



# The Bam We All Want: Technical Workshop 1 Lessons learnt from past reconstruction programmes

Tehran, Islamic Republic of Iran  
25-26 February 2004





## Background and objectives

On 26 December 2003, a powerful earthquake measuring 6.3 on the Richter scale struck the historic city of Bam and its surrounding villages. It took the lives of some 45,000 people and left over 25,000 injured and about 75,000 homeless. About 85 percent of the houses, commercial units, health and educational facilities and administrative buildings in the city and surrounding villages were either severely damaged or completely destroyed.

Given the extent of the devastation, rebuilding Bam in all its dimensions – social, economic, physical, cultural – will be a major challenge for Iran in the coming years. Reconstruction and rehabilitation will require significant financial resources, skilled human resources and innovative institutional arrangements to accomplish rapid and sustainable recovery. The design and implementation of the reconstruction programme will also require very specific technical inputs.

This workshop, organised by the Steering Committee for the Reconstruction of Bam and UNDP, was intended to provide a forum for post-earthquake reconstruction experts from Iran, Japan, India and Turkey to share their experiences, identify best practices and lessons learnt, and develop a menu of possible technical, financial and institutional arrangements that could be applied to the reconstruction of Bam. The workshop was also intended to set the stage for follow-up sectoral workshops and consultations, focused training activities, technical inputs as well as small-scale demonstration projects. A copy of the workshop concept paper is attached as Annex 1.

## The workshop

The workshop was organised under the auspices of the national Steering Committee for the Reconstruction of Bam, with support from UNDP. Participants included post-earthquake reconstruction experts from India, Japan and Turkey; high-level representatives from key Governments ministries, agencies and departments involved in the reconstruction and rehabilitation of Bam; and UN agencies and NGOs. A list of participants is attached as Annex 4. The workshop was opened by H.E. Mr. Abdolizadeh, the Minister of Housing and Urban Development. The welcome address was given by Mr. Frederick Lyons, UN Resident Coordinator in Iran.

Day 1 of the workshop was divided into five sessions on the following topics:

- Institutional arrangements for reconstruction
- Site selection and land tenure
- Shelter sector reconstruction: appropriate delivery mechanisms
- Rebuilding critical infrastructure and promoting higher standards of safety
- Urban redevelopment and planning

Each session comprised a summary report on the situation in Bam, experiences in other countries and question and answer sessions. Please see Annex 2 for the agenda

Day 2 of the workshop was devoted to a roundtable discussion on themes raised on the previous day. The discussion resulted in the preparation of a list of recommendations for the reconstruction programme for Bam, which The list was forwarded to the Steering Committee for the Reconstruction of Bam, for action, and is attached to this report as Annex 3.

## **Summary of the workshop proceedings**

### **Session 1: Institutional arrangements for reconstruction**

Moderator: *H.E. Mr. Moghimi, Deputy Minister, Ministry of Interior, Iran*

Panellists: *H.E. Mr. Saeedikia, President, Housing Foundation of the Islamic Revolution, Iran; Dr. Fatemi, Head, Natural Disaster Research Centre, Iran; Professor Murat Balamir, Middle East Technical University, Turkey; Mr. Maheswar Sahu, UNIDO Project Director, India; Dr. Shingo Nagamatsu, Research Scientist, Disaster Reduction and Human Renovation Institute, Japan.*

The session highlighted a variety of institutional arrangement options: from an ad-hoc advisory committee approach adopted in response to the Great Hanshin-Awaji earthquake in Japan; to the creation of a legally autonomous reconstruction management body at the state/provincial level such as the Gujarat State Disaster Management Authority; to an elaborate system of statutory regulations implemented through a central disaster authority under the Government in Turkey. Despite the differences in approach, there was unanimous agreement by the panellists of the importance of community ownership of the reconstruction process, and of the need to involve all levels of government, particularly local government, in the planning and implementation of the reconstruction programme. Empowerment of local level authorities at the municipal level, and through them, the community, will be key to the development of a sustainable reconstruction and rehabilitation programme. It was noted that following the most recent earthquakes in Turkey, the central authority took full responsibility for post-disaster relief, recovery and rehabilitation. This approach resulted in the “alienation” of the affected communities because it excluded local administration from the reconstruction work and put the community in the role of a spectator.

