

The Reconstruction of Bhuj

Case Study: Integration of Disaster Mitigation into Planning and Financing Urban Infrastructure after an Earthquake

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Introduction to EPC and its Involvement in Bhuj

The Environmental Planning Collaborative (EPC), established in 1996, is a not for profit, private, professional planning and development management company. The company provides professional consultancy services primarily to urban local bodies including municipal corporations and urban development authorities. EPC also works with a variety of other agencies involved in urban development such as state government departments, international funding and lending agencies, special purpose vehicles for urban development and non-government/autonomous organizations. Most projects are undertaken in a collaborative and participatory manner with significant involvement from the client, major stakeholders and other related agencies. EPC's work is primarily of four types: (1) urban and regional development planning, (2) environmental and policy planning, (3) development management and (4) research and development.

Immediately after the earthquake, EPC deputed its personnel in Bhuj to study the situation and initiate public consultations. This evolved into a USAID funded project entitled "Initiative for Planned and Participatory Reconstruction in Kutch" (IPPR) in collaboration with The Communities Group International (TCGI). The IPPR consisted of experiments in participatory planning at the regional level and in urban and rural communities. This was followed by a United States-Asia Environmental Partnership (USAEP)-funded project, "Atlas for Post-Disaster Reconstruction" under which EPC in collaboration with the Planning and

Development Company (PADCO) prepared maps of the four towns showing plot level information on intensity of damage, land use and number of floors. These maps were provided to the respective town planning consultants through the Gujarat Urban Development Company (GUDC). In May 2001, EPC was commissioned by GUDC to prepare a development plan for Bhuj and subsequently, in February 2002, the contract was extended to include a detailed plan for the walled city. While the detailed plan for the walled city is nearing completion, EPC continues to be involved in Bhuj through the IPPR project.

The objectives of this paper are:

- to describe the various methods and instruments by which earthquake mitigation measures were employed
- to examine sources of financing for each method or instrument
- to critically reflect on these financing mechanisms.

Basic Definitions:

Disaster mitigation is an act of any sort designed to reduce or eliminate damage from a hazard event.

Urban planning includes land use planning, physical planning and ‘development control regulations.’

- Land use planning determines the use of land and its intensity
- Physical planning involves the actual layout of plots, open spaces, and streets
- Development control regulations determine the precise characteristics of built forms such as the height and bulk of buildings and construction standards.

Urban infrastructure includes both physical and social infrastructure:

- Physical infrastructure constitutes public facilities that link parts of the city together and provide the basic services the city needs to function, such as a network of roads and utilities
- Social and economic infrastructure includes facilities such as hospitals, parks and gardens, community centers, libraries, entertainment and shopping facilities, and educational buildings. While the benefits from physical infrastructure are patently tangible, the benefits from social infrastructure are often intangible.

Institutional and regulatory frameworks consist of institutions of government and civil society acting individually and together to run cities.

The Context of the Disaster and Its Impact

A disaster's context and its impact are described in two ways – geographically, and in terms of urban systems.

Geographical

Kutch District

Five districts in the State of Gujarat were severely impacted, but the worst affected was Kutch, where more than 90 percent of the deaths and 85 percent of the asset losses occurred. This district is a sparsely populated region, poor in natural resources (in a relatively rich state), and vulnerable to cyclones and drought, as well as earthquakes. The 6.9 magnitude earthquake struck in a second consecutive drought year. Four towns, including the district's largest – Bhuj -- and more than 400 villages were severely hit, destroying lives, infrastructure, buildings, the economy, and livelihoods. The death toll was nearly 14,000, and 167,000 were injured. More than 1.2 million homes were damaged or destroyed. So were small enterprises, schools, health clinics, rural and urban water systems, and electricity and telecommunications systems. While the greatest asset losses were in the housing sector, the livelihoods of many families were also disrupted. A joint assessment by the World Bank and Asian Development Bank a month later found that 19,000 handicraft artisans and several thousand salt farmers in Kutch were the most severely affected. Some 20,000 cattle deaths were also reported, the loss of another important source of livelihood.

The City of Bhuj

Bhuj was one of the worst affected towns in the district; almost 50 percent of its walled city alone was considerably damaged. Over 7,000 people perished in Bhuj, most of them in the walled city area, as buildings constructed of stone and mud collapsed on extremely narrow streets. The lack of an effective street pattern was a major obstacle to disaster management in the earthquake's aftermath. Over the years, poorly framed building regulations had been weakly enforced, and this had exacerbated congestion in the city. Many historic buildings had to be demolished during the rubble removal, making retracing the original street form and architectural character difficult.

Urban Systems

Local Governance

Bhuj Municipality was almost paralyzed. Many municipal buildings were destroyed, and records were lost. The municipality lost several staff, and other staff members lost their families and suffered injuries. The municipality lacked the internal capacity to take the lead in relief, rehabilitation and reconstruction activities.

Bhuj's societal structure is fractured along the lines of community groups and economic interests. The petty interests of such rival groups often compromised the principle of the common good. No strong political leadership emerged in the process. However, these caste-based and special interest groups contributed significantly to recovery by leading localized relief and rehabilitation activities for their constituent communities.

Social and Economic Infrastructure

Social assets (both public and private sector) such as schools, hospitals, community halls, town halls, markets, libraries, colleges, recreational buildings (a local gymkhana, an open-air theatre) and religious buildings were badly affected. However, the community facilities that *did* survive were quickly made available to the city by community groups. Since such places are the first refuge for people needing shelter, this demonstrates the enormous value in strategizing the future provision of social assets designed to withstand disasters and managed either by local government or local institutions themselves.

Physical Infrastructure

Water and sewer networks in the old city were badly damaged, ironically more during the movement of heavy machinery to demolish damaged buildings and to remove debris than during the earthquake itself. Outside the old city, too, important facilities such as reservoirs, pipelines, telephone exchanges and power infrastructure were damaged. However, the trunk lines in these networks survived with minor damage, enabling the quick restoration of services. Buildings and infrastructure networks had not been designed specifically to withstand an earthquake's impact and neither had the possibility to isolate – and separately repair – badly affected components of the infrastructure system.

Urban Planning and Development Regulation

The state government found itself searching for an appropriate regulatory framework in the absence of specific regulatory measures that would respond quickly to the earthquake and the complex challenges of reconstruction. The previous development plan for Bhuj had been prepared twenty-five years earlier. Its strategy was outdated, and its maps did not

reflect the city's present-day vastly expanded limits; the old plan would need to be completely revamped to respond to new needs. To compound matters, citizens showed little respect for a municipality that had a record of poor enforcement of whatever regulations had earlier existed, and as a result unregulated development in the months following the earthquake have proven difficult to control. Citizens showed no culture of conforming to rules that should apply to society as a whole, in a disaster situation or otherwise. All said and done, the earthquake gave the state government an opportunity to completely rethink the applicability of existing planning, regulatory and development mechanisms in an unlikely context.

An Overview of Mitigation Initiatives in Bhuj

“Build Back Better” – Defining Basic Principles and Policy for Reconstruction

- To build the city back better, applying a policy of encouraging partial relocation and partial *in situ* reconstruction.
- To continue with the city's existing infrastructure, repairing and revamping it after the earthquake so that it is better managed responds better to natural disasters. This approach would save the government the considerable expenditure of building new infrastructure in the aftermath of a future disaster.
- To improve building construction quality so that it incorporates earthquake-resistant technologies and adheres to regulatory norms.
- Assist people in the reconstruction process; help them to understand statutory requirements in planning, build consensus, and frame projects that respond to people's concerns and needs.
- Make the planning process as participatory as possible, by encouraging public-private partnerships, building fora at which citizens can participate in decision making and voice their concerns; and build a modicum of public trust in the process to ensure implementation.

Establishing an Institutional and Regulatory Framework for Reconstruction:

- The government established the Gujarat State Disaster Management Authority (GSDMA). The GSDMA's current role is to finance and oversee the entire post-disaster reconstruction project in the State of Gujarat. Its future role will be to guide the preparation of disaster

management and mitigation plans for all cities, towns and regions in Gujarat and to finance their implementation.

- With the assistance of experts from the USAID-FIRE(D) project and in consultation with various local institutions and international agencies, the government created the following institutional framework for undertaking reconstruction:
 - In May 2001, the government created Area Development Authorities in Bhuj, Bhachau, Anjar and Rapar under the provisions of the Gujarat Town Planning and Urban Development Act, 1976. The ADAs were made responsible for implementing town planning proposals and ensuring adherence to improved regulations.
 - The government negotiated a US\$100 million (Rs. 500 crore) loan from the Asian Development Bank to fund urban reconstruction.
 - Since the post-earthquake urban reconstruction project demanded special attention, dedicated staff and special skills, the government designated the Gujarat Urban Development Company (GUDC) as the implementing agency for the project. The GUDC is a special purpose vehicle established by the government (before the earthquake) to conceptualize and implement urban development projects.
 - In contrast to the conventional method of staffing such organizations, the Government of Gujarat chose the more progressive method of outsourcing the tasks of town planning, infrastructure planning, and scrutiny of applications for building permissions to support the ADAs and GUDC.

Designing Policy Packages for the Earthquake Victims

The urban reconstruction package announced in April 2001 favored partial reconstruction and partial relocation. It envisaged the following:

- Reduction of development intensity in urban areas by restricting both building height and the permissible floor space index, implying horizontal expansion of the city, during reconstruction and in the years to come.
- To guide and regulate the city's reconstruction and growth, the government package announced that town planning would be carried out and development control regulations would be revised.

- The package offered plots at specific relocation sites to homes and businesses that wished to relocate from the walled city and to those that would be affected by town planning proposals. Though the sites were not specified, possible locations were indicated based on the availability of vacant government land.
- In the case of Bhuj, the package also specifically mentioned that government properties inside the walled city would be made available for the redevelopment of the walled city. There were special provisions for tenants and unauthorized/illegal settlements.

Reconstruction Activities

The reconstruction process involves a wide range of activities. For the purpose of this paper, these activities have been grouped under the following titles. The next sections analyze the mitigation aspect of each of these activities.

Key activities:

- Mapping and property database
- Preparation of a city-level development plan
- The development of urban infrastructure
- Town planning schemes to redevelop the walled city
- Experiments in community planning, institution building and supporting civil society initiatives.

Mitigation Measures in Bhuj's Reconstruction Activity

This section describes the major activities undertaken as part of the reconstruction process in Bhuj. It also outlines how disaster mitigation concerns have been integrated into each of these activities. Further, this section also attempts to analyze the role of financing methods in decision making.

Mapping and Property Databases

A few weeks after the earthquake, when attention shifted from rescue and relief to rehabilitation and reconstruction, the realization dawned that there were no useful maps of the severely affected towns in Kutch. Base maps available with the City Survey Department were thirty years old and had no information other than property numbers. The process of mapping the city and creating reliable databases for the city went through the following stages in the last two years:

Atlas for Post-Disaster Reconstruction

The activity

As a first step towards planning the reconstruction, IPC and PADCO prepared an Atlas for Post-Disaster Reconstruction to assess damage to buildings. The atlas consists of the cadastral maps of Bhuj, Bhachau, Anjar and Rapar, showing plot-level information on land use, the number of floors, the type of construction, and the intensity of damage. Updating the maps was done using satellite images and data was collected using field surveys. These were prepared and provided as preliminary base maps to the Gujarat Urban Development Company, who in turn provided them to the respective town planning consultants for all four cities. The consultants subsequently prepared more detailed and accurate maps of the above four towns. However, as the mapping, database generation and planning were carried out simultaneously, the atlas was useful in formulating conceptual plans, which were then refined using the detailed maps.

How the activity promotes disaster mitigation

Most cities in the developing world, particularly small towns have no useful maps. The kind of preliminary maps prepared for the atlas are relatively inexpensive, but can go a long way in identifying vulnerability and guiding the preparation of mitigation plans.

How it was financed

Funding for this mitigation activity came from the US-Asia Environmental Partnership (USAEP).

Lessons learned

Such strategic investments by aid agencies can help build the capacity of local agencies to undertake disaster mitigation and thus reduce future aid requirements. It is important to publish immediately such maps in hard and electronic copies to enhance public awareness about the usefulness of such tools. Making such maps publicly available will also help in correcting and updating the maps as people would point out mistakes and shortcomings.

Inventory of Historic Properties

The activity

A mapped inventory of historic properties to guide heritage conservation was prepared for the city of Bhuj alone. The inventory presented a tabular

enumeration of all historic properties in the walled city of Bhuj; a series of maps showing these properties and the type of buildings on them (major monuments, religious structures, institutional buildings, houses, etc.); and a catalogue of photographs to match each entry on the maps.

How the activity promotes disaster mitigation

This overall map helped planners to anticipate problems in networking roads in the walled city, to avoid religious structures, and to acknowledge the historic center of Bhuj as a commercial sector and tourist destination. The maps set a methodological precedent for the future comprehensive listing of buildings that have survived post-disaster demolition, and which could be highlighted in the long term as tourist sites. In fact, the inventory was utilized later to design a heritage walk brochure and a poster on Bhuj heritage (the walk has yet to take off as an activity).

How it was financed

Funding for this mitigation activity came from the USAID FIRE (D) Project as part of the Initiative for Planned and Participatory Reconstruction (IPPR).

Lessons learned

In retrospect, if the heritage inventory and maps had been immediately published, it might have helped save some buildings during the demolition and debris removal process that followed. It might also have helped planners and the public at large to assign cultural values to buildings and places in a more informed manner during the participatory planning process for reconstruction.

Preparation of Detailed and Accurate Base Maps for Bhuj

The activity

The planning area delineated for Bhuj covered 56 square kilometers to accommodate the growth of the city and its suburbs that presently house a population of 125,000. The last development plan for Bhuj was made in 1976. The city had not been resurveyed in the past 30 years. The base maps were outdated and devoid of detail. There were no contour maps (which are needed to plan infrastructure). The entire planning area was resurveyed in great detail with the latest computerized equipment by eight survey teams working simultaneously for two months. These maps show all physical features visible above the ground such as roads, plot boundaries, building footprints, telephone poles, manholes and trees. The survey also generated a

contour map with contours at 0.5 meter intervals. As of today, no city in India has a map of this level of accuracy and degree of detail.

However, when the survey was complete, the planners discovered that the survey results did not match with the official cadastral maps. Matching survey outputs with the 30-year-old official maps and land records of the City Survey Department and the District Inspector of Land Records became a tedious and painstaking task, involving the reexamination of each property record. This activity took an additional four months to complete.

To avoid delays in the planning process, survey outputs were overlaid on the official map and a draft development plan was prepared and published for comment while correction of the official map was in progress. Though this did result in some confusion, it helped speed up the planning process. The new corrected base map was used to modify the draft development plan incorporated citizens' comments and the development plan was finalized. The base map, based on an X-Y coordinate system, provided the basis for implementing infrastructure projects later on.

Later in the process, town planning schemes (land readjustment schemes) were prepared for the walled city. The density of plots compounded the problems (there were 12,000 plots in a 130 hectare area – that is, nearly 100 plots per hectare). It was critical to assess the condition of buildings on a plot by plot basis. The government carried out an official assessment of building condition, categorizing buildings as G0 to G5, with G5 being the most severely damaged category. All buildings officially designated G5 were marked on the base map. However, the official records identified G5 buildings by municipal house number, while the base map had only city survey numbers. The only register that matched city survey numbers with municipal house numbers (the Inquiry Register of the City Survey Department) had old house numbers. The municipality had renumbered the houses, but had not maintained any register that had both old and new house numbers. Therefore the planning team had to carry out its own survey of buildings to be able to make planning decisions.

How the activity promotes disaster mitigation

Detailed and accurate maps of cities are necessary for the following purposes:

- To assess vulnerability to flooding
- To provide a base for seismic/geotectonic and geological studies to assess earthquake vulnerability

- To design city-level rainwater harvesting systems to reduce vulnerability to drought and other problems related to ground water depletion
- To provide the base for collecting and compiling data on housing condition and land use for a multi-hazard vulnerability assessment.

How it was financed

The cost of the survey and base map preparation was integrated into the cost of formulating the development plan (however, the level of effort required to correct the official maps and land records was grossly underestimated). The USAID-FIRE Project played a key role in assisting GUDC with formulation of the Terms of Reference for the town planning consultants – it was the foresight of the FIRE team that led to incorporation of the survey in the TOR. The TOR was subsequently sanctified by the Asian Development Bank's (ADB) approval as part of its reconstruction loan package.

Lessons learned

The importance of accurate base maps for cities cannot be over-emphasized. Usually, no survey is carried out during the planning stage and the preparation of development plans, therefore planners prepare proposals using inadequate information. The cost of carrying out a survey is often seen as unaffordable, whereas the future costs of planning infrastructure with inadequate information is never visible to the untrained eye. A systematic effort has to be mounted to create accurate base maps for all Indian cities without waiting for disasters to strike each one of them. This requires close collaboration between the Urban Development Department and the Office of the Settlement Commissioner, under whom the City Survey Department and the District Inspector of Land Records work. It is also worthwhile considering amendments to law that would make local urban bodies responsible for and the custodians of updated maps and land records. Often cadastral information is maintained by several local agencies on different base maps, making it impossible to relate these maps to each other. Therefore it is important for the main local government agency to create a unified base map with all topographical, cadastral and thematic information and to persuade all agencies to work using the same base map.

City-Level Development Plan

Background – The Reconstruction Strategy

The devastation that occurred in Bhuj, particularly in the old city, was unprecedented in the history of urban India. With no past experience to draw

upon, putting in place a reconstruction strategy required careful thought. In comparison, for rural areas, the experience of earthquakes at Latur and Uttarkashi were available for reference. In the immediate aftermath of the earthquake, the discussion both on the ground and in government revolved around two drastic alternatives – total relocation of the city (“New Bhuj”) and *in situ* reconstruction. There were vocal proponents of both approaches among the public and among government officials. Having carefully considered all options, in April 2001, the government formulated a reconstruction package for the affected urban areas of Gujarat, with separate sections for Bhuj, Bhachau, Anjar and Rapar. As mentioned in the earlier section, one of the key features of this package was the mention of town planning and development control regulations to guide and regulate the reconstruction and future growth of the city.

Not without some hesitation, the Government of Gujarat decided to utilize existing provisions in the Gujarat Town Planning and Urban Development Act, 1976, to undertake preparation of a development plan for the cities of Bhuj, Bhachau, Anjar and Rapar. The preparation, publication, revision and sanction of a city-level development plan normally takes two years at the very least for a city the size of Bhuj. However, in the case of the above four towns, despite the complexities involved, the government achieved this stupendous task in just six months and that too with much greater detail, accuracy and public participation than was ever done before, at least in Gujarat if not in India.

Studies and Public Consultations

The activity

A series of studies were carried out in record time to assess earthquake risk in different parts of the city and its surroundings as well as to provide input into the development plan. These studies included:

- Land suitability analysis
- Demographic studies
- Land market
- Development regulations
- Infrastructure status and needs
- Intensity of damage and seismic vulnerability

- Rehabilitation needs.

GUDC commissioned a study by the Geological Survey of India to assess soil conditions in various parts of the city from the point of view of suitability for foundations of various kinds of buildings. While the scientists broadly categorized the city in terms of good, fair and poor soil conditions, their study could not give concrete micro-level information that could be incorporated into the regulations, nor did the study conclusively rule out development in any part of the city.

“Micro-zoning” was not carried out for Bhuj. It is an exercise that takes a long time and has to be carried out meticulously. The results of a micro-zoning study would probably provide input for the structural design of buildings in specific locations rather than land use zoning in the development plan.

A series of public consultation exercises were carried out in two rounds. The first round of meetings was with opinion leaders and specific stakeholder groups leading up to the preparation of a conceptual development plan. In the second round of consultations, the conceptual development plan was presented at a series of public meetings and group discussions including a city-level workshop with invitees from a cross-section of Bhuj society. In all, over 150 consultation meetings were held and documented. In addition, a household level questionnaire survey was carried out, interviewing 2,500 families and several hundred trade and industrial establishments.

How the activity promotes disaster mitigation

Market forces influencing the planning process in an insidious manner often drive land use planning. In the case of Bhuj, detailed studies provided the basis for the development plan. The conceptual plan was presented to the public, breaking the monopoly on information that usually prevails. It is common for real estate developers to speculate in land based on the proposals of the development plan. In the case of Bhuj, the public consultation process ensured that the opportunity to speculate was eliminated. More importantly, the rationale for the proposed land use pattern is now clearly known to the general public and therefore non-conforming uses that endanger public safety are likely to meet with opposition from concerned citizens. The public consultation process itself informed the preparation of the plan tremendously as people came forward and contributed not just their opinions on the plan, but also their understanding of the ground realities and the history of the city. The process also triggered local initiatives for the development of the city.

How it was financed

“Official” public consultations on the development plan were financed by the GUDC under the ADB loan. However, the stakeholder consultation process was set in motion in Bhuj by the EPC (in collaboration with TCGI) well in advance of the development plan project, through the USAID-FIRE-funded Initiative for Planned and Participatory Reconstruction. The most heartening fact is that the collective thinking process initiated (and still supported) in Bhuj by EPC has since evolved into a local initiative named Bhuj Development Council. It is funded independently by NGOs operating in Bhuj.

Lessons learned

During the consultations, it emerged that public opinion is fragmented on the various issues surrounding reconstruction. There was no strong local leadership. In retrospect, perhaps the government could have spent more effort on proactive consensus building and less on opinion seeking.

Early in the process, EPC had proposed the establishment of a community resource center as a joint effort of the local administration and the planning team or an NGO. The center, as a single window facility, would provide information, assistance and help in consensus building. This is still relevant and should be taken up.

The evolution of the process in Bhuj sufficiently proves the value of investing strategically in kick-starting local initiatives through stakeholder consultations and studies. Once again, the importance of publishing all such material cannot be over-emphasized.

Preparation and Publication of a City Level Development Plan

The activity

Based on responses received during the presentation of the conceptual development plan in July-August 2001, modifications were made, proposals were detailed and the draft development plan was published in September 2001 (under Section 15 of the Gujarat Town Planning and Urban Development Act). The plan was open for comments from the public for two months - until mid-November. Incorporating changes based on public comments on the base map, the plan was finalized in December 2001 and sanctioned immediately by the government (under Section 16 of the GTPUD Act).

Typically, a draft development plan prepared under the GTPUD Act focuses on three components: (1) the road network plan, (2) the land use zoning plan and (3) the development control regulations. These are the three major factors that determine future land values. In the case of Bhuj, EPC with USAID support had already initiated a strategic planning exercise and this was integrated into the development plan. Thus the draft development plan for Bhuj became a comprehensive plan that dealt with the following components:

1. Relocation and Rehabilitation
2. Economic Development
3. Land Development – Land Use Zoning and Development Control Regulations
4. Road Network and Transportation
5. Physical Infrastructure
6. Social Infrastructure
7. Open Spaces, Water Bodies and Environment
8. Heritage Conservation
9. Solid Waste Management
10. Informal Sector
11. Implementation Strategy.

The relevance of the content of each section to disaster mitigation is described below. The gist of the development plan was displayed on a touch-screen info-kiosk placed initially in the office of the Bhuj Area Development Authority. EPC also prepared a booklet on the development plan, but it was never published.

How the activity promotes disaster mitigation

The proposals of the development plan go beyond the exigencies of the post-disaster situation and articulate a vision (that includes public input) for the city. The vision statement of the development plan clearly notes, “Bhuj is equipped to withstand and manage disasters with minimum loss of life and property.” Each component of the plan incorporates some elements of disaster mitigation. A few examples are listed below:

- The section on economic development proposes the development of heritage tourism, thus creating the possibility of investments being

channeled into the retrofitting and conservation of heritage properties in the city. The section on heritage conservation supports this through a preliminary listing of heritage properties and the introduction of heritage regulations. The regulations protect heritage properties and also promote their adaptive reuse through incentives.

- The economic development section also proposes to build on the current strengths of the Bhuj economy and utilize opportunities available to diversify the economic base, so following a disaster there should be multiple economic activities to fall back upon. This is critical for vulnerable regions since loss of economic opportunity cripples an urban population far more than any other loss.
- One of the major causes for the huge loss of life and property in the walled city was the haphazard layout and high density of development. The land development section proposes a more even distribution of development density across the city with job concentrations along major transport corridors, thus ensuring that vulnerability is reduced and land servicing is improved both in terms of access and infrastructure.
- The land development section also proposes a new set of General Development Control Regulations (GDCR). The GDCR is published as a separate document. In September 2001, the EPC had prepared a GDCR tailored to the needs and character of Bhuj. However, in December 2001, when the Government of Gujarat sanctioned the development plan, they changed the GDCR to make it uniform and consistent across Kutch. They followed the same model as in Ahmedabad and ran into serious trouble, then changed it twice. The whole exercise has been fraught with problems. The significant aspects of the revised GDCR are that new structural codes have been introduced; procedural requirements have been made stringent; building height been restricted to ground plus one floor and the floor space index has been restricted to 1.2 outside the walled city and 1.5 inside the walled city. Changes in the GDCR will enhance safety, provided people conform.
- In the twenty-five years following the publication of the last development plan in Bhuj, the city has grown in a haphazard manner with practically no structure in its street network. The new development plan for Bhuj gives the city a structural skeleton of ring and radial roads, creating sectors of approximately one square kilometer in size. This will ensure that even if micro-level town planning is not carried out in the entire city (which should ideally be

done), in a future disaster, every sector of the city should have access to a major road within 500 meters.

- The section on physical infrastructure incorporated a conceptual plan for water supply, sewerage, storm water drainage and solid waste management. This was followed later by the preparation of a detailed design for infrastructure systems by the Infrastructure Design and Supervision Consultants (IDSC).
- The development plan examined the current distribution of facilities such as hospitals, parks and gardens, community centers, libraries, entertainment and shopping facilities, and educational buildings and found that the areas where low income groups lived in slums (30 percent of the city's population) were the least served by such facilities. The plan therefore proposed allocation of land for such facilities in these areas. This is important for disaster mitigation as such places are the first refuge for people needing to turn for shelter.
- Bhuj experiences low rainfall, but is blessed with a bowl-shaped topography with a large city lake (the Hamirsar) at the lowest point, in the center of the city, next to the walled city. The historic rulers of Kutch had established a system of interlinked water bodies and water channels that at one time ensured that even in a moderate rainfall year, the Hamirsar would fill up with run-off from catchments, also boosting groundwater recharge. The section on open spaces, water bodies and the environment proposes the revival of this traditional system, thus reducing vulnerability to floods, drought and problems related to groundwater depletion.
- The section on informal sector deals with perhaps the most neglected sector of urban development in the post-disaster planning and reconstruction effort. The proposals deal with the provision of shelter and physical, social and economic infrastructure for the residents of informal settlements (slums). This is important from the disaster mitigation point of view simply because these people constitute the most deprived and therefore the most vulnerable segment of society.

How it was financed

Even though the ADB urban reconstruction loan was meant to finance urban infrastructure, the terms of the loan included funds for technical consultancy services. The Government of Gujarat utilized these funds for commissioning town planning consultants and infrastructure design and supervision consultants.

Lessons learned

Comprehensive, multi-sectoral plans for the overall development of the city must be made mandatory as a precursor to any major city-level infrastructure development project. The infrastructure plan should follow and be based upon this comprehensive development plan.

The government of Gujarat's decision to revitalize and utilize existing legislation and planning systems rather than create new ones is laudable. However, the Town Planning Act could have been amended to introduce special provisions for disaster-affected areas, changing laws, rules, procedures and conventions to increase speed and flexibility. Such modifications were later introduced for town planning schemes. Following the Hanshin earthquake (1995) in Japan, the Japanese government enacted a "Special Act for Disaster Afflicted Urban Areas" with special provisions for urban planning including the creation of neighborhood committees called Mazikuri for land readjustment projects.

One of the major flaws in the building regulation system is the definition of roles and responsibilities of the professionals involved – for example, architects, structural engineers and clerks of works. These problems have yet to be resolved.

As with the other activities, it is important to widely publicize the planning process to enable meaningful public participation.

The Development of Urban Infrastructure (Physical, Social and Economic)

The activity

Following the sanction of the development plan, the infrastructure design and supervision consultants prepared detailed plans for the city outside the walled city area. GUDC commissioned contractors for executing capital works. The Bhuj Area Development Authority (BHADA) initiated the land acquisition process for major road alignments and other facilities such as treatment plants. The construction of roads, installation of water supply and sewage lines are underway today.

The infrastructure project also includes many public facilities that fall broadly under the category of social and economic infrastructure such as hospitals, town hall, shopping facilities, and educational buildings. While buildings belonging to the municipality are handled through the GUDC, line departments handle other buildings. For example, government schools are being rebuilt by the education department and primary health centers by the

health department. There are also special projects funded by other agencies. The best example is a specialized hospital that is financed by the Government of India from the Prime Minister's Relief Fund. The social infrastructure projects are not limited to reconstruction alone. The reconstruction process is also seen as an opportunity to create new facilities. For example, a new engineering college and a new university are being established in Bhuj.

How the activity promotes disaster mitigation

Infrastructure placement has been designed utilizing existing systems and the topographical features of Bhuj (the accurate surveys helped in ensuring this), reducing capital costs, power consumption and therefore operating and maintenance costs. One of the most important features is that the components of each system – reservoirs, treatment plants and pipe networks have been designed to withstand earthquakes.

The introduction of new social infrastructure also has great value in disaster mitigation. The specialized hospital that is being constructed in Bhuj will become a resource not just for Bhuj, but the entire underdeveloped Kutch region. This hospital has been designed to withstand even severe earthquakes.

How it was financed

The entire urban infrastructure reconstruction program in Bhuj is being financed through the ADB loan. The Government of Gujarat perceives this project as a model for all future urban infrastructure programs in Gujarat. However, the cost recovery policy is still unclear. The terms of the ADB loan played a significant role in ensuring that the new infrastructure is disaster resistant from a multi-hazard point of view.

As mentioned earlier, the social infrastructure has been financed from various sources.

Lessons learned

In the case of Bhuj, the entire reconstruction project is given practically free of cost and is perceived to be the responsibility of the Government of Gujarat. Therefore neither basic costs nor the cost of disaster mitigation is being recovered. In future mainstream projects it would be important to estimate the additional cost of mitigation and include this in cost recovery proposals.

Town Planning Schemes to Redevelop the Walled City

The activity

There was and still is a clear consensus that the walled city needs to be drastically improved. The main requirement is the enhancement of safety and enabling effective disaster management. For this it is necessary to make the street network more efficient and create more open spaces. The existing street network was full of bottlenecks. At the risk of oversimplifying the issue, it can be said that there were two clear options – widen existing main streets or create new streets by using the space created by collapsed buildings.

1. The first option would have meant demolition of large numbers of standing buildings, particularly the thriving market streets that survived the earthquake. This would have resulted in massive displacement of people and businesses (which drive Bhuj's economy).
2. The second option was clearly preferable, not only from an economic point of view but also from a practical implementation point of view. The development plan published in September 2001 proposed that a set of new wide loop roads be created utilizing patches of open land created by collapsed buildings. These roads would give access to markets and the entire walled city, while the market streets could be converted into pedestrian areas. This approach was endorsed by all levels of decision-making from the general public in Bhuj right up to the Chief Minister. However there was and still is, a small group of people who feel that the markets should be demolished and widened, and by not doing so amounts to "being partisan to commercial interests."

There were three options again for realizing the proposed plan:

1. Put "road widening lines" in the development plan and hope that the roads would be created over many years as buildings are rebuilt.
2. Acquire the land and buildings coming encroaching upon major road alignments through the land acquisition process (leaving the rest of the walled city as it is).
3. Reorganize all open plots using the town planning scheme process, improving plot layout and creating new streets.

Since urban renewal in such a complex situation has never been attempted before in India, and perhaps seldom in the world, it was a difficult decision for the government to take. Having evaluated all options, it was decided that the own planning scheme option should be chosen as it would create an

overall improvement and at the same time, spread the burden of land and property loss evenly over all affected properties. Displacement would be minimized.

The town planning schemes, prepared under the provisions of the Gujarat Town Planning and Urban Development Act, go through a three-stage process. In the first stage, known as the draft town planning scheme (completed in August 2002), the Bhuj Area Development Authority prepared and published a plan, sought input from plot owners, revised the plan in response to comments and submitted the draft scheme to the government for approval. After the draft scheme was approved, town planning officers who act in a quasi judicial capacity were appointed. All owners were provided with three rounds of individual hearings before the physical layout, known as the preliminary scheme (being completed now) was finalized. In the third stage, known as the final scheme, financial details such as compensation to be paid to owners and betterment charges to be levied upon them will be finalized.

The basic principle in creating the new streets is to deduct a portion of land from all owners, change the size and shape of their plots, and improve plot layout. In the case of the walled city of Bhuj, to ensure equity and practicality, the following deduction policy was adopted:

Plots less than 30 square meters,	no deduction
30 to 100 square meters	10 percent
100 to 200 square meters	20 percent
200 to 500 square meters	30 percent
More than 500 square meters	35 percent

Standing buildings would be spared from deduction unless they were affected by proposed road alignments. Against every “original plot”, a “final plot” is allotted after deduction. The ownership rights associated with the original plot are transferred to the final plot.

While this workshop was being held, final plots are being handed over to owners. The infrastructure design and supervision consultants have already prepared plans for completely replacing the utility networks in the walled city area and have started road execution.

It is worth noting that the Government of Japan adopted a similar approach to the post-earthquake reconstruction of Kobe. The government first prepared a city-level plan for the major road network and other city-level infrastructure. As part of this plan, they delineated “land readjustment areas”

and formed neighborhood committees known as *mazikuri*. The *mazikuri* were made responsible for taking ownership of the micro-level planning decisions and they were provided the services of town planners to carry out the technical work (physical planning). As in the case of Bhuj, they also ran into serious problems related to inaccurate base maps and outdated land records. The reconstruction process in Kobe is still ongoing, nearly eight years after the quake.

The planning process carried out for the redevelopment of the walled city of Bhuj is perhaps the most complex physical planning exercise ever attempted in India. It has already consumed over 100,000 hours of work by highly qualified professionals using the best available technology, coordinated the work of nearly a dozen organizations and dealt with over 12,000 plots for which over 30,000 persons have ownership claims. What has been achieved is almost unbelievable given the conditions in which the work has been carried out.

How the activity promotes disaster mitigation:

The reorganization of the walled city of Bhuj will result in significantly enhanced safety for residents and visitors. Evacuation of the city in the event of a disaster will now be much faster. The likelihood of buildings crashing on the streets has been minimized. Emergency vehicles can now access the entire walled city area.

The infrastructure systems in the walled city had already begun to deteriorate significantly when the earthquake struck. Significant damage was inflicted by the quake and the movement of heavy machinery for demolition and debris removal. Today it is certain that there are numerous breakages in both water supply and sewer lines and these are practically impossible to trace. There is significant risk of drinking water contamination. There would also be major supply losses due to these breakages. The complete renovation of the system will mitigate such risks.

In most Indian cities, there are areas that are as vulnerable to disasters as the walled city area of Bhuj. Micro-level planning interventions are required in all of them to enhance safety and improve the quality of the urban environment. However, generally, governments hesitate to intervene in such areas, as the task is complex. EPC has in the past prepared “walled city revitalization plans” for the cities of Ahmedabad and Surat in Gujarat, both exercises in collaboration with municipal corporations. However, both plans remain largely on paper, primarily because of this hesitation to attempt such a complex intervention. What has been achieved in Bhuj is proof that such interventions are possible.

How it was financed

Preparation of the town planning schemes and implementation of infrastructure construction are financed through the technical consultancy component of the ADB loan. About 30 percent of the cost is being borne by the Government of Gujarat from its main budget and about 30 percent is being passed on to the plot owners through the levy of betterment charges.

Lessons learned

Town planning schemes are a legislative mechanism with which the government physically reorganizes parcels of land in a given jurisdiction, retaining a small portion of land from each plot to create new streets and open spaces. This is usually done at a city's edge, as a practical maneuver in converting agricultural plots to urban use. But in Bhuj's case, the legislative instrument has been creatively used as a strategy to reorganize the walled city's morphology. The precise significance in its application lies in the fact that a piece of urban legislation has been reinterpreted and grafted – in a rather an unusual manner – to a city's historic core, enabling its post-disaster reconstruction. The essential act of reinterpreting this piece of legislation to suit a post-disaster urban context represents a considerable leap of faith, and demonstrates the potential flexibility of urban regulations as catalysts of reconstruction.

Community Planning, Institution Building and Civil Society Initiatives

In February 2001, soon after the earthquake, EPC established an office in Bhuj in a tent at a relief camp operated by Kutch Nav Nirman Abhiyan (KNNNA), a collective of NGOs operating in Kutch. In collaboration with TCGI and with support from the USAID-FIRE Project, EPC initiated pilot planning work in a project that is known as “Initiative for Planned and Participatory Reconstruction” (IPPR). The IPPR consisted of experiments in participatory planning at three levels – at the regional, urban community and rural community levels. Bhuj was chosen as the site for working with the urban community.

Usually EPC prefers to interact with communities through a grassroots NGO with long term interest in a community. However, initially there was no NGO active in the urban area on reconstruction issues. KNNNA was focused at that time on rural reconstruction. Therefore EPC carried out a series of stakeholder consultations with the urban community in Bhuj, including community groups, representatives of trade and industry, women's groups and NGOs. These consultations led to the formulation of project proposals as well as advocacy initiatives. The following section describes how IPPR

contributed to the statutory development plan. Some other significant activities are mentioned below.

Supporting the Bhuj Development Council

The activity

The Bhuj Development Council (BDC) was a dormant NGO which ten years earlier had initiated city development activities with a vision. After the earthquake, EPC interacted with some of the key people of BDC regularly through the entire planning process. In December 2001, BDC regrouped and became active, initially with a confrontationist posturing. Through sustained interaction, this changed and BDC became the most important civil society partner in the process. EPC provided technical support to BDC consistently for a period of over one year and continues to interact with them regularly.

How the activity promotes disaster mitigation

During the preparation of the Draft Town Planning Schemes for the walled city, BDC set up eight “ward offices” in the walled city, with staff and a computer. The plans were displayed in the ward offices and people were assisted in filing objections and suggestions to the plans. This helped improve the plan.

BDC has a special focus on a neighborhood in the walled city called Soniwad, where the greatest number of people perished in the quake. Through BDC’s efforts, Soniwad people were able to interact effectively with planners to get their area planned the way they wanted.

Today BDC is one of the most important repositories of information, knowledge and understanding both about the reconstruction process and disaster mitigation in Bhuj. They have carried out advocacy on behalf citizens to the government and *vice versa*.

BDC is currently in the process of negotiating with the Bhuj Area Development Authority to set up a city resource center for the continuing reconstruction process.

How it was financed

The technical support provided to BDC by EPC was funded by the USAID-FIRE Project through the Initiative for Planned and Participatory Reconstruction. For other expenses, BDC received grants from the Kutch Nav Nirman Abhiyan, that eventually decided to get involved in urban reconstruction.

Lessons learned

In a process that involves persuading society at large to take decisions that require sacrifices in the present for future benefits, it is important to involve local institutions with a broad vision and a long term stake in the city's development. If such organizations don't exist or the existing ones are weak, then it is worth the effort to support and build them. This pays rich dividends in the long term.

Compiling a Book on the Cultural History of Bhuj

The activity

Through the IPPR project, the EPC is compiling a book on the cultural history of Bhuj. Written by scholars from Bhuj and edited by the author of this paper, the book will showcase and analyze the rich heritage of Bhuj – not just architectural, but a variety of aspects of life in the city. The compilation of the manuscript is well under way. Over 400 old photographs have been collected and annotated; dozens of people interviewed and documents relating to Bhuj's history and culture researched.

How the activity promotes disaster mitigation

Bhuj is a city that has been affected by three earthquakes in recent history: 1819, 1956 and 2001. Each time, Bhuj has risen again. However, this time, there is a great opportunity to make the reconstruction an occasion for retrospection, introspection and forward vision. We believe that disaster mitigation need not be perceived merely as a technical exercise about building better foundations or widening streets. The book, written primarily by the people of Bhuj, hopes to help citizens place themselves in perspective in the continuum of history, understand holistically their identity in the context of the city's identity and envision where they wish to take their city.

On a more mundane note, the book will be a practical resource book for economic development initiatives that focus on heritage and tourism. It will also be of help in identifying and prioritizing heritage properties that need protection against future disasters. The book, it is hoped, will set in motion the process of packaging commercially viable heritage conservation and adaptive reuse projects.

How it was financed

Manuscript compilation has been funded through the USAID-FIRE Project Initiative for Planned and Participatory Reconstruction. Funding for printing and marketing is being sought.

Lessons learned

The book is another example of the convergence of ideas and initiatives by different individuals and organizations in Bhuj. It demonstrates how a small strategic investment by an aid agency can produce tremendous spin-off benefits.

A Musical Concert, the Creation of a Cultural Forum and Establishment of a Cultural Precinct

The activity

Our forays into the architectural and cultural heritage of Bhuj led us to the conclusion that building a serious activity with heritage as focus would require the creation of a platform to bring together the living exponents of the cultural traditions of Bhuj and its region. One of the strategies tried was the organization of cultural programs in locations of architectural heritage value. The first such event was held in “raghunathji no aaro,” a historic lakefront location. A concert of traditional Kutchi music was held there with the active involvement of the Bhuj municipality and the support of the Gujarat State Disaster Management Authority (GSDMA). The municipality helped by cleaning up the ‘aaro,” a 30-foot-wide series of steps leading down to the lake that was turned overnight into an open-air theater. GSDMA contributed money to cover some of the expenses.

Following the concert, there was an upsurge of interest in the concept of cultural heritage. Kutch Nav Nirman Abhiyan pitched in to support the idea. The result was a series of group consultations leading to formalization of a pan-Kutch cultural forum called “Kutch Sanskriti Manch.”

The next stage of proposed activities is the establishment of a cultural precinct at Patwadi Gate, a heritage location in the walled city of Bhuj. There are several heritage buildings close to the lakefront. These include Fateh Mohammed no Khordo, named after a great Kutchi statesman; the Nani ba ni Pathshala, once a poetry school that trained eminent poets of Gujarat, an old courthouse and other smaller buildings, most owned by the government of Gujarat. The EPC has conceptualized a project to turn this area into a heritage/cultural precinct that can house tourism-oriented economic activities such as traditional arts and crafts, facilities for training in traditional music and performance. This is being packaged as a viable public-private partnership.

How the activity promotes disaster mitigation

The Kutch Sankriti Manch is relevant to disaster mitigation in two ways. First, as mentioned in the previous section, there is a need to build on heritage tourism as an economic activity both to protect heritage resources and support the city's economy. Second, for a society to internalize ideas such as planning, mitigation and management, there are no better media than elements of tradition and culture. A facility such as the proposed Patwadi Heritage/Cultural Precinct can effectively showcase heritage and cultural resources and focus attention on the need to conserve them.

How it was financed

The technical support provided by the EPC so far has been a *pro bono* effort. Funding is being sought. KNNA is expected to source funding initially for the activities of the Kutch Sankriti Manch. Eventually it is expected that they will build the capacity to find their own funding.

Lessons learned

The concert at “raghunathji no aaro” was a great learning experience in how people can rally around a simple event and how such events can be leveraged to generate a movement.

Supporting Kutch Nav Nirman Abhiyan in Reviving the Hamirsar Lake System

The activity

In the development plan for Bhuj, the EPC proposed the traditional system of interlinked water bodies and water channels that at one time used to fill Hamirsar Lake. This proposal was inspired by a geologist at Sahjeevan, one of the member organizations of the KNNA. While the development plan was being implemented, Sahjeevan began working on selected channels of the Hamirsar catchments, utilizing leftover funds from a reconstruction project for watershed management structures. HCP Design and Project Management Ltd., a sister concern of EPC, helped Sahjeevan conceptualize a lakefront development project for Hamirsar. Subsequently Kutch Nav Nirman Abhiyan and Sahjeevan along with the Gujarat Institute of Desert Ecology (GUIDE) and EPC conceived a comprehensive project to revive the catchments of the Hamirsar, with multiple components including ecological revival, rainwater harvesting, parks and gardens, and urban design. EPC provides technical assistance in macro-level planning, land inventory, physical planning strategies, project formulation and architectural design.

How the activity promotes disaster mitigation

The revival of the Hamirsar catchments ensures that the lake fills up each year, boosting groundwater recharge. The project expects to achieve ecological restoration in and around the water bodies and other parts of the catchments. An immediate visible impact would be the return of bird life, native and migratory. The project would create multiple opportunities for Bhuj citizens to enjoy the waterfront for leisure, recreation as well as traditional occupations such as *dhobi ghats* (laundry areas designed not to pollute). This would achieve a larger and more important goal of improving the manner in which citizens relate to and value urban water bodies.

How it was financed

The initial explorations by EPC on this subject were part of the development plan project funded by GUDC. KNNa funded internally its own efforts. Sahjeevan (including EPC's and GUIDE's costs) paid for its work from grants received from national and international agencies for watershed management. Ecological restoration projects are being funded through current efforts to conceptualize and plan the project. The Government of India through the Prime Minister's Office will fund the cost of implementing the capital works.

Lessons learned

Again, this is an example of participatory planning and small strategic investments that gradually emerge as independently-funded, significant projects. The importance of involving and supporting local organizations is also reinforced by the experience of the Hamirsar project.

Consolidation of Lessons Learned

Investments in Mapping and Databases

Strategic investments by aid agencies in mapping and databases can help to build capacity in local agencies to undertake disaster mitigation and thus reduce future aid requirements. It is important for the main local government agency to create a unified base map that has topographical, cadastral and thematic information and to persuade all agencies to work using the same base map. It is also important to immediately publish such maps in hard and electronic copies to enhance public awareness about the usefulness of such tools. The cost of carrying out a survey is often seen as too expensive, whereas the future costs of planning infrastructure without adequate information is never visible to the untrained eye.

Stakeholder Participation

The evolution of the planning and reconstruction process in Bhuj sufficiently proves the value of investing strategically in kick-starting local initiatives through stakeholder consultations and studies. However, the Bhuj experience also shows that participation is not only about finding out what people want or giving them an opportunity to decide their future, it is also about proactive efforts to sell ideas, build consensus and involve people in the process. Participation can be made more effective by creating a platform/forum such as a community resource center proposed by EPC. Once again, the importance of publishing material cannot be over-emphasized.

The experience of working with the Bhuj Development Council proves that it is important to involve local institutions with a broad vision and a long-term stake in a city's development. If such organizations don't exist or the existing ones are weak, then it is worth the effort to support and build them.

Planning and Legislative Framework

Comprehensive, multi-sectoral plans for the overall development of the city must be made mandatory as a precursor to any major city level infrastructure development project. It is worth considering the amendment of the town planning act to introduce special provisions for disaster-affected areas and changing laws, rules, procedures and conventions to increase speed and flexibility. The manner in which the town planning scheme mechanism in the Town Planning Act was reinterpreted to suit a post-disaster urban context represents a considerable leap of faith, and demonstrates the potential flexibility of urban regulations as catalysts of reconstruction

The regulation system needs to be thoroughly revamped to better define the roles and responsibilities of the professionals involved and to rationalize building standards. As in other activities, it is important to widely publicize the planning process to enable meaningful public participation.

Design and Pricing of Infrastructure

The Bhuj experience reveals that it is possible to design disaster-resistant infrastructure and that cost is not prohibitive. In the case of Bhuj, the entire reconstruction project is given practically free of cost. In future mainstream projects, it would be important to estimate the additional cost of mitigation and include this in cost recovery proposals.

Investing in Innovation

The book on the cultural history of Bhuj, the concert at “raghunathji no aaro,” the creation of the Kutch Sanskriti Manch and the mobilization of the Hamirsar project are all examples of the convergence of ideas and initiatives

The Reconstruction of Bhuj

by different individuals and organizations. All of these projects demonstrate how small strategic investments in participatory planning by aid agencies can evolve into independently-funded, significant projects.