

Reconnaissance Report on Bam Earthquake Social and Public Policy Issues

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ABSTRACT: *May, 2004 the "Learning from Earthquakes" program of the Earthquake Engineering Research Institute sent a team of researchers on a reconnaissance mission to Iran and the site of the Bam earthquake (December 26, 2003). The purpose of this team was to study social science and policy aspects of the earthquake impact, relief and recovery phases. Interviews were conducted with a wide range of stakeholder groups including victims and those responsible for public and private recovery activities. Observations were collected related to transitional housing, mental health, economic and social recovery and the planning process for permanent reconstruction. Particular attention was paid to innovative programs and policies developed in response to this earthquake disaster.*

Keywords: Earthquake; Iran; Social Impact; Disaster Recovery; Post-earthquake reconstruction; Economic recovery; Transition housing

1. Introduction

The Earthquake Engineering Research Institute (*EERI*) through the "Learning from Earthquakes" program sponsors technical reconnaissance missions to study the effects of damaging earthquakes throughout the world. A team of engineers and seismologists was sent to the site of the Bam earthquake shortly after the event to study evidence of the event and subsequent physical damage. This article summarizes initial findings from a second reconnaissance trip to Iran and the earthquake-stricken area, carried out from May 8-16, which focused on societal impacts five months after the Bam event, early recovery activities, longer-term recovery planning, and public policy aspects of earthquake loss-reduction in Iran. For this report, fact-finding meetings were conducted with many organizations, including the International Institute of Earthquake Engineering and Seismology, which hosted the *EERI* team; *UN*-affiliated organizations; national-level entities concerned with loss reduction and disaster response and recovery; international non-governmen-

tal organizations (*NGOs*); local *NGOs* in Bam, city and provincial government officials and agencies; and health care and mental health professionals.

2. The Social and Policy Context

Response and recovery activities following the Bam earthquake were influenced in important ways by four broader societal factors: the 1979 revolution; the Iran-Iraq war, which lasted from 1980 to 1988; the experience of other recent earthquake events in Iran, especially the *M* 7.2 1990 Manjil-Rudbar earthquake, which killed 37,000; and the distinctive characteristics of Iran's governmental system.

The 1979 revolution, which established the Islamic Republic of Iran, resulted in significant policy shifts and in the creation of new governmental institutions. One cornerstone of the Islamic revolution was a focus on rural development and the provision of services to residents of small towns and villages, which had been seriously neglected under the previous regime. Such services included the distribution of

grants, low-interest loans and building materials, as well as land and technical assistance for the improvement of rural housing. The Housing Foundation, a quasi-governmental organization established following the revolution, was given major responsibilities in the area of rural redevelopment. The responsibilities of the Housing Foundation also extended to both post-war and post-disaster reconstruction—for example, through financing homes destroyed in war and disasters and providing temporary shelter for war refugees and disaster victims. Consistent with this mission, the Foundation is now directing post-earthquake residential reconstruction in Bam.

The Iran-Iraq war, which resulted in the deaths of an estimated 600,000 Iranians, required Iranian society to develop capacity in such areas as the provision of emergency medical care and reconstruction and recovery-related services. Skills and capabilities developed during eight years of war, like those employed in rural development initiatives, were readily transferable to earthquake response and recovery.

Both before and after the revolution, Iran had experienced a number of damaging earthquakes, which also fostered the development of response and recovery capacity within Iranian society. The 1990s decade was a particularly active seismic period; three major damaging earthquakes occurred in rural areas of the country in 1997 alone. While the Bam event differed from earlier earthquakes in that it affected a relatively urbanized population, lessons learned in responding to and recovering from recent seismic events were in many respects applicable to the Bam disaster. The 1990 Manjil earthquake proved to be a watershed event in terms of policies it helped set in motion, including a 1991 law that established the Natural Disaster Headquarter (*NDH*) under Iran's Ministry of Interior. That law gave the Department of Interior full authority for the management of seismic hazards, including the coordination of disaster response, reconstruction, and recovery.

