

Learning from Earthquakes

Social and Public Policy Issues following the Bam, Iran, Earthquake

This is the second reconnaissance report on the December 26, 2003, Bam, Iran, earthquake. The first report, which appeared in the April 2004 Newsletter, focused on the seismological characteristics of the Ms 6.6 earthquake, damage to the built environment, and initial impacts on the population in the affected region. The April report also provided information on selected aspects of emergency response, including search and rescue, medical care, and the provision of shelter for victims.

This report summarizes initial findings from a second reconnaissance trip to Iran, carried out from May 8-16, which observed 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. The EERI team was made up of Kathleen Tierney, University of Colorado; L. Thomas Tobin, Tobin & Associates; Bijan Khazai, University of California, Berkeley; and Fred Krimgold, Virginia Tech. Fact-finding meetings were conducted with many organizations, including the International Institute of Earthquake Engineering and Seismology (IIEES), which hosted the EERI team; UN-affiliated organizations; national-level entities concerned with loss reduction and disaster response and recovery; international nongovernmental organizations (NGOs); local NGOs in Bam; city and provincial government officials and agencies; and health care and mental health professionals.

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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 people; 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 grants, low-interest loans and build-

ing materials, and 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, 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 the provision of emergency medical care and in reconstruction and recovery-related

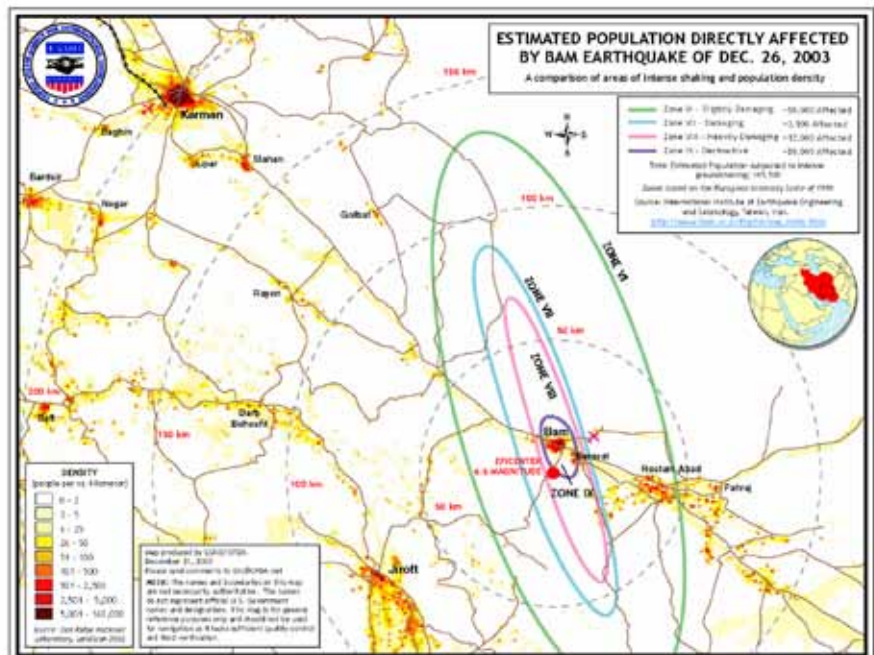


Figure 1. Isoseismal map and population affected by the earthquake.

services. The skills and capabilities required 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 been struck by a number of damaging earthquakes that also improved response-and-recovery capacity. The decade of the 1990s was a particularly active seismic period: three major damaging earthquakes struck 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 seismic events were applicable to the Bam disaster.

The 1990 Manjil earthquake gave rise to a number of pertinent policies, including a 1991 law establishing the Natural Disaster Headquarters (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, policies and practices following the Bam earthquake must be understood within the context of Iran's highly centralized governmental system. While local government elections were introduced in the late 1990s, theoretically increasing local 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. 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 planning process.

Societal and Economic Impacts

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 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: 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 of casualties, and injury severity — have to date proven unsuccessful. Follow-up work is needed to collect and analyze epidemiological data.

The high death and injury toll can be attributed to the time the earthquake

struck and to the extreme vulnerability of the built environment in the greater Bam region. The earthquake hit just before dawn when most residents were still asleep, and 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 contributed to the deaths of those trapped under the rubble.

It 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; some residents left their houses during the night and warned others, but most people remained in their homes. Residents now question whether some sort of warning should have been issued to the public when the 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 uninhab-



Figure 2. Temporary small businesses. Note containers in background, used for business and storage (photo: Tierney).



Figure 3. Temporary market. Many businesses now operating in Bam were not doing business in the city before the earthquake (photo: Tierney).

itable. Nearly all of the housing in Bam and in eight to ten villages within 10 km of Bam must be replaced. Adobe and nonengineered buildings accounted for 80% of the residential building stock. Additionally, rapid and uncontrolled development in recent years resulted in the construction of many unsafe buildings.

Education: Schools in Bam and the surrounding region were destroyed or very severely damaged. Iran's very young population includes many school-age children. Before the earthquake, 48% of the population of Bam was under the age of 20; there were about 32,000 students, 3,200 teachers, and nearly 300 schools in Bam. Hundreds of teachers and 8,000-10,000 students were killed in Bam and surrounding areas.

Economy: Bam is a regional agricultural center known for its high-quality dates, citrus crops, henna, and dairy products. Many of the 400 surrounding villages have close economic ties with Bam, with villagers bringing goods to sell and working in Bam, and the city providing services, such as warehousing of

dates and health care for the surrounding region. 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 the surrounding villages, with a total population of 100,000 residents.

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. The city of Bam is currently dealing with a severe budget deficit, a shortfall that reportedly will be made up at a later time by the central government.