It was suggested that one way to ensure community participation in the decision-making and implementation processes would be to use and strengthen existing structures at the local level such as village councils, neighbourhood committees etc. Such an approach would also help ensure two-way communication with the affected families. Policy initiatives, financial assistance, and technical know-how will not be effective without a system that: communicates their content swiftly to the public; allows the community to discuss and assess the suitability of what is on offer; and accepts feedback from the community. Village councils and committees provide an excellent platform for the Government to get its message directly to individual families and to ensure that the recovery and reconstruction efforts meet the needs of the most vulnerable groups. In addition, identifying and placing responsibility on citizen’s committees, would not only hasten the rehabilitation process and assist the affected communities in working through their trauma, but it would also reduce resistance to hard but necessary decisions such as relocation etc.

It was pointed out that a post-disaster reconstruction programme should be dynamic and flexible. It should reflect the needs of the communities and their aspirations, and it should seek a balance between affordability, technical feasibility, and the quality of life. A sound reconstruction strategy should also look ahead towards longer-term disaster risk reduction and integrate disaster mitigation strategies with social, economic and environmental measures. In Bam, for example, there is an opportunity to introduce water management practices that could help re-charge ground water resources. By empowering village-based institutions and other agencies through training programmes, the Government will be better able to plan and manage equitable and participatory rehabilitation processes as well as initiate disaster preparedness of the community.

## **Session 2: Site selection and land tenure**

Moderator: *Dr. Ghassem Heidarinejad, President, Building and Housing Research Centre, Iran.*

Panellists: *H.E. Mr. Pirooz Hanachi, Deputy Minister for Urban Affairs and Town Planning, Ministry of Housing and Urban Development, Iran; Professor Murat Balamir, Middle East Technical University, Turkey; Mr. Krishna Vatsa, Secretary (Relief and Rehabilitation), Revenue and Forest Department, Government of Maharashtra, India; Mr. Sandeep Virmani, Kutch Nav Nirman Abhiyan, India.*

Re-planning the city should be seen as an opportunity to redress issues of illegal land holdings, fairer distribution of land titles, and better integration of marginalised sections of the population into the mainstream. To minimise ownership disputes, the Government of Iran is preparing legislation that will forbid the buying and selling of land in the Bam during the reconstruction phase. To reinforce this, it was suggested that land and property ownership records should be systematized to avoid competing claims at later stages of the reconstruction process. It may also be useful to set up special courts for grievance redressal, and an Area Development Authority, as was done in Gujarat, to deal with day-to-day problems and disputes that might emerge as reconstruction progresses.

Regarding site-selection, it was noted that in-situ reconstruction is often seen as a better and cheaper choice than relocation. But relocation and in-situ reconstruction are not mutually-exclusive. Towns and cities need to be decongested during re-planning, and a certain amount of relocation is therefore inevitable. The decision to either stay or relocate should be made by the communities and should be guided by the desire to improve the habitat and living conditions of the community. An "ideal" situation would be one that combines the positive features of both options i.e. in situ reconstruction on a bigger plot, with a better layout and architectural design and a decongested environment. In Bhuj, Gujarat, an incentive-based system of "optional relocation" allowed community members to decide whether to stay or relocate. Those who wanted to relocate received more land, while those who chose to stay on in the city, for commercial and other reasons, received plots that were on, or as close as possible to their original plots. While the exercise in Bhuj was rated as very successful, one lesson learnt would be to ensure in future that planners have a database and clear understanding of the city's economic pattern.

## **Session 3: Shelter sector reconstruction: appropriate delivery mechanisms**

Moderator: *Mr. Saroj Jha, UNDP Assistant Resident Representative (Vulnerability Reduction).*

Panellists: *Dr. Haqshenas, Housing Foundation of the Islamic Revolution, Iran; Mr. Seyyed Abbas Jazayeri, Head, National Disaster Taskforce, Iran; Mr. Yasushi Nakano, Assistant Manager, Crisis Management Office, Kobe City Authority, Japan; Professor Anand S. Arya, Capacity Building Advisor, Ministry of Home, India; Professor Bahraini, Department of Environment, University of Tehran, Iran.*

