistakes made during those operations. The main concern in this article is to understand to what extent such programs met the people's needs and priorities.[1] To this end, the major reconstruction projects in Iran, over the last four decades are reviewed, being: *Buyin Zahra* (1962), *Dasht-e Bayas* and *Ferdows* (1968), *Qir-Karzin* (1972), *Tabas* (1978) and *Southern Khurasan*, *Gonabad* and *Taybad* (1979), *Manjil* (1990).

1962- Buyin Zahra: The earthquake in the populated region around the city of *Qazvin* totally destroyed more than 90 villages, killing 12000 people and injuring some 3000. In all, over 300 villages were damaged, 180 of them with loss of life. (Ambraseys & Melville 1982: 95). Western relief agencies planned the housing reconstruction. A great number of pre-fabricated concrete units were designed to house the homeless. Two major principles were considered in the layout of the new sites: firstly, the separation of access for humans and animals for hygiene purposes, and secondly, the construction of a number of earthquake resistant pre-fabricated beam shaped buildings. All of the work of reconstruction was carried out by international agencies. However, through a failure to consider the socio-cultural aspects of lifestyles in the new town of *Rudak* caused that new site to remain uninhabited for years (Ambraseys & Melville 1982: 109).

It was claimed that the technology applied was unfamiliar and not adapted to the local environment, while also being inflexible and not allowing the people to extend their units. Consequently, people built new rooms with simple and vulnerable construction methods around the village (*Andishe* Consultant Eng. 1992, 150-161).

1968- Dasht-e Bayaz and Ferdows: The North East of *Khurasan* Province, and town of *Ferdows*, was struck by an earthquake in August 1968. The number of human fatalities and injured people amounted to more than 10000 and high damage was sustained by a large number of villages (Moinfar 1969, Memarzadeh 1978). Ambraseys and Melville (1982) reported the effects of relocating and consolidating in 1971, all the earthquake-destroyed villages into two major agricultural co-operatives. They claimed that such a decision was not wise because it ignored the traditional living styles of the people (p. 195).

Parham (1976) analysed the process of decision-making for determining the new site for *New Ferdows*, and claimed the inhabitants had two different views. The first group argued that the new town could be rebuilt on the same site, while the second group, who were mostly farmers and gardeners, preferred a new site between two villages, namely *Behesht-abad* and *Magsoud-abad.* The reasons for this latter view were based on the shorter distance to agricultural lands, and easier access to water resources and the gardens (p. 5). Over two years, two different towns were reconstructed. *New Ferdows* was built by the government on the same site, while *Eslamyieh* was the new settlement, built by the people themselves on the new site. Parham's observations (1978) on the comparison between the two new towns showed that the settlers in *Eslamyieh* were more satisfied with their surrounding environment because the site was either closer to their work fields (gardens, water resources, agricultural lands), or the architectural aspects of their houses were more

[1] This is evidence that replacing the lost livestock in some communities might be a higher priority than rebuilding of houses. For example, following the 1992 flood in Pakistan, much of the governmental subsidies allocated for damaged houses were used by the communities to buy animals, fodder and seeds. (see Aysan & Davis 1993: 11)

adapted to their basic needs. On the other hand, in the author's view, *New Ferdows* still had many unsolved problems. For example, its inhabitants often complained that the new resistant buildings were not insulated against the extreme hot weather and that they suffered from a lack of suitable infrastructure facilities (pp. 5-15).

1972- Qir-Karzin: The central *Fars* Province, to the south of Iran, was shaken by a catastrophic earthquake in 1972. The town of *Qir* was totally destroyed and some 5000 people perished (AIDUSA 1972). For the purpose of reconstruction, while the authorities attempted to integrate the remote small villages into large settlements in order to provide better public services, less consideration was given to the selection of appropriate sites. For example, the task of selecting new settlements was undertaken simply by flying over the affected areas, as the authorities were in favor of finding flat lands which could be easily and quickly built upon (Razani, 1984: 81). A number of the dome-shaped concrete buildings were provided as earthquake resistant units.

These buildings were set up with little attention to social, cultural, economic and environmental adaptability. Moreover, they were not compatible with the local architecture (Moinfar & Naderzadeh, 1986: 43). For instance, the occupiers often complained of insufficient protection against damp condition, especially during the hot and cold seasons. Also, the prefabricated units were not properly insulated. Apart from finding them unbearably hot, the villagers felt that the regular wide-spacing of the houses broke up their communal life. Such problems created conflict between the authorities and the local people, for example with the selection of new sites (Razani, 1984: 83). Consequently, the reconstruction not only failed to meet the villagers' real needs and government did not provide a satisfactory new environment for the homeless, but it also left a heavy cost for the government (Moinfar & Naderzadeh, 1986: 20-42). In other words, it became clear that, besides the new units, the survivors had other needs which the authorities should have addressed.