Finally, response- and recovery-related policies and practices following the Bam earthquake must be understood within the context of Iran's centralized governmental system. While local government elections were introduced in the late 1990's, theoretically increasing local-level participation in political decision-making, authority for governmental programs and policies remains overwhelmingly at the national level, with implementation carried out through provincial offices of national ministries such as Health and Housing. Consistent with Iran's overall

governmental structure, the major responsibility for post-disaster reconstruction and recovery resides with the central government, although, as discussed below, efforts are being made to involve the population of the disaster-stricken region in the recovery process.

3. Societal and Economic Impacts

3.1. Earthquake Casualties

As tends to be the case in major disasters, early reports on the earthquake's death toll appear to have overestimated the number killed. While the numbers are still not finalized, revised figures now indicate that 26,271 people died in the quake—although some continue to dispute that death count. Over 20,000 people were injured and an estimated 120,000 were made homeless. The dead included Bam's foremost singer, many writers and scientists, farmers and bazaaris, and an estimated 560 teachers and 200 health professionals, accounting for almost one-fifth of the city's teachers and one-third of its health workers. The survivors include an estimated 2,000 widows, 1,600 widowers, 1,200 orphans and 3,000 children with one parent. About 400 people were permanently disabled. Efforts to obtain more detailed data on patterns of mortality and morbidity, such as gender and age breakdowns and injury severity, so far have been unsuccessful. Follow-up work is needed to collect and analyze epidemiological data.

The high death and injury toll can be attributed to the time of day the earthquake occurred and to the extreme vulnerability of the built environment in the greater Bam region. The earthquake, which took place before dawn when most residents were still asleep, caused the immediate collapse of residential structures, the vast majority of which were of adobe construction. Asphyxiation due to dust inhalation and the cold December temperatures undoubtedly also contributed to the deaths of survivors who were trapped under the rubble.

It also appears that most residents were unaware of the magnitude of the earthquake threat in the region and thus were unprepared when the earthquake struck. There were significant foreshocks in the hours leading up to the earthquake, and some residents warned others or left their houses during the night to seek shelter outdoors, but most people remained in their homes. Residents now question whether some sort of warning should have been issued to the public when those smaller earthquakes occurred.

Residential Damage. Damage to residential structures was very severe, leaving approximately

95% of the homes within the city of Bam and a large proportion of dwellings in the surrounding villages uninhabitable. Nearly all of the housing in Bam and in eight to ten villages within about 10km of Bam must be replaced. The high vulnerability of residential structures to the earthquake was largely due to the existence of adobe and non-engineered buildings, which accounted for 80% of the building stock. Additionally, rapid and uncontrolled development in recent years resulted in the construction of many unsafe buildings.

3.2. Educational Institutions

Iran's very young population includes many school-age children. Forty eight percent of the population of Bam was under the age of 20 before the earthquake. Schools in Bam and the surrounding region were destroyed or very severely damaged. Before the earthquake, there were about 32,000 students, 3,200 teachers, and nearly 300 schools in Bam. Hundreds of teachers and 8-10,000 students were killed in Bam and surrounding areas.

3.3. Impacts on the Economy and Population of the Region

Business impacts were comparable in scale and severity to impacts on households; at the time of the May reconnaissance trip, very few business establishments were operating in Bam's commercial districts. Some businesses had been reestablished in containers and makeshift sheds outside the city; however, many of these businesses gravitated to Bam from outlying areas. Many more prosperous and established businesses relocated to other cities, such as Kerman, the provincial capital. Bam is a regional agricultural center that is known for its high-quality dates, citrus crops, henna and dairy products. Many of the 400 surrounding villages have close economic ties with Bam. The economies of these communities were already severely stressed before the earthquake due to a six-year drought. Because of the extensive damage that had been done to the qanats, an irrigation system distinctive to the region, there was great concern that these high-value crops would be lost. However, repairs to the irrigation system progressed well, and this year's crops will likely not suffer as a consequence of the earthquake.