The Government, has decided to provide shelter for the earthquake-affected communities in two stages: 1) interim or transitional shelters in urban areas that can be erected in a short time and that will be located in existing vacant land; 2) permanent shelters in rural area in the original plots, and 3) permanent shelter for urban areas following the preparation of a detailed master plan. Experience in countries such as Japan indicates that temporary/intermediate shelters should be used wherever possible to buy some extra time for building permanent shelters. For instance, following the Kobe earthquake the decision to provide temporary housing, gave authorities time to develop a comprehensive ten-year restoration plan for the city. Nonetheless, it was pointed out that the linkage between immediate and permanent shelter should be carefully examined as experience has also proved that it is not always advisable to upgrade or integrate a temporary shelter into a permanent shelter.

As shelter sector reconstruction is likely to be the largest component of the reconstruction programme, it should be closely linked to local economic recovery and the enhancement of livelihood options. Economic rehabilitation ought to run parallel to shelter rehabilitation as the economic status of the affected families will determine the pace and quality of the shelter rehabilitation. Rather than purchase materials, expertise and labor from outside, efforts should be made to revitalize the local economy by utilizing local materials and resources, and by training and employing local people in the reconstruction activities. Designs for earthquake-resistant, non-engineered buildings, as well as systems for producing locally appropriate, low cost building materials such as stabilised, compressed earth blocks have already been developed and used in countries such as India.

An advantage of owner-driven construction is that it is more likely to ensure that the buildings that are constructed not only meet the requirements of natural disaster resistance, but that they are also in keeping with local, tradition and style. In addition, it ensures “technology transfer” to the community, gives homeowners greater control and ownership of the reconstruction and often results in better utilization of resources. However, such an approach may not be feasible for all families, such as those that have lost adult members. A combination of owner-driven and contract-driven approaches may therefore be more appropriate. Ultimately, however, the decision to use either a contractor-driven or an owner-driven strategy will depend on the needs of the communities and their capacities and vulnerabilities. In addition there are several innovative approaches, such as the establishment of family cooperatives for owner-driven construction that can be explored.

#### **Session 4: Rebuilding critical infrastructure and promoting higher standards of safety**

*Moderator: Engineer Tafazoli, Housing Foundation of the Islamic Revolution, Iran*

*Panellists: Dr. Ghassem Heidarinejad, President, Building and Housing Research Centre, Iran; Mr. Mustafa Erdik, Advisor on Earthquake Risk Management, Municipality of Istanbul, Turkey; Professor Anand S. Arya, Capacity Building Advisor, Ministry of Home, India; Mr. Tetsushi Kurita, Senior Researcher, Asian Disaster Reduction Centre.*

The need for a review of earthquake-resistant design codes for buildings and other engineering structures and for their enforcement, as well as the undertaking of proper arrangements for the infrastructure to be able to deal with hazards was strongly emphasised. Iran has one of the best developed building codes for earthquake reconstruction. However the rate of compliance, even in urban areas, is very low, and there are few financial incentives or disincentives to ensure the enforcement of safety standards. In cases where building designs do adhere to building codes, the execution of those designs on construction sites is often very poor. Shoddy construction was in fact a major contributor to the high death toll from the Bam earthquake. All building technologies employed in the area, from the traditional ones such as adobe and masonry, to the more modern technologies, such as concrete with steel frames, behaved badly; demonstrating that in the absence of appropriate design execution, no technology is safe.

Appropriate arrangements need to be put in place to ensure enforcement of safety standards and building codes. In Turkey, for example, legislation has been enacted to enforce mandatory design checking and construction inspection of all buildings by government-licensed private “supervision” firms. There is also a need for regulations specifying what can and cannot be done on various sites, for example, based on information indicated in earthquake micro-zonation maps, land-use restrictions could be imposed, to prevent development in certain areas, limit development of specific types of construction and use categories, and impose special controls. Architects and engineers should also be made personally responsible for the safety of new buildings. One suggestion is to establish performance criteria for all national and international organisations involved in the reconstruction to ensure compliance with earthquake resistant standards.

Given the large scale reconstruction that will have to be undertaken in Bam, there is an urgent need for training programmes targeted at local construction supervisors, masons and building workers to ensure that the construction is earthquake-resistant and up to code. User-friendly guidelines and manuals should also be developed for local builders and contractors.