1978- Tabas: A destructive earthquake hit the region around *Tabas* in the North-east of Iran, in September 1978, resulting in killing some 18000 people, of whom 80% perished in the town of *Tabas* itself. Khalili (1983) criticized the approach of providing housing with modern materials and construction techniques, such as concrete and steel (p. 64). In another study, Parsa (1985) pointed out that many mistakes were made in the reconstruction of *Tabas*, due to hurried decision-making (p. 42). For example, after six years, a number of families were still living in some of the temporary mobile units, on both the old and the new settlements. His conclusions highlighted the 'high cost' and 'inhospitable atmosphere' of the new houses, which did not belong to that environment (p. 3).

1979- Southern Khurasan: In November 1979 another earthquake struck the eastern extension of the 1968 *Dasht-e Bayaz* earthquake area, killing a few people but causing widespread damage. The process of reconstruction of the towns of *Gonabad* and *Taybad* was described by Rafyie and Niroomand (1983 & 1986). These documents reported many shortcomings, such as the inappropriate design of layouts in the new settlements and 'uniform plans' for all the families, without considering their particular situations (eg. family size); this did not meet the people's needs. The authors' views from their observations, pointed to a number of misunderstandings in planning, arising from the lack of consultation with the local people and leading to: a) unfamiliar architectural forms for housing; b) new design restricting the future extension of buildings; c) inadequate size of plots for housing, and d) unfamiliar construction technology.

1990- Manjil earthquake: On 21 June 1990, a major earthquake, measuring 7.3 on the Richter Scale struck the provinces of *Gilan* and *Zanjan*, in the North-west of Iran. It was the worst earthquake in the country's history, the seventh major one in the world up to 1990 (Coburn &

Spence 1992: 5). The official estimate was 40000 dead, 60000 injured, 500000 homeless and the destruction of 2.5% of the Gross National Product (GNP). The final official estimate indicates that the total number of damaged towns was 15, and the total number damaged villages were 3152. Following the earthquake, the objectives of the Iranian Reconstruction Housing Policies constituted by the Housing Foundation were as follows:

- Attain the earliest possible reconstruction of the towns and villages damaged by the earthquake;

- The return to normal economic and social life in towns and villages affected by the earthquake, through rehabilitation of the local population by means of providing employment and commencement of production activities.

The proposed housing reconstruction policies after the 1990 *Manjil* Earthquake relied on the householders' participation, the use of local materials and techniques, by allocating financial assistance and subsidized materials to each household. The Housing Foundation (H.F.) was selected to take the responsibility for the execution of the reconstruction. There are a number of studies indicating that this program has been successful in encouraging affected people to participate in various stages of rebuilding process. In deed, community participation concept came to reality for the first time in this operation (Fallahi 1996).

3. National disaster management system in Iran

Under the Ministry of Interior, there are three organisations that play important roles in disaster management and reconstruction: the Bureau for Research and Coordination of Safety and Rehabilitation Activities (BRCSR), the National Disaster Task Force (NDTF) and the Housing Foundation (H.F.). The BRCSR conducts research on safety measures; formulates preparedness and mitigation plans; and collects, analyses and disseminates information on disaster management. The NDTF is an inter-organisational body chaired by the Ministry of Interior, whose activities vary during different phases following disasters. The Housing Foundation (H.F.) is a revolutionary council and semi-autonomous agency. Amongst its legal responsibilities, reconstruction after disasters and rural development are predominant.

Due to the past reconstruction experiences, rebuilding of housing is carried out in collaboration and participation of the owners, people's assistance, support of banks and the free technical and engineering services from the government. As mentioned earlier, the Housing Foundation is the government's implementing arm for the construction and reconstruction of damaged houses. The Headquarters in Tehran and more than 100 branches in the country, maintain rural development activities consisting of planning and implementation, regional planning, research and development, post-disaster reconstructions and the improvement of buildings.

4. City of Bam

The ancient City of Bam is in Kerman Province. This city is located on the way of cities of Kerman and *Zahedan*. It is said that Bam is the door of country from eastern boarder. The weather of region is hot in summer and cold in winter. Most of houses are being built with mud and dried brick that are vulnerable to earthquakes due to their poor performances against quakes (Fig 1). However, in

the recent years, a number of so called 'urban buildings' have been constructed using metal, brick and reinforced concrete.