The "New Arg" industrial complex east of the city is another engine for the local economy. Prior to the earthquake, 1000 workers at an automobile plant in this complex were laid off, creating ripples throughout

the community. Even before the earthquake, unemployment was about 20 percent.

Arg-e-Bam, the 2,000-year-old Bam Citadel, is a major resource and important tourist destination that attracted numerous tourists to Bam every year. The Citadel, which was of adobe construction, was very extensively damaged. *UNESCO* and other international organizations are currently considering ways of rehabilitating and restoring the Citadel, both because of its enormous cultural significance and because of its economic value for the region. How that restoration will be planned and financed has yet to be determined. In its current degraded state, the Arg is highly vulnerable to water damage, and additional deterioration is virtually certain unless steps are taken immediately to protect the Citadel complex. The Arg has long been a living symbol of Bam, and many among the population feel an intense sense of attachment to the site. Plans for recovery must thus consider the cultural, economic, and social value of this unique complex.

Bam is located along a major drug-smuggling route, serving as a conduit point for drugs smuggled out of Afghanistan and bound for Europe. Although there are of course no exact figures, drug transport clearly contributes to the informal economy of the region. The trade is responsible for significant safety and health problems among the already demoralized population. It is also a major contributor to high incarceration rates for males in the region.

The earthquake dealt a severe blow to public finances in Bam and surrounding communities. The city of Bam is currently experiencing a severe budget deficit—a shortfall that reportedly will be made up at a later time by the central government.

Major population shifts have occurred as a consequence of the earthquake. At the time of the earthquake, the greater Bam area consisted of the city itself, with a population of approximately 86,000, as well as numerous surrounding villages with a total population of 100,000 residents. City and village economies were tightly integrated, with villagers bringing goods to sell and working in Bam, and the city providing services, such as warehouse services for dates, health care, and other services, for the surrounding region. The earthquake disrupted the regional economy, causing many survivors to leave the area on at least a temporary basis, while stimulating migration into the city from surrounding regions, as villagers came to the city in search of temporary housing and other disaster-related services. Thus,

despite the high death toll, the population of Bam is larger now than it was before the earthquake.

4. Status of Early Recovery Activities

While much has been accomplished since the earthquake, conditions remain desperate in Bam, and a host of problems persist. The earthquake had a devastating impact on community institutions. In addition to causing widespread residential and commercial damage, the earthquake destroyed or severely damaged all schools, hospitals, and health care facilities in the impact area. Virtually every household was touched in some way by the earthquake. Recovery activities thus must address all aspects of community life, including homes, businesses and economic activity, education, and health and social services.

The Red Crescent Society and the Iranian military played key roles in the initial response and the provision of emergency aid to affected populations. Additionally, there was an enormous outpouring of charitable giving from the general population, overseas Iranians, Islamic charitable organizations, and other donors. In an unprecedented move, after the earthquake, the government of Iran invited international aid organizations into the country and lifted visa and passport restrictions following the earthquake. This resulted in a large-scale convergence of aid-giving organizations into the impact region and ensured an abundance of relief assistance for victims while also creating major coordination problems. In an effort to better co-ordinate relief activities, the impact region was divided into fourteen geographic sectors, and different Iranian provinces and aid organizations assumed responsibility for service provision to individual sectors. This system provided a management framework and ensured a steady flow of resources and volunteers during the post-impact period. This arrangement was to be replaced by management by the province of Kerman at the end of May.

In contrast, intermediate-term and especially longer-term recovery planning has not been as well coordinated. International NGOs are gradually leaving the earthquake-stricken area, and while some recovery-related needs are being addressed, others are being neglected. Many of those contacted during the reconnaissance visit cited problems with various aspects of "transition planning", such as how to ensure continuity of services when agencies leave the area and how to manage the transition from temporary

shelter to intermediate-term temporary housing.

Relief, reconstruction and recovery activities are being managed through a Ministry of Interior Council consisting of 24 organizations, including governmental ministries, the Red Crescent Society, and international organizations, with representation from the Bam City Council. The task force composition follows guidelines established in the new disaster management system, which had been developed in May 2003. The new system was designed to integrate agency activities across the hazards cycle, encompassing mitigation, preparedness, response, and recovery activities. Reconstruction is being financed through a range of sources, including the national government; the Islamic Development Bank; UN agencies such as UNESCO (for the Arg-e-Bam project) and UNDP; a \$300-400 million loan from the World Bank, and private charitable donations.