### **Session 5: Urban redevelopment and planning**

*Moderator: H.E. Mr. Pirooz Hanachi, Deputy Minister for Urban Affairs and Town Planning, Ministry of Housing and Urban Development, Iran.*

*Panellists: Representative from the engineering consultancy firm preparing the Bam reconstruction plan; Professor Murat Balamir, Middle East Technical University, Turkey; Mr. Keisuke Shikata, Deputy Director, Housing Development Division, Hyogo Prefecture, Japan; Mr. Maheswar Sahu, UNIDO Project Director, India.*

Given the extent of the damage in Bam, a certain amount of urban and rural resettlement planning will be required. The poor and marginalised sections of society often live in the most unfavorable parts of the village or towns, in weak and/or unsafe structures. Urban redevelopment provides an opportunity an opportunity to redress these inequalities. It offers the chance for “creative recovery” in the efficient design and use of public spaces and services to address the special needs of the poor, women, children and other vulnerable groups such as the elderly and the handicapped.

Urban redevelopment and planning redevelopment and planning should be closely linked to economic recovery processes in the affected areas. It should put emphasis on making the existing livelihoods options more resilient and should also look into other options. Development plans and town planning schemes should be prepared through public consultation, should look ahead to at least 25 years in the future and should incorporate long-term disaster risk management. In this regard, it may be advisable to set up an advisory committee to guide the reconstruction process and to ensure regular quality control checks and benefit monitoring.

## **ANNEX 1: WORKSHOP CONCEPT PAPER**

### **Technical Workshop Rebuilding Bam: learning from the past reconstruction programmes 25 February 2004 Iranian Centre for International Conferences Tehran, Islamic Republic of Iran**

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#### **Introduction**

On 26 December 2003, an earthquake measuring 6.5 on the Richter scale struck the city of Bam and its surrounding villages in Kerman province, south-eastern Iran. The quake killed more than 30,000 people, rendered more than 75,000 people homeless and severely damaged and destroyed about 85% of the houses, commercial units, health facilities and administrative buildings in Bam and the surrounding villages. The 2,500 year-old historic citadel of Bam (Arg-e-Bam), an internationally renowned heritage site, was almost completely destroyed. The economic prospects of the Bam region and the livelihoods of its people were dealt a severe blow for years to come.

#### **The Challenge of Rebuilding Bam**

As soon as the arrangements for intermediate housing and basic infrastructure for the affected people are determined, the process of rebuilding of Bam and its surrounding areas will begin. Rebuilding Bam in all its dimensions – social, economic, physical, cultural – will be a major challenge for Iran over the next two years. Given the magnitude of the disaster, it will require huge amounts of financial resources, skilled human resources and innovative institutional arrangements to accomplish rapid and sustainable recovery. As in all large-scale reconstruction programmes, the focus is on restoring normalcy (in livelihoods, shelter, social services, infrastructure etc.) as quickly as possible. Yet there is also an opportunity to introduce new practices that could reduce the risk of future disasters. Achieving a balance between these two, sometimes competing, priorities is always a challenge.

Within the context of Bam, a number of challenges are beginning to emerge, including:

- What kinds of institutional arrangements need to be put in place for the reconstruction of Bam? The government is already considering options ranging from setting up a multi-sectoral committee, to the establishment of separate arrangements for each sector, to sub-dividing the reconstruction by geographical units.
- Whether to reconstruct the city of Bam in the same location or in a different location?
- Irrespective of location, what process of urban redevelopment and planning would ensure that the people of Bam have a better standard of urban living and higher standards of safety?

- What kinds of building technologies need to be adopted to ensure safety, social and cultural appropriateness as well as sustainability?
- How would the shelter sector reconstruction be managed? Will it be entirely owner driven or built by government contractors? In either of these cases, how would it be ensured that an appropriate level of earthquake safety is achieved in new building construction?
- What kind of system needs to be put in place to undertake a detailed and objective damage assessment in all sectors?
- What kind of financing mechanism is required? How will the mechanisms of financial (or in-kind) assistance devolve down to the household level?

### **The Need for a Technical Workshop on Reconstruction Management**

As the reconstruction program begins, several complex issues, including the ones raised above, are likely to emerge. Since most reconstruction managers have no prior experience in dealing with operations of this magnitude, they tend to work in a “learning by doing” mode and rise to the challenges as they emerge. However, the trajectory of reconstruction programmes and the issues that emerge at different stages is quite predictable. A lot of value can be added to the work of reconstruction managers, if “lessons from the past” can be shared with them at the very outset of a reconstruction programme.