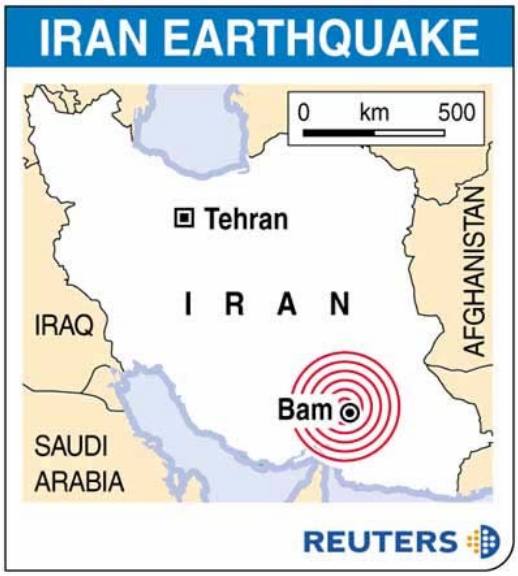

Fig 1. The City of Bam and Earthquake

The main people's income source is administrative and small business. However, most of people are engaged in agricultural activities. Dates and Oranges are the most well-known agricultural productions throughout the country. Date trees are scattered in the city. The Bam residents believe that "Bam is nothing without date orchards". Land ownership is seen as a value and family heritage. It means that land is not only a source of income but also a part of family identity and characteristic. As a result, inhabitants are depending upon land rather housing.

'New Bam' has been developed over the recent years as an industrial zone, 10 kilometers far from the City of Bam. There are a number of automobile and packaging factories in this new area. In terms of socio-cultural aspects, people are mainly educated. However, many of young generations have already migrated to the nearby cities or abroad.

5. Bam Earthquake

The Bam Earthquake with a magnitude of 6.5 on the Richter Scale occurred at 5.28 a.m. on 26th December 2003 in southeast Iran and caused considerable human and financial loss in this region. According to official statistics, more than 30000 people were killed and 80% of Bam was ruined. It also caused considerable loss to lifeline infrastructures, such as water supply network, power lines and also health care centers, educational buildings, cultural centers, cultural heritage. The earthquake was centered approximately 10 km to south-west of Bam. Damage was concentrated in a 16 km radius around the city, which is famed for its 2500 year old citadel *Arge-Bam*. In terms of human cost, the Bam earthquake ranks as the worst recorded disaster in Iranian history.

6. Emergency Phase

With support from the United Nations Development Program (UNDP), an Integrated National Disaster Management Plan (INDMP) was developed and was approved by Cabinet in April 2003. The INDMP provides a framework for emergency management at the national, provincial and local levels during preparedness, mitigation and recovery phases. Despite the enormous devastation caused by the earthquake, the response of and cooperation between the Iranian authorities, Iranian Red Crescent Society (IRCS) and the international community was swift and exemplary (United Nations 2004). Various government agencies including the Ministry of Interior, Ministry of Health, the Army and the IRCS launched a massive rescue and relief operation. Nearly 12000 people were airlifted and taken to hospitals in other provinces. The IRCS mobilized 8500 relief volunteers (Fig 5). The provincial government set up a six-member committee chaired by the Governor-General of Kerman to coordinate the relief efforts in the affected area. In addition, all sections of Iranian society came together to help the affected people. (National Report of the Islamic Republic of Iran 2005)

Likewise, the international community showed tremendous solidarity in responding swiftly and generously. More than 1600 search and rescue, health and relief personnel from 44 countries arrived in the affected area to assist in the rescue and relief operations. Within hours of the earthquake, the UN dispatched its Disaster Assessment and Coordination Team (UNDAC) to support the Government in coordinating this enormous international response. The UN Country Team and UN agencies mobilised relief items, as well as, technical support. The International Federation of Red Cross and Red Crescent Societies (IFRC) and various Non-Governmental Organisations set up field hospitals, distributed food items and blankets (United Nations, 2004). Tents, as emergency shelters, were distributed among the homeless since the early days.

6.1 Damaged buildings

By using a pre-earthquake image, the location of individual buildings was registered on GIS and city blocks surrounded by major roads were assigned. Then, visual inspection of building damage was conducted. Comparing the pre and post-earthquake images, buildings surrounded by debris (Grade 3), partially collapsed buildings (Grade 4) and totally collapsed buildings (Grade 5) were identified (Fig. 2).

By this visual interpretation using the pre- and post-event images, a total 12063 buildings classified based on their damages grades. The numbers of identified damaged buildings were 1597 (Grade 1 and 2), 3815 (Grade 3), 1700 (Grade 4), and 4951 (Grade 5) (Figs 6, 7). In this case, it was not carried out damage interpretation using only the post-event image since the accuracy of single image interpretation was not so high. As a matter of fact, houses in Bam are generally small and brightness of the two images looks different due to different sunlight condition. Therefore, damage detection was rather difficult even in the case using both pre- and post-event images (Fallahi 2005).