4.1. Temporary Housing and Residential Reconstruction

At the time of the second reconnaissance trip, the vast majority of displaced households were still living in tents, most of which had been provided by the Red Crescent Society. At the insistence of residents, the majority of these tents had been placed on private property near homes that had been destroyed. Other tents were erected in congregate camps, while still others were located on streets adjacent to former dwellings. Tent camps are being used mainly to house former renters and migrants from the nearby villages. The tents are very small, and the vast majority have no capacity for cooling, with temperatures currently rising to over 100 degrees. There are no bathroom facilities; instead, displaced residents must use collective toilets and showers.

Under the general direction of the Department of Interior and the supervision of the Housing Foundation, approximately 18,000 temporary housing units have been constructed, and plans were underway to move residents into these units beginning in late May. Like the tents, temporary housing units are very small (3 x 6 meters); the units are being constructed both on private property and in large complexes. Bathroom and sanitary facilities are either single-stall temporary toilets located near tents and temporary structures, or in some instances consist of groups of stall joined together. The shower is usually in the stall, using the toilet for a drain. The sewerage and wastewater are not treated. Concerns have been expressed regarding the congregate toilet/shower facilities, both because

women may be reluctant to use them owing to modesty concerns, and because no funds have been allocated to maintain the facilities.

Plans for the provision of approximately 20,000 units of permanent housing are well under way, again under the direction of the Housing Foundation. Housing reconstruction is expected to take between two and a half and three years. In an arrangement that blends governmental and private-sector initiatives, the central government will provide the financing for residential reconstruction through a combination of grants and loans to homeowners. However, to retain control over the rebuilding process, the government will also screen contractors, review designs, and select builders who will then make their services available to residents through a government sponsored "housing bazaar" designed to allow property owners to select builders who will meet their personal and budgetary requirements. Government agencies will provide a range of services to residents, from debris removal and site preparation to design review, inspections, and the enforcement of price controls to prevent price-gouging. At the same time, homeowners will be able to choose contractors and builders as well as home designs and building materials, within constraints set by reconstruction authorities.

Housing reconstruction is already under way in the villages surrounding Bam. Much of this work is being done by international NGOs that have contracts with the Housing Foundation, which provides the designs. Individual organizations take responsibility for providing the foundation, steel frames and ceilings in the villages to which they are assigned. Typically the masonry work and basic finishing is left to the owner. For example, Relief International is constructing 1060 steel-frame houses and Swiss Caritas is building 430 reinforced concrete frame houses in 13 villages in the impact region. The footprints of these units range from 43m² to 85m² depending on the size of the household.

4.2. Businesses and Schools

Business reconstruction is being coordinated through the Ministry of Finance and Trade. Plans for rebuilding businesses resemble those for residential structures. Business owners will receive a grant totaling approximately \$1,200, plus a loan of \$60 per square meter of reconstruction. The reconnaissance team was unable to determine whether there are specific plans that target business recovery.

Schools were back in session within a few days

after the earthquake, operating out of tents provided by UNICEF and other organizations. Initially, rather than dividing students by grade, separate schools were set up for all male and female students. School is now being held in metal tents and other temporary structures. Some students left the area after the earthquake and are presumably in school in other cities. Approximately 80% of Bam's surviving students are at least registered for school. However, attendance is lower than before the earthquake, particularly for boys, many of whom are no longer interested in school. Those in charge of the schools have reportedly tried to provide a supportive environment for the students, rather than returning immediately to the regular curriculum. Nevertheless, at the time of the reconnaissance visit students were still finding it difficult to concentrate on schoolwork.