It is therefore proposed that a small technical workshop be held before the end of February to generate input from other countries into the design of the post-earthquake recovery strategies and programmes for Bam and to foster learning both ways. Organized under the leadership of the national Committee on the Reconstruction of Bam Management, with collaboration from other relevant government departments and agencies, and with support from UNDP, this workshop could bring together technical experts from countries that have experienced recent major earthquake disasters such as Algeria (2003), India (2001), El Salvador (2001), Peru (2001), Turkey (1999), Colombia (1999) and Kobe (1995). The workshop would not focus on either seismic engineering or seismology per se but rather on the macro aspects of reconstruction management. It is envisaged that the workshop will present a menu of approaches (technical, financial, institutional etc.) that have worked in other contexts and that could add value to the design and implementation of the Bam reconstruction programme.

### **Key Objectives:**

- To capture some of the key lessons learned (what has worked and what has not) from selected large-scale post-earthquake reconstruction programmes following distinct but inter-related themes such as:
  - Institutional arrangements for reconstruction
  - Site selection and land tenure
  - Shelter sector reconstruction: appropriate delivery mechanisms
  - Rebuilding critical infrastructure and promoting higher standards of safety
  - Urban Redevelopment/ Planning
- To assist the concerned authorities within the Government of Iran in coming up with a strategic framework for post-earthquake reconstruction in Bam.

### **Workshop Format**

This will be a highly interactive workshop geared towards providing specific inputs to the Iranian authorities. For each of the themes listed in the previous section, separate sessions will be organized. Each session will explore the situation in Bam in relation to experience in other countries. The workshop is intended to result in a synthesis of key lessons or insights learned from other countries that could be incorporated in the design of Bam reconstruction program.

Following the conclusion of the workshop, a brief synthesis report will be prepared as an input to the design and implementation of Bam reconstruction.

## ANNEX 2: WORKSHOP AGENDA

25 February 2004, Tehran, Iran

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- 08:30 – 08:45**      **Opening by the Head of the Committee on the Reconstruction of Bam**      (*H.E. Minister of Housing and Urban Planning*)
- 08:45 – 08:55**      **Introduction by Mr. Frederick Lyons, United Nations Resident Coordinator in Iran**
- 08:55 – 09:05**      **Workshop organization**
- 09:05 - 09:15**      **Tea break**
- 09:15 –10:45**      **Institutional arrangements for reconstruction**  
*Moderator: H.E. Mr. Moghimi, Deputy Minister, Ministry of Interior, Iran*
- Analysis of the situation in Bam [30 min]
    - o *H.E. Mr. Saeedikia, President, Islamic Housing Foundation, Iran*
    - o *Dr. Fatemi, Head, Natural Disaster Research Centre, Iran*
  - Experiences elsewhere [30 min]
    - o *Professor. Murat Balamir., middle East Technical University, Turkey*
    - o *Mr. Maheswar Sahu, UNIDO Project Director, India*
    - o *Dr. Shingo Nagamatsu, Research Scientist, Disaster Reduction and Human Renovation Institution, Japan*
  - Q &A and discussion [30 min]
- 10:45 – 12:15**      **Site selection and land tenure**  
*Moderator: Dr. Ghassem Heidarinejad, President, Building and Housing Research Centre, Iran*
- Analysis of the situation in Bam [30 min]
    - o *H.E. Mr. Pirooz Hanachi, Deputy Minister for Urban Affairs and Town Planning, Ministry of Housing and Urban Development (Iran)*
  - Experiences elsewhere [30 min]
    - o *Professor Murat Balamir, Middle East Technical University, Turkey*
    - o *Mr. Krishna Vatsa, Secretary (Relief and Rehabilitation), Revenue & Forest Department, Government of Maharashtra, India*
    - o *Mr. Sandeep Virmani, Kutch Nav Nirman Abhiyan, Gujarat, India*
  - Q &A and discussion [30 min]
- 12:15 – 13:00**      **Lunch**
- 13:00 – 14:30**      **Shelter sector reconstruction: appropriate delivery mechanisms**  
*Moderator: Mr. Saroj Jha, UNDP Assistant Resident Representative (Disaster Management and Vulnerability Reduction)*
- Analysis of the situation in Bam [30 min]