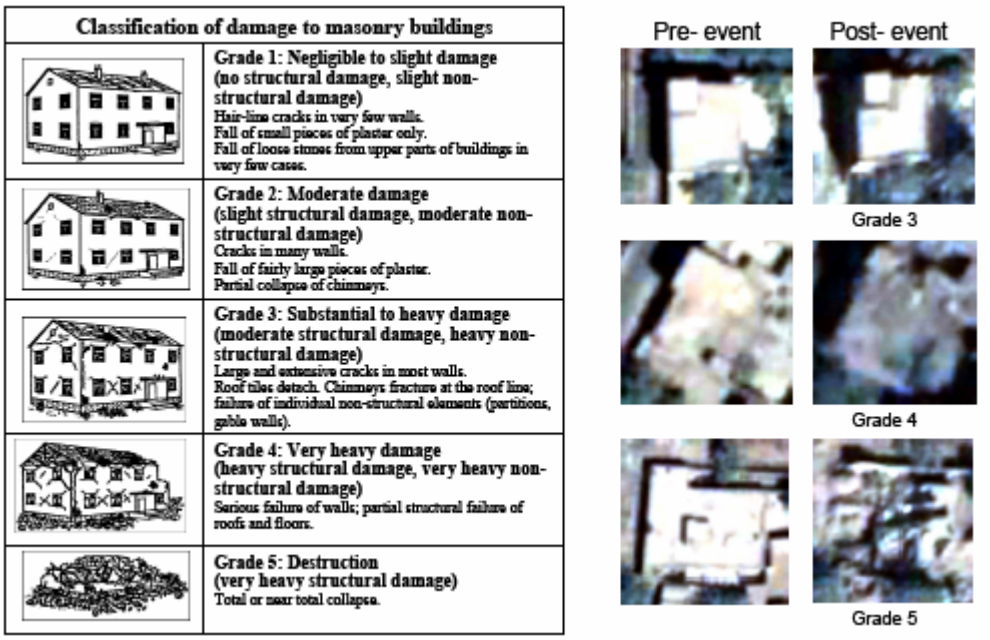

Fig. 2 Classification of damage to masonry buildings and typical pre- and post-earthquake for Grades 3, 4 and 5 buildings

6.2 United Nations Flash Appeal

The UN Flash Appeal for the Bam Earthquake focused on the first 90 days of the relief and recovery phases. Although the mandate of the United Nations states a close working relationship with non-governmental organizations, and the Appeal itself states, *"It is important that the UN agencies identify the most strategic areas of support and work in close partnership with their provincial and national counterparts"*. It should be noted that local and national NGOs could also act as viable partners in aiding the region into recovery, reconstruction and sustainable development.

At the outset of the twelve programs and projects outlined in the appeal, only three directly addressed NGOs as partners for implementation. Of these, none specify if the non-governmental implementing partners would be local NGOs. No project outlined identified Iranian civil society as a partner for planning, development or monitoring.

Through a lobbying process, the local NGOs managed to place themselves on the map as an important partner. A rapid needs assessment was undertaken at the end of last year, organized by local NGOs with participation of the local government in Kerman, UN agencies, representatives of the Bam local councils and the private sector (including the Kerman and Tehran Chamber of Commerce). Over the past two years, NGOs from Bam and Kerman have often been invited to government and UN consultation meetings.

The Kerman NGOs focused on eight broad categories for local NGO action in the immediate, mid and long-term phases of recovery, as follows: 1. planning, coordination and management, 2. local NGOs capacity building, 3. housing and reconstruction, 4. employment generation and economic activities, 5. health sector reconstruction, 6. education and social services, 7. environmental sustainability, 8. synthesis of all needs assessment.

7. Rehabilitation and reconstruction phases

One of the most devastating realities of the Bam Earthquake was the amount of the population that it had left homeless. With more than 80% of the city destroyed, it left a disproportionately large amount of the surviving population living in tents and prefabricated camps. Thus, a major need was for temporary and permanent housing to be made available to the populace as soon as possible. In addition to government sponsored plans a number of international NGOs were negotiating with local NGOs to help construct housing within the government master plan, particularly in nearby devastated villages.