School reconstruction is being coordinated through the "New Construction and Improvement of Schools", program, which is part of the Ministry of Education. No government aid is available for private schools, many of which were of even poorer construction than the public schools. A considerable amount of school reconstruction is being financed by international NGOs, Iranian donors, and Iranian expatriates. The cost of rebuilding a school ranges from \$100,000-300,000.

4.3. Health and Mental Health Issues

Impacts on the health and psychological well-being of residents have been severe. Since so many health-care professionals lost their lives in the earthquake, many health services are now being provided by health-care workers from Kerman, Tehran, and other parts of the country. Medical residents have reportedly been especially eager to volunteer in order to provide care to residents of the impact region. A temporary hospital is operating in Bam, but patients requiring surgery must go to hospitals in Kerman.

With funding from UNICEF and the Mental Health Department of the Ministry of Health, a large-scale project has been established to provide psychosocial support to residents of the impact area. Training for psychosocial intervention in disasters had already been under way prior to the disaster; a "train-the-trainers" workshop for mental health service providers had been held in Tehran just a month before the earthquake.

The psychosocial intervention program established after the earthquake involves extensive outreach and needs assessment throughout the impact region, beginning with "tent visits" conducted by trained

mental health professionals. These visits are followed by a series of group counseling sessions for children and adults identified through screening, focusing on such problems as anxiety and avoidance behavior. Longer-term individual counseling is provided for more severe psychosocial problems. The program also offers a range of other services, including the provision of crisis care, training of teachers and school counselors, referrals, and broad public awareness programs.

As is the case with medical personnel, a large number of mental health professionals from the province, the capital, and other parts of Iran have made their services available for earthquake victims. As of the May visit, of the more than 53,000 individuals who had been screened, nearly 26,000 had been referred to group counseling sessions, and more than 3,000 sessions had been held. Approximately 550 mental health professionals had been involved with the program as of Mid-May, and about 45 professionals were active in providing services each week.

4.4. The Bam General Plan

In Iran, centralized planning is carried out according to a 20-year National Master Plan that is divided into a series of five-year plans. The earthquake occurred near the beginning of a new planning cycle, and as a consequence of the Bam event, seismic loss reduction is now being emphasized in planning nationwide. The general plan for Bam was essentially complete at the time of the earthquake. A consulting firm in Tehran was preparing it for the Ministry of the Housing. The Bam City Council submitted comments on 26 issues within five days of the earthquake so that it could guide recovery. In particular, the City Council wants to maintain the scale of buildings and desert ambiance of the reconstructed city, and they want the Arg-e-Bam restored.

Although the City Council offered a broad array of recovery and reconstruction recommendations to central government representatives shortly after the earthquake, the general plan for the city has been developed in Tehran for the Ministry of Housing. Local government must "sign off" on the plan, but its own influence on the planning process has been minimal. The reconstruction cannot begin until the plan is completed. Land-use patterns are expected to alter little in the aftermath of the earthquake, except for minor changes, such as the widening of streets.

The preservation of Bam's distinctive urban form as a "garden city" of single-family homes located within

date groves, as well as restoration of the Arg-e-Bam, are major issues for reconstruction planning. Debates can be anticipated over such topics as the use of adobe in reconstruction in this highly seismic region. A number of conferences and workshops have already been held under the auspices of the *UN* and other agencies to identify "lessons learned" as a result of the earthquake. A conference on Bam reconstruction is scheduled to be held in Italy, probably in September. At that meeting, both the Bam reconstruction plan and overall risk management strategies will be discussed.

5. Overarching Issues

The sections above have attempted to provide a broad picture of both earthquake impacts and the status of recovery activities five months after the earthquake. Over the course of its activities, the team also identified a series of more general issues affecting the impact region and Iranian society more generally. Those issues center on the role of the public and civil society institutions in the reconstruction process; public awareness and risk communication; and effective coordination of response and recovery activities, including the need to better manage the transition between response-related and short- and longer-term recovery strategies.

5.1. Public Participation

There is a broad recognition of the importance of public participation in the reconstruction and recovery process. Local residents, *NGOs*, international organizations, and Iranian government officials all acknowledge the need for such participation. The challenge for the earthquake-stricken areas and for Iranian society more generally is to find ways of widening public participation in what to date has been a centralized, top-down governmental framework. Following the earthquake, mechanisms were developed to encourage such participation, but it is unclear at this time whether they will be implemented and to what effect. What was described by the media as a "riot" that took place in Bam in early March can be seen as a reflection of public frustration with the recovery process and unmet promises of aid and of the public's need for a more direct voice in the recovery process. The unrest was also a reflection of high rates of unemployment among significant sectors of the population, especially young people.

5.2. Public Communication and Hazards Education

A second overarching concern centers on the need for more effective public risk communication, both within and outside the impact region. As noted earlier, Bam residents had little awareness of the earthquake threat prior to the time the earthquake occurred. In the aftermath of the earthquake, there is a clear need for public education on topics ranging from the likelihood of aftershocks to earthquake prediction science, recommended earthquake preparedness measures, and the importance of adhering to earthquake resistant codes and standards during the reconstruction process. Rumors abound concerning the causes of the December earthquake and the possibility of future seismic activity--again evidence that the public's demand for accurate information is not being met. Local *NGOs* have criticized the limited dissemination of information related to reconstruction, and some city and provincial government agencies are mobilizing to publish newspapers, distribute posters and hold information sessions in public meetings or through the media. However, these efforts also require better coordination.

5.3. Interagency Coordination and Transition Strategies

The earthquake revealed strategic gaps in post-earthquake response and recovery. While as indicated earlier, many response activities were managed well, individuals consulted for this report also pointed to the lack of more rapid and localized search and rescue capability as a major problem following the earthquake. Some hypothesized that the high death toll can be attributed at least in part to the absence of local search and rescue capacity in the affected region. Search and rescue activities are carried out by the Red Crescent Society, which needed time to send personnel into affected areas. As is often the case, international search and rescue teams arrived too late to play a role in lifesaving operations.

Due to poor information sharing, lack of trust among some organizations, and other factors, many agencies are working independently of one another, rather than coordinating their activities. This has resulted in duplication of efforts and confusion for those seeking services. Efforts at establishing mechanisms to link aid-related organizations with one another have been complicated by organizational factors, such as frequent turnovers in personnel. Organizations that might have been expected to play a larger role in recovery decision making, such as the

Bam City Council and local *NGOs*, frequently lack both the resources and the authority to become more actively involved in official recovery efforts. This last-mentioned issue is again a reflection of a general absence of mechanisms for incorporating community participation into the governmental decision-making process.

Disaster scholars have long noted that transitions through the phases of response, early recovery, and longer-term recovery are generally not well-managed. Some individuals contacted during this reconnaissance visit argue that this is also the case for the Bam earthquake. Those directly involved in early recovery activities have noted that strategies are needed to ensure that transitions are well-timed, that resources are made available when they are needed, and that the public is kept up-to-date and has the opportunity to participate in the recovery process.

6. Research Needs

The Bam earthquake raises many questions that should be addressed in future social science and policy research. Studies are needed to analyze factors associated with mortality and morbidity in this event and to assess the post-earthquake search and rescue process. Follow-up research is needed to better understand longer-term impacts upon the surviving population, including psychosocial impacts, and to track the social and economic recovery process for households and businesses. Special attention should be paid to at-risk populations, such those who suffered very severe losses, disrupted families, and youth. The Bam event also provides a significant opportunity for economics-based research on disaster losses, costs, and recovery. It will also be important to document decision-making, policy development, and policy implementation affecting the reconstruction of the Arg-e-Bam historic complex. Additionally, research is needed to evaluate the provision of services to affected populations, including mental health care, temporary and permanent housing aid, and assistance provided to businesses. Studies assessing the effectiveness of governmental aid programs and policies could provide valuable lessons both for Iranian society and for other nations. Finally, systematic research is needed to document the extent to which this event results in changes in earthquake loss reduction policies and practices within Iran, including public education and preparedness programs, the implementation and enforcement of earthquake-resistant design and construction practices, and what changes, if any, take place with respect national, provincial, and community loss-reduction programs.