

Pramod K. Mishra



# THE KUTCH EARTHQUAKE 2001

Recollections, Lessons and Insights

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*Recollections, Lessons  
and  
Insights*

**Pramod K. Mishra**

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# Contents

<i>List of Abbreviations</i>	<i>ix</i>	
<i>List of Tables</i>	<i>xiii</i>	
<i>List of Charts</i>	<i>xv</i>	
<i>Conversion</i>	<i>xv</i>	
<i>Foreword</i>	<i>xvii</i>	
<i>Preface</i>	<i>xix</i>	
<b>Chapter I</b>	<b>Introduction</b>	<b>1</b>
<b>Chapter II</b>	<b>Some Recollections</b>	<b>4</b>
<b>Chapter III</b>	<b>The Aftermath</b>	<b>17</b>
	The State Capital	17
	The City of Ahmedabad	20
	The City of Bhuj and Kutch District	26
	State-level Response	33
	Assistance by the Government of India and State Governments	40
	Assistance by the Domestic and International Community	46
	Damage and Destruction: Magnitude and Spread	51
	Media Perceptions	66
	Some Experiences of the Great Hanshin-Awaji Earthquake (Japan) of 1995	67
<b>Chapter IV</b>	<b>Assessment of Damage and Immediate Needs</b>	<b>69</b>
	Assessment of Damage to Houses	69

	Assessment of Damage by the Joint Assessment Team	74
	<i>Housing</i>	74
	<i>Health</i>	74
	<i>Education</i>	76
	<i>Dam safety and irrigation</i>	76
	<i>Rural water supply</i>	78
	<i>Municipal infrastructure</i>	79
	<i>Public buildings and historic monuments</i>	79
	<i>Power</i>	82
	<i>Transport infrastructure</i>	83
	<i>Telecommunication</i>	87
	<i>Agriculture and livestock</i>	87
	<i>Industry</i>	89
	<i>Service sector</i>	89
	Overall Assessment of Asset Losses and Reconstruction Cost	92
<b>Chapter V</b>	<b>Transition from Relief to Recovery</b>	94
	Shelter	94
	Removal of Debris	100
	Emergency Measures for Social Infrastructure	102
	Creating a New Organizational Structure	103
	Financing of Relief and Rehabilitation Work	104
<b>Chapter VI</b>	<b>Reconstruction and Rehabilitation Policy of the State Government</b>	112
	A Holistic Approach	112
	Components of the Programme	113
	Schemes for Various Sectors	114
	Incentives and Tax Exemptions	116
	Organizational Arrangements	118
	Organizational Structure of the GSDMA	120
	Grievance Redressal Mechanism	123
	Mechanism for Community Participation	124
	Focus on Effective Implementation	124

<b>Chapter VII</b>	<b>Progress of Reconstruction and Rehabilitation Work</b>	126
	Housing	126
	Education	130
	Health	134
	Public Buildings	136
	Rural Water Supply	139
	Power	141
	Roads and Bridges	141
	Dam Safety and Irrigation	141
	Urban Infrastructure	141
	Archives and Monuments	143
	Social Rehabilitation	144
	Livelihood Rehabilitation	144
	Community Preparedness, Capacity Building and Disaster Mitigation	147
<b>Chapter VIII</b>	<b>Some Innovative Aspects of the Reconstruction and Rehabilitation Work</b>	148
	Owner Driven Reconstruction of Houses	148
	House Insurance	151
	Urban Reconstruction	154
	Role of NGOs	161
	Multi-hazard Resistant Construction and Retrofitting	164
	Meeting the Demand for Skilled Masons	166
	Training of Engineers	166
	Revision of Syllabus and Training of Teachers of Technical Institutions	169
	Strengthening of the Regulatory System for Safe Construction	170
	Licensing of Engineers and Certification of Masons	170
	Measures for Long-term Disaster Management	172
	<i>Disaster Management Policy and Act</i>	172



	<i>Establishment of earthquake observatories and accelerographs</i>	173
	<i>Establishment of a Seismological Research Institute</i>	174
	<i>Establishment of the Gujarat Institute of Disaster Management (GIDM)</i>	174
	<i>Review of disaster management plans</i>	175
	<i>Upgrading the emergency response system and search and rescue capability</i>	175
	<i>Community-based disaster preparedness programme</i>	180
	<i>Information, Education and Communication (IEC) activities</i>	181
	<i>Studies on important aspects of disaster management</i>	182
	Social Impact Assessment	185
	A Reconnaissance Survey on Disposal of Debris	185
	Benefit Monitoring	186
	<i>Benefit quantification</i>	189
<b>Chapter IX</b>	<b>An Appraisal</b>	192
	The Devastation: A Glimpse	192
	Some Important Lessons and Initiatives	194
	A Remarkable Reconstruction Programme and its Performance	200
	Some International Experiences and Comparisons	203
	<i>Sharing post-earthquake reconstruction experiences</i>	203
	<i>Some international comparisons</i>	211
	Role of the GSDMA	214
	<i>Relevance of the GSDMA to other states</i>	216
	Consolidation and Sustainability of Initiatives	219
<b>Chapter X</b>	<b>Concluding Remarks</b>	220
	<b>Select Bibliography</b>	224
	<b>Index</b>	226