In immediate response to the needs of the earthquake stricken people of Bam, the Housing Foundation (HF) took action to provide temporary shelters for the homeless. Some 16 Assisting Headquarters (AHs) from 16 provinces in the country were established in Bam. 10 of these Headquarters were situated in the City of Bam while the other six were located in rural areas. The HF started a program for removing debris of about 19000 houses in city and 4000 in rural areas. Interior Ministry and Kerman Governor General Office provided prefabricated units with an area of 18-20 square meters, equipped with water heater, air conditioning in various designs and using different construction methods, ranging from a prefabricated unit to an on-site constructed room with adequate safety measure. Most of the survivors received temporary units till the end of April 2004 (Havaii & Hosseini 2004: 229).

7.1 The reconstruction strategy

Aysan and Davis (1993) address a number of dilemmas which decision makers face in most post-disaster operations. While these scholars confirm the knowledge of recovery/reconstruction is still less developed, they state a number of so called "dangerous assumptions", such as: "rapid reconstruction is possible without any sacrifice in quality or safety", "effective reconstruction is an isolated process from normal (pre-disaster) planning and building" (pp.32-34). The authors counted dilemmas and alternatives in reconstruction activities as follows:

- Rapid damage survey versus accurate technical surveys
- Repairs versus rebuilding
- Safety standards versus rapid reconstruction
- Relocation versus reconstruction on the same site
- Participation versus rapid response
- Special organization versus existing organization
- Public versus private investment
- Physical reconstruction versus economic rehabilitation
- Local resources versus imported resources (pp.35-40)

Generally, three possible options, in terms of location, may be implemented for reconstruction after disasters. Firstly, rebuilding on the same site, ignoring any other development in location and re-establishing the pre-disaster norms; secondly, reducing the vulnerability of communities, further decentralizing services and decreasing high-density areas while introducing improvements on the same site (eg. earthquake resistant houses); thirdly, abandoning the old site and moving to a new location in order to initiate new development programs, including or excluding the reconstruction of existing damage

The Guiding Office for the recovery of Bam (GO), which consists of 11 members, mostly governmental ministers, was appointed for policy making and planning a master plan for the reconstruction phase. The Head of the GO is the Minister of Housing and Urban Development. One of the most important decisions made by the GO is to appoint consulting architects to review and analysis a comprehensive urban design and planning of the City of Bam.

The topics of the Bam reconstruction program, based on participatory approach, are as follows:
1. Removing the debris in the city and suburban villages
2. Reconstructing the city in its original location, observing local architecture
3. Reconstructing damaged residential and commercial units through:
   - Householders participation in rebuilding
   - Providing people with the necessary facilities to have information about construction technology
   - Promoting regional construction quality
   - Inviting academics, consulting engineers and contractors to render technical services, including design and implementation
   - Inviting construction material suppliers to set up plants to meet the material needs and supervision
   - Establishing a workshop and exhibition area for offering technical and engineering advice and services to householders
   - Preparing the ground for mass residential construction complexes in the areas where these units cannot be built due to technical reasons
   - employing local people for reconstruction with the aim of creating job opportunities
   - Setting up Bam Architecture Council to lead architectural and urban development process
4. Inviting all related organizations to offer proposals on reconstruction with the aim of regional development
5. Utilizing international aid (foreign loans) for implementing development plans on infrastructure and public services
6. Authorizing of the Ministries of Agriculture, Energy and Industries and Mines, to reconstruct their own sectors
7. Introducing qualified people to banks by the Housing Foundation to receive financial facilities

The below table summarizes the responsibilities of the affected people and the government.

Government responsibilities	**Affected people responsibilities**
Free of charge and long-term bank loan	Construction management
Technical assistance	Design, consultation, implementation
Preparing plans and designs	Participation in the process of decision making and planning
Construction materials and other resources	Choice to accept or reject the proposed plans
Supporting of vulnerable families	Training programs

7.2 Council of architecture and urban development

The Council of Architecture and Urban Development (CAUD) immediately started to work. It consisted of 8 distinguished members, from private enterprises, academics, members of Housing Foundation, architects and engineers. This Council provided necessary measures and guidelines for rebuilding of houses, as well as, urban design of the City of Bam.

The Council approved the amount of credits and bank loans for each individual household and business unit. In the rural areas, 60 square meters for reconstruction of houses was allocated with a credit of 15 million *Rials* as a free loan, and also, 45 million *Rials* as a long-term bank loan with a low interest rate. In the City of Bam, the amount of free loan allocated to each family was 35 million *Rials*, and a long-term loan of 60 million *Rials* with low interest was granted. For business unit holders the amount of 80 million *Rials*, was allocated and the amount of 1.3 million *Rials* per square meter with another low interest loan wais considered. The maximum ceiling of this loan was 60 million *Rials* (Housing Foundation and Peace Winds Japan 2005).