- *Mr. Haqshenas, Deputy for Housing Reconstruction, Representative of Islamic Housing Foundation, Iran*
- *Mr. Seyyed Abbas Jazayeri, Head, National Disaster Taskforce, Iran*
- Experiences elsewhere [30 min]
  - *Mr. Yasushi Nakano, Assistant Manager, Crisis Management Office, Kobe City Authority, Japan*
  - *Professor Anand S. Arya, Capacity Building Advisor, Ministry of Home Affairs, Government of India*
  - *Mr. Bahraini, Department of Environment, University of Tehran, Iran*
- Q &A and discussion [30 min]

**14:30 – 16: 00**

**Rebuilding critical infrastructure and promoting higher standards of safety**

**Moderator: Engineer Tafazoli, Ministry of Housing and Urban Development, Iran**

- Analysis of the situation in Bam [30 min]
  - *Dr. Ghassem Heidarinejad, President, Building and Housing Research Centre, Iran*
- Experiences elsewhere [30 min]
  - *Mr. Mustafa Erdik Advisor on Earthquake Risk Management, Municipality of Istanbul, Turkey*
  - *Professor Anand S. Arya, Capacity Building Advisor, Ministry of Home Affairs, Government of India*
  - *Mr. Tetsushi Kurita, Senior Researcher, Asian Disaster Reduction Center, Japan*
- Q &A and discussion [30 min]

**16:00 – 16:15**

**Tea break**

**16:15 – 17:45**

**Urban Redevelopment/ Planning**

**Moderator: H.E. Mr. Pirooz Hanachi, Deputy Minister for Urban Affairs and Town Planning, Ministry of Housing and Urban Development (Iran)**

- Analysis of the situation in Bam ([30 min]
  - *Representative from the engineering consultancy firm preparing the Bam reconstruction plan*
- Experiences elsewhere [30 min]
  - *Professor Murat Balamir, Middle East Technical University, Ankara, Turkey*
  - *Mr. Keisuke Shikata, Deputy Director Housing Development Division Hyogo Prefecture , Japan*
  - *Mr. Maheswar Sahu, UNIDO Project Director, India*
- Q &A and discussion [30 min]

**17: 45 – 18:00**

**Wrap-up: Workshop conclusion and closing remarks**

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**Thursday, 26 February 2004**

**09:00 - 13:00**

**Group discussion and preparation of workshop report**

## **ANNEX 3: Workshop Recommendations**

### **Institutional Arrangements**

- The local authorities (municipal governments) should play a central role in planning and implementation of the reconstruction program. Reconstruction effort can be used as an opportunity for the empowerment and capacity building of the local government.
- Continuity of leadership of the reconstruction program at all levels – policy, programme design as well as implementation levels -- should be ensured.
- The institutional arrangements for the reconstruction program should reflect strong ownership of the program at the provincial and local levels. The reconstruction program should continue to derive strength from high-level political support.
- While ensuring smooth and rapid recovery in the affected area, the institutional arrangements for the reconstruction program should also pave the way for longer-term disaster risk reduction.
- Special attention should be paid to the most vulnerable groups (such as orphans, women headed households, lone survivors in the family, severely injured and permanently disable), affected by the earthquake. The institutional arrangement should provide for a review of the situation of these vulnerable groups after every six months for the next several years.
- “Participation” of the affected communities in decision-making and implementation is a key success factor in making any reconstruction and recovery program sustainable. The institutional arrangements should make use of existing structures at the local level, such as village councils, to ensure participation at all levels and at all stages of decision making. Appropriate methodologies, tools and techniques need to be devised and applied to ensure effective participation.
- The civil society organizations should have an important role in the institutional arrangements for the reconstruction program. As required, their capacities also need to be developed to play an appropriate role in the reconstruction program.
- Recognizing that a reconstruction program requires a different (quicker and flexible) way of operating, appropriate operational guidelines/ manuals should be developed for the implementation of the program.
- To ensure a structured and institutionalized information dissemination system, that links to other stakeholders such as donors, civil society organisations, non-government organisations and the private sector, the Government may wish to hire a professional public relations firm.