The economies of the neighboring small agricultural communities were already severely stressed due to a six-year drought. Because of extensive earthquake damage to the qanats (an irrigation system distinctive to the region), there was originally great concern that high-value crops would be lost. However, repairs to the irrigation

system have progressed well, and this year's crops will likely not suffer as a consequence of the earthquake.

Business impacts were comparable in scale and severity to household impacts; at the time of the May reconnaissance visit, very few business establishments were operating in Bam's commercial districts. Some businesses had been set up in shipping containers and makeshift sheds outside the city, but many of them had come from outlying areas. Prosperous and established businesses relocated to other cities such as Kerman, the provincial capital.

The "New Arg" industrial complex east of the city is another engine for the local economy. Prior to the earthquake, 1,000 workers at an automobile plant in this complex were laid off, because what was originally a Daewoo plant was bought by General Motors, and because of U.S. trade sanctions against Iran, the plant was forced to close, creating ripples throughout the community. Even before the earthquake, unemployment was at about 20% in the city of Bam.

Arg-e-Bam, the 2,000-year-old Citadel which was extensively damaged in the quake, is a major resource and important tourist destination that attracted numerous visitors to Bam every year. 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 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 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. Of course, there are no exact figures, but 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 because a number of people are addicted and because of drug-related crime. Because of the crime, drugs are also a major contributor to high incarceration rates for males in the region.

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, causing not only widespread residential and commercial damage, but also destroying or severely damaging all schools, hospitals, and health care facilities in the impact area. 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, 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; it ensured an abundance of relief assistance for victims, but also created major coordination problems.

The impact region was divided into 14 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 Cres-

cent Society, and international organizations, with representation from the Bam City Council. The task force composition follows guidelines established in a new disaster management system which had been developed in May 2003. This 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.

Temporary housing and residential reconstruction: At the time of this reconnaissance visit, 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



Figure 4. Tent shelters placed among piles of debris. Some residents are still living in tents next to debris from their homes (photo: Tierney).



Figure 5. Temporary housing under construction (photo: Khazai).

cooling; daily temperatures are currently over 100 degrees. Tent 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 the temporary structures, or in some instances groups of stalls 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 them.

Plans for the provision of approximately 20,000 units of permanent housing in Bam are well underway, 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 make their services available to residents through a government sponsored "housing bazaar" in which property owners will be able to select builders who 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 home designs and building materials, within constraints set by reconstruction authorities. Housing reconstruction is already underway in the villages surrounding Bam. Much of this work is being



Figure 6. Resident looks out from temporary housing structure. Although units are still under construction and not approved for occupancy, some families have already moved in (photo: Tobin).

done by international NGOs that have contracts with the Housing Foundation, which provides the designs. Individual organizations provide 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 43 m² to 85 m² depending on the size of the household.

Business and school reconstruction: 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 a few days after the earthquake, operat-

ing 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, but 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," a program 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 to \$300,000.

Health and mental health issues: Impacts on the health and psychological well-being of residents have been severe. Since so many local 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 students have reportedly been especially eager to volunteer in order to provide care in 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 been undertaken 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 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 the children and adults identified through screening, focusing on such problems as anxiety and avoidance behavior. 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.

Longer-term individual counseling



Figure 7. Life goes on in Bam, as women wash cooking and eating implements in a ditch (photo: Tierney).

is provided for more severe psychosocial problems. The program also offers a range of other services such as 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 volunteered their services for the earthquake victims. Approximately 550 mental health professionals had been involved with the program by mid-May, and about 45 professionals were providing services each week.

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. Local government must “sign off” on the plans, but its influence on the planning process is minimal.

The earthquake occurred near the beginning of a new planning cycle; as a consequence of the Bam event, seismic loss reduction is now being emphasized in nationwide planning. At the time of the earthquake, a consulting firm in Tehran was completing the Bam plan for the national Ministry of Housing. The Bam City Council submitted comments on 26 issues within five days of the earthquake so that the plan could be revised to guide recovery. In particular, the City Council wanted to maintain the scale of buildings and the desert ambiance of the reconstructed city, and to restore Arg-e-Bam. 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 are taking place on 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.

Overarching Issues

Over the course of its activities, the reconnaissance team also identified a series of more general issues affecting the impact region and Iranian society 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.

Public participation: Local residents, NGOs, international organizations, and Iranian government officials all acknowledge the need for public participation in the reconstruction and recovery process. 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 highly 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 born of high rates of unemployment among significant sectors of the population, especially young people.

Public communication and hazards education: There is a 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 quake. In the aftermath, rumors abounded concerning the causes of the earthquake and the possibility of future seismic activity. There was a clear need for public education on topics as various as the likelihood of aftershocks, earthquake prediction science, recommended earthquake preparedness measures, and the importance of adhering to earthquake-resistant codes and standards during the reconstruction process.

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.

Interagency coordination and transition strategies: The earthquake revealed strategic gaps in post-earthquake response and recovery. While many response activities were managed well, individuals consulted for this report pointed to the need for more rapid and localized search and rescue capability following the earthquake. Some hypothesized that the high death toll can be attributed at least in part to its absence. 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 life-saving operations.

Due to poor information sharing and lack of trust among some organizations, 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 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 indicate that this is true 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 involved in the recovery process.

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 busi-

nesses. Special attention should be paid to at-risk populations, such as young people, those who suffered very severe losses, and disrupted families.

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 historic Arg-e-Bam 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 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, and what changes, if any, take place with respect to national, provincial, and community loss reduction programs.

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Figure 8. Residents queue up daily to request urgent recovery assistance at the headquarters of Bam's regional governor (photo: Khazai).