The Council of Architecture and Urban Development also made decisions regarding the allocation of loans for the fencing of gardens, surrounding walls, and the reconstruction of schools that had already been approved. In terms of temporary housing, some 30000 units were built in Bam. These houses initially were supposed to be built in camps. However, by consulting with survivors, most of units were erected in the sites of damaged houses, within the same plots of lands where the houses located prior to the earthquake. Most of newly reconstructed units are reinforced steel structures.

7.3 Bam sustainable reconstruction manifesto

One of the policies which proposed by the (CAUD) was the Bam sustainable reconstruction manifesto. Three principles in the master plan for sustainable reconstruction and development in Bam were recommended by a group of academic and experts in reconstruction, including: a) preserving the city identity in urban design, b) strengthening the new houses against national building code, c) householder participation in the process of rebuilding. Community participation was suggested in various aspects of physical, environmental, social and economic issues, as well as, improving living quality in Bam without affecting the later generation (The Committee on Sustainable Development 2004).

In this respect, sustainable reconstruction was developed as a comprehensive process consisting of all technical, constructive, prosperous, cultural, economic, legal, social and physical factors. In addition, while Iranian's idea of living with earthquakes was taken into account, it was also reconsidered and developed into a modern living habit by establishing safety and building resistance in daily training programs. According to the statement by the architectural and planning group, the essence of Iranian architecture lies in logical reconstruction, based on the technical recommendations and regulations. It is worth mentioning that it was announced that survivors and householders should not be looked upon as "desperate condemned people" but "cooperative active actors" in the process of designing, planning and implementation of own houses. In other words, local people should be involved in the process of planning reconstruction and its execution. Such integration would pave the way of training people to acquire new skills and reviving their spirits.

8. Community, designers and contractors interaction

As mentioned earlier, people observation the execution takes priority over codifying new regulations for constructing earthquake resistant buildings during the rebuilding. Therefore, it was essential to predict a supervisory system for careful observation of the reconstruction process. On the other hand, the importance of community participation in securing the effectiveness of a reconstruction program has been widely emphasized by scholars. It is believed that such approach would lead a community towards innovation objectives. Reviewing the different links between disasters and building safely leads to the examination of various relationships between reconstruction and development.

Fig 3. community, designers and contractors consultation in the mosque of Bam

In the City of Bam, community active participation in the process of designing, planning and implementation of units were strongly encouraged. Such approach provided a great relief to peoples' pains and helped to mitigate their psychological pressures. In addition, research has shown that the lower the level of participation rates of recipient individuals in the reconstruction process, the lower the level of satisfaction rates of the resultant relocation and shelter (Fallahi 1996). In the case of Bam, householders were given the choices to choose their own plans and layouts and act as the supervisors of their projects by paving the way to establish a cooperation line between designers and contractors. This approach allowed the government loans to result in the desired houses for the people.

The Housing Foundation (HF) invited distinguished designers, practitioners, contractors, and provided construction materials and allocated a site (Figure). These private enterprises erected and displayed their designs in real scales. They also share their technical advice with people in order to build safely. In this sense, all selected firms were located in a site complex and exhibited models of their recommended houses to the public. These proposed models had to be approved and certified by the HF. There were a number of criteria for such units: The models should be resistant against future earthquakes, economically viable, suitable for the climatic and environmental situations, culturally familiar for local people and easy to repair and construct with available local expertise and materials.

An interaction was established between the community, designers and contractors. People expressed their needs and designers tried to sketch it. This cooperation took place until the householders were satisfied with the plans based on architectural and urban innovation requirements. Moreover, qualified contractors were selected and introduced to the public. Although householders were free to select their designers and contractors, an agreement framework form was developed between the contractors and the reconstruction committee within the Housing Foundation branches. The reconstruction committee supervised the process of technical and legal agreements between communities, designers and contractors.

In this process, people were encouraged to fully participate in all stages of rebuilding their houses. In addition, the Civil Engineering Society Organization of the Province was allocated to supervise the process by sending architects and engineers to the areas of reconstruction. At the same time, building materials quality control committee took the responsibility through making the soil mechanic laboratory and building material tests.

9. Survey results

Reviewing available literature shows that there is not much information on users' attitudes in relation to post-disaster housing projects. One reason might be that such studies usually require time and certain prerequisites to make them worthwhile. Moreover, most research has been conducted by outsider scholars from industrial communities, while most disasters occur in developing countries (Cuny 1992). It is accepted that direct objective observations will often be required; however, 'intimate local knowledge is essential' (Casley & Lury 1987: 2). Davis and Aysan (1992) acknowledge this limitation of an 'academic view', and suggest that to 'balance this bias' work needs to be carried out with local counterparts, for 'virtually all fieldwork and consultancy' (p. 9).