### ***Urban redevelopment planning, site selection and land tenure***

- Given the proximity of Bam to seismically active fault lines, the location of some of the critical facilities will have to be reevaluated and if required, changed to safer location. Overall, it is likely that the reconstruction will follow a combination of reconstruction on the same site and relocation of some of the critical buildings to a new location.

- The main cause of extensive damage to Bam city was due to bad quality of construction. Therefore the main emphasis will have to be on improving the quality of construction to ensure adequate level of earthquake resistance.
- In the newly reconstructed Bam, the issues of security of tenure for the inhabitants will have to be addressed. The security of tenure of not only the permanent inhabitants of Bam but also those living on rented land and property needs to be ensured.
- Land and property ownership records (through existing official registration documents, aerial maps, mutual confirmation by local people etc.) should be systematized in order to avoid competing claims at later stages of the reconstruction process. It may be useful to set up an Area Development Authority to deal with day-to-day problems and disputes that might emerge as the reconstruction progresses.
- Appropriate arrangements need to be put in place to ensure enforcement of safety standards and building codes. The architects and engineers need to be made responsible for the safety of new buildings. Approved drawings of the newly constructed buildings in Bam city should be digitized and kept for posterity in government records.
- The process of urban redevelopment and planning after an earthquake is a complex one. It will be beneficial for a team of relevant officials to visit Gujarat and to learn from the experience of reconstruction of urban centers after the Gujarat earthquake.
- The process of debris removal should be seen as an opportunity to improve the habitat of affected communities. Several potential uses of the debris can be explored such as salvaging of reusable house building components and construction of flood protection dykes.
- The reconstruction program also offers opportunities to promote improved environment management practices and to reduce vulnerability to other natural hazards. In the case of Bam, there is an opportunity to introduce water management practices that help re-charge ground water resources. Like wise, application of roof water harvesting and wastewater recycling processes can also be explored.
- Urban redevelopment planning should be closely linked to economic recovery processes in the affected area. There should be adequate emphasis on making the exiting livelihood options more resilient as well as exploring new livelihood options.
- Training of architects and engineers
- Development of check lists for compliance with earthquake resistant standards

#### **Shelter sector – appropriate delivery mechanisms**

- The linkage between temporary or intermediate shelter and permanent needs to be carefully examined. The experience of past reconstruction programs in some countries indicates that temporary shelter should be used to buy some extra time for building permanent shelters. It is not always advisable to easily upgrade or integrate a temporary shelter into a permanent one.
- Shelter sector reconstruction is likely to be the largest component of the reconstruction program. It should be closely linked to local economic recovery and enhancement of livelihood options.
- Systems for producing locally appropriate, low cost building materials (such as stabilized compressed earth blocks and compressed earth construction) need to be put in place. A lot of technological innovation has taken place in other countries. Possibilities of technology transfer from other countries can be explored.

- Building codes, in their existing format, are not easily understandable to local builders and contractors. Easily understandable and locally usable guidelines and manuals need to be developed for earthquake resistant construction.
- Training programmes for a large number of supervising engineers need to be instituted to facilitate the delivery of safe housing at such a large scale.
- Financial mechanisms to support delivery in shelter sector should be linked to application of earthquake safety standards. An appropriate system of incentives and disincentives needs to be put in place.
- There should be a provision for retrofitting owner built new houses that are not built to earthquake safety standards.
- While owner-driven housing reconstruction has its merits, it may not always be possible to apply this approach. The house-owners may be pre-occupied with their other livelihood activities and may not be able to participate in the reconstruction activity. Therefore, a combination of owner-driven and contractor-driven approach should be adopted. There may be other innovative approaches such as establishment of family cooperatives for owner-driven construction that can be explored.
- The assistance package to the affected households can be structured in such a way that it is more targeted towards the less affluent, less privileged and the most vulnerable groups.
- While promoting low-cost and locally appropriate technologies, aspirations of the affected population should be taken into account.
- Training of masons
- Development of quality control guidelines
- Intensive training in detailing
- Development of design checklist
- Establishment of building centers for technology transfer

***Rebuilding Critical Infrastructure and Enhancing Standards of Safety***

- For all critical infrastructure performance based codes need to be established.