## List of Abbreviations

<b>ACEO</b>	Additional Chief Executive Officer
<b>ADA</b>	Area Development Authority
<b>ADB</b>	Asian Development Bank
<b>AIIMS</b>	All India Institute of Medical Sciences
<b>AMC</b>	Ahmedabad Municipal Corporation
<b>AUDA</b>	Ahmedabad Urban Development Authority
<b>BAPS</b>	Bochasanwasi Akshar Purushottam Sanstha
<b>BSF</b>	Border Security Force
<b>CAPAM</b>	Commonwealth Association for Public Administration and Management
<b>CBRI</b>	Central Building Research Institute
<b>CDPO</b>	Chief District Project Officer
<b>CEO</b>	Chief Executive Officer
<b>CEPT</b>	Centre for Environmental Planning and Technology
<b>CHC</b>	Community Health Centre
<b>CII</b>	Confederation of Indian Industry
<b>CIRG</b>	Central Implementation Review Group
<b>CRF</b>	Calamity Relief Fund
<b>CRPF</b>	Central Reserve Police Force
<b>CS</b>	Chief Secretary
<b>DDO</b>	District Development Officer
<b>DFID</b>	Department for International Development
<b>DG</b>	Diesel Generator
<b>DM</b>	Disaster Management
<b>DMA</b>	Disaster Management Authority
<b>DOT</b>	Department of Telecommunication

*Abbreviations*

<b>DRM</b>	Disaster Risk Management
<b>DSRP</b>	Dam Safety Review Panel
<b>EGOM</b>	Empowered Group of Ministers
<b>ERU</b>	Emergency Response Unit
<b>FEMA</b>	Federal Emergency Management Agency
<b>FICCI</b>	Federation of Indian Chambers of Commerce and Industry
<b>GCVT</b>	Gujarat Council of Vocational Training
<b>GDCR</b>	General Development Control Regulation
<b>GEB</b>	Gujarat Electricity Board
<b>GEERP</b>	Gujarat Emergency Earthquake Reconstruction Program
<b>GEON</b>	Geosciences Network
<b>GERI</b>	Gujarat Engineering Research Institute
<b>GERP</b>	Gujarat Earthquake Reconstruction Programme
<b>GERRP</b>	Gujarat Earthquake Reconstruction and Rehabilitation Program
<b>GICEA</b>	Gujarat Institute of Civil Engineers and Architects
<b>GIDC</b>	Gujarat Industrial Development Corporation
<b>GIDM</b>	Gujarat Institute of Disaster Management
<b>GIF</b>	Gujarat State Insurance Fund
<b>GIL</b>	Gujarat Informatics Limited
<b>GMDC</b>	Gujarat Mineral Development Corporation
<b>GNFC</b>	Gujarat Narmada Valley Fertilizers Company Limited
<b>GOG</b>	Government of Gujarat
<b>GOI</b>	Government of India
<b>GSDA</b>	Gujarat State Department of Archaeology
<b>GSDMA</b>	Gujarat State Disaster Management Authority
<b>GSFC</b>	Gujarat State Financial Corporation
<b>GSI</b>	Geological Survey of India
<b>GSLDC</b>	Gujarat State Land Development Corporation
<b>GSWAN</b>	Gujarat State Wide Area Network
<b>GUDC</b>	Gujarat Urban Development Company
<b>GUIDE</b>	Gujarat Institute for Desert Ecology
<b>GWIL</b>	Gujarat Water Infrastructure Ltd
<b>GWSSB</b>	Gujarat Water Supply and Sewerage Board
<b>H&amp;EC</b>	Housing and Emergency Communication

*Abbreviations*

<b>HF</b>	High Frequency
<b>HUDCO</b>	Housing and Urban Development Corporation
<b>I&amp;B</b>	Information and Broadcasting
<b>IAF</b>	Indian Air Force
<b>IAS</b>	Indian Administrative Service
<b>ICDS</b>	Integrated Child Development Scheme
<b>IDRN</b>	India Disaster Resource Network
<b>IEC</b>	Information, Education and Communication
<b>IFAD</b>	International Fund for Agricultural Development
<b>IFFCO</b>	Indian Farmers Fertilizer Cooperative Ltd
<b>IIT</b>	Indian Institute of Technology
<b>ILO</b>	International Labour Organization
<b>IMD</b>	India Meteorological Department
<b>INMARSAT</b>	International Maritime Satellite Organization
<b>INTACH</b>	Indian National Trust for Art and Cultural Heritage
<b>IMO</b>	International Migration Organization
<b>IOC</b>	Indian Oil Corporation
<b>KPMG</b>	Klynweld, Peat, Marwick, Goerdler
<b>L&amp;T</b>	Larsen and Toubro
<b>MPLAD</b>	Member of Parliament Local Area Development
<b>NBCC</b>	National Building Construction Corporation
<b>NCCBM</b>	National Council for Cement and Building Materials
<b>NCCF</b>	National Calamity Contingency Fund
<b>NCMC</b>	National Crisis Management Committee
<b>NGO</b>	Non-Governmental Organization
<b>NGRI</b>	National Geophysical Research Institute
<b>NICD</b>	National Institute of Communicable Diseases
<b>NIDM</b>	National Institute of Disaster Management
<b>NTPC</b>	National Thermal Power Corporation
<b>OCHA</b>	Office for the Coordination of Humanitarian Affairs
<b>ONGC</b>	Oil and Natural Gas Corporation
<b>OSOCC</b>	On-Site Operations Coordination Center
<b>PHC</b>	Primary Health Centre
<b>PMC</b>	Project Management Consultant
<b>PMNRF</b>	Prime Minister's National Relief Fund
<b>PPPP</b>	Public Private Partnership Programme

*Abbreviations*

<b>R&amp;B</b>	Roads and Buildings
<b>RAF</b>	Rapid Action Force
<b>RBI</b>	Reserve Bank of India
<b>RCC</b>	Reinforced Cement Concrete
<b>RMC</b>	Rajkot Municipal Corporation
<b>S&amp;R</b>	Search and Rescue
<b>SDRN</b>	State Disaster Resource Network
<b>SEEDS</b>	Sustainable Environment and Ecological Development Society
<b>SEWA</b>	Self-Employed Women's Association
<b>SHG</b>	Self-Help Groups
<b>SMC</b>	Surat Municipal Corporation
<b>SP</b>	Superintendent of Police
<b>SPIPA</b>	Sardar Patel Institute of Public Administration
<b>SSNNL</b>	Sardar Sarovar Narmada Nigam Limited
<b>TCS</b>	Tata Consultancy Services
<b>TDO</b>	<i>Taluka</i> Development Officer
<b>TTI</b>	Teachers' Training Institute
<b>UNCRD</b>	United Nations Centre for Regional Development
<b>UNDAC</b>	United Nations Disaster Assessment and Coordination
<b>UNDP</b>	United Nations Development Program
<b>UNESCO</b>	United Nations Educational, Scientific, and Cultural Organization
<b>UNICEF</b>	United Nations Children's Fund
<b>USA</b>	United States of America
<b>USAID</b>	United States Agency for International Development
<b>VHF</b>	Very High Frequency
<b>WB</b>	World Bank
<b>WCD</b>	Women and Child Development
<b>WFP</b>	World Food Program
<b>WHO</b>	World Health Organization
<b>WIP</b>	Work in Progress

## List of Tables

<b>Table 1</b>	Emergency hospitals	31
<b>Table 2</b>	Personnel in rescue and relief work	34
<b>Table 3</b>	Rescue equipment deployed during the immediate aftermath of the earthquake	34
<b>Table 4</b>	Mobilization of buses for rescue and relief work	35
<b>Table 5</b>	Medical personnel and vehicles	35
<b>Table 6</b>	Distribution of emergency assistance	37
<b>Table 7</b>	Water supply restored in towns and villages as of 19 Feb. 2001	38
<b>Table 8</b>	Police cases filed after the Kutch earthquake	40
<b>Table 9</b>	International search and rescue, and medical teams	47
<b>Table 10</b>	Number of affected districts, <i>talukas</i> and villages	51
<b>Table 11</b>	Severely affected <i>talukas</i> and villages	53
<b>Table 12</b>	Kutch earthquake death toll	56
<b>Table 13</b>	Changes in figures of collapsed and damaged houses over time	58
<b>Table 14</b>	Year-wise aftershocks	59
<b>Table 15</b>	Significant earthquakes that have occurred in India	61
<b>Table 16</b>	Assessment of damage to health facilities and equipment	75
<b>Table 17</b>	Assessment of damage to educational facilities	76
<b>Table 18</b>	Number of public buildings affected by the earthquake	81
<b>Table 18.1</b>	Number of police department buildings affected by the earthquake	81
<b>Table 19</b>	Sector-wise asset losses and reconstruction costs	92
<b>Table 20</b>	Total financial loss	93
<b>Table 21</b>	Plot size and construction area in package 1 meant for relocation of villages	96
<b>Table 21.1</b>	Assistance under package 2 for destroyed houses	96
<b>Table 21.2</b>	Assistance under package 2 for partially-damaged houses	97

*List of Tables*

<b>Table 21.3</b>	Assistance under package 3 for destroyed and partially-damaged houses	97
<b>Table 21.4</b>	Assistance under package 4A for repair and strengthening of non