In the case of Bam, it seemed that a combined research tools should be applied. There are several reasons for adopting this method: *First,* traditional communities are generally complex and too difficult to understand if a single method only is used. *Second,* as the field work was carried out at the final stages of the rebuilding operations, it was anticipated that the respondents, both the survivors and officials, would provide different views through the survey methods. It was considered that a 'bottom-up' point of view from the survivors involved in the process of housing would complement a 'top-down' approach from the decision-makers concerned with the overall policy issues. *Third,* limitations of time and cost were major factors and, due to research requirements; the time available to conduct the survey was restricted. *Fourth,* a common characteristic amongst the residents in Bam was their interest in talking about a variety of topics. Undertaking informal face to face talks was therefore critical, although seeking specific data was also necessary. In other words, reliance on both data obtained from questionnaires and from less structured interviews became apparent. *Finally*, similar studies carried out previously, had frequently employed mixed methods of survey with success (Aysan and Oliver 1987, Zargar 1989, Barakat 1993). In this regard, both qualitative and quantitative analysis techniques were employed with benefits flowing from the advantages of each method. Below is a summary of findings and survey results:

General characteristics of householders	Most of the householders were over 35 years old, and more than half of them were farmers or shepherds holding areas of land on their own. Nuclear families were the highest percentage of households. The average number of people in a dwelling was 5. More than half of the respondents were literate.
Pre-earthquake housing condition	The task of housing was often implemented by family members, and a local builder. The prevailing materials used for housing were mud brick, metal beam, and a few concrete and cement. The majority of houses were connected to electricity and piped water.
Process of providing emergency & temporary shelter	**1- Emergency shelter:** A high percentage of the respondents received tents and lived in them for more than three months. These shelters created a number of problems. More than half of the respondents erected their emergency shelters inside of plot of lands. **2- Temporary shelter:** For a high percentage of householders temporary shelters with financial and material assistance were built and located in their lands. The average surface areas of these units was 18 sq. m. However, a number of families who owned no house were located in pre-fabricated units in camp cities.

Process of providing permanent shelter	**1- Design:** A high percentage of householders designed and planned their permanent shelters with cooperation of architectural firms free of charge. **2- Technical advice:** All designed sketches were subjected to be checked according to civil calculation and building code. In addition, more than half of the householders participated in providing their permanent shelters. **3- Construction materials:** concrete ceilings and metal structures were used by a high number of householders. **4- Community participation:** Participation of the survivors in the process of housing was significant. In deed, the task of reconstruction carried out by cooperation between householders, contractors and designers. The Housing Foundation supervised the process of such interaction **5-Administrative process:** Paper-work process was a major obstacle on the way of rapid and active householder participation. For instance, in order to approve the quality of foundation, householders needed to fill out different documentation papers for nine times!! **6- Priorities in reconstruction:** The urgent priorities for reconstruction were seen differently by survivors and interveners. For example, to the intervener, the priorities were, respectively: 1) house, 2) school, 3) water for land and drink. However, it was emerged very soon that watering to date orchards were the most urgent tasks in recovery phase. In addition, while providing permanent houses took a great amount of the reconstruction budget, a number of people lived in their temporary shelters after two years. It seemed that investment for temporary units was high. As a matter of fact, a number of families found the provided temporary units much better than their damaged units, and therefore, they were not very interested in implementing their permanent houses. A lesson learned in this process is that the authorities should spend less for intermediate units, as they are only temporary shelters. Another point is that the intervener should consider the pre-earthquake housing situation, as well.
Degree of householders satisfaction	There were discrepancies between those people who remained in their plot of lands and those who moved to other places. In general, householders who rebuilt their houses in their own land were more satisfied than those who were relocated.
Physical aspects of the new houses	**1- Strength of house:** More than 90% of the householders were happy with the solidity of their new houses. **2- Quality of materials:** Most of the survivors were satisfied with the materials used in their new buildings.

A summary of survey results

10. Conclusion

The Head of Housing Foundation announced that Bam reconstruction should be seen as a social task rather merely physical operation. Such official view was a major progress in programming of reconstruction policies. In addition, 'the Committee on Sustainable Development' which was appointed for developing the reconstruction program proposed three principles in the master plan for sustainable reconstruction and development in Bam, including: a) preserving the city identity in urban design, b) strengthening the new houses against national building code, c) active householders participation in various aspects of physical, environmental, social and economic issues (Fig 4). Such approach differed from previous programs in that it incorporated a number of lessons from the past, particularly the 1990 Manjil Earthquake program.

Fig 4 Exterior and interior of the reconstructed houses in Bam after less than two years

It has been stated that the appropriate time span for evaluating a housing reconstruction program should not be less than five years (Maskrey 1994: 120). Furthermore, Blaike *et al* (1994) claims "too often people are abandoned when the official books on a disaster are closed" (p.213). Otherwise, it could still be too early to fully understand the long-term consequences of rebuilding. More time and research may be needed in Bam to undertake periodic reviews of the occupiers' modifications to their new settlements and shelters. However, there are several reasons why the current investigation of the householders' attitudes towards the reconstruction has validity.

Firstly, the survey was carried out at the time of completion of the rural reconstruction in 2004, while almost all householders were synonymous with survivors who had endured the earthquake. *Secondly,* the peoples' memories and experiences were valuable in terms of their recent involvement in the process of decision-making and design. *Thirdly,* the local authorities and headquarters of agencies were still in the reconstructed regions and, therefore, access to key persons and local information was still possible. *Finally,* it should be noted that this assessment needs to be perceived as a first evaluation and the initial step toward future research, particularly in the same area, and about the same concerns.

The principles of traditional housing design and structure should be considered in future operations. Shelter should meet the lifestyle of the users in all aspects of their living circumstances. For instance, the special climate of Bam, with varying temperatures in different seasons has a major impact on housing design. Common dissatisfaction with permanent shelters was not related to design but to their inadequate floor area limitations.

The data analysis shows that the financial and construction material aid from the Housing Foundation on the one hand, and the survivors' participation in the process of rebuilding on the other, can be two important factors contributing to the success of the Bam reconstruction program. It was found that, although the local people are the main resource for any reconstruction operation, their importance is often overlooked by interveners. For example, while the householders were free to design their houses, training in the acquisition of new building skills was not generally available.

In summary in determining satisfaction levels, it was found that:

- The process of providing shelter by householders is as important as the final product
- There is sufficient evidence to indicate causal relations between the degree of user participation (eg. design, planning, decision making, management) and the outcomes of the Bam reconstruction program

- Designers and contractors should never underestimate the importance of local knowledge.
- The long process of paper work is still a problem from the points of views of householders.

Within these interrelated stages of interactions amongst designers, community and contractors, it has become clear that the survivors themselves are not only the recipients, but also the main resources. Thus, attempts should be made to upgrade the knowledge base of survivors, their skills and culture in building safety, through means of training and education programs. This would be the first step towards mitigation planning in Bam region. In terms of the requirements for the success of a reconstruction program, the field survey has confirmed the need for the survivors' involvement in the process of management, design and implementation, to be regarded as key factors in achieving maximum satisfaction with their new settlements

The critical importance of offering training in building safety techniques has been emphasized for both mitigation and reconstruction programs. However, an important factor is the improvement of overall local construction techniques. In this sense, the objectives of disaster operations and innovation should be linked through community participation. **As a result, the greater the consultation and interaction among other parties, the greater the opportunity for achieving positive results**. Active survivor participation in housing leads to operational cost and time reduction, and reduce the negative psychological impact of earthquakes. However, analyses from the field survey and on-site observations have also shown that, although the survivors were involved in the process of reconstruction, the program was deficient in providing householders with training in new forms of building safety. In other words, while evidence indicates a positive relationship between the degree of householders' participation and the general success of the program, the actual improvement of local building knowledge was limited.

11. Towards a policy innovation in housing reconstruction in the city of Bam

It has become clear that interacting and consulting amongst communities, designers and contractors can create trust and provide safer housing, as well as safeguarding the livelihood of households during a reconstruction program. It has also become evident that three fundamental factors should be paramount in the process of housing after earthquakes.

Firstly, consideration of the stages in the housing process is a crucial factor for rapid and effective recovery. The notion of 'time' should be interpreted as an interrelated sequence in a continuum of activities, and not as a series of different and discrete operations. For example, separate phases of rehabilitation and reconstruction have prevailed in most operations in Iran but with limited consideration given to how they interrelate.

Secondly, cost effectiveness is another factor in the provision of earthquake-resistant buildings. Reducing and combining the stages of housing can result in cost and time saving, by greater self-reliance and a lesser expectation on foreign aid. These outcomes could be achieved by using appropriate design and construction methods, presented by designers and contractors.

Thirdly, people's satisfaction with new buildings and settlements could be further enhanced by greater consultation, education and training. More effective community participation in local settlement management is desirable, for both local residents and contractors and designers. Such a program would be a means rather than an end in itself, and would promote community

rehabilitation in a more comprehensive sense. In fact, such a sharing of responsibilities would act as a warranty and, by overcoming bureaucratic limitations, promote the value of governance and professional intervention in the process of reconstruction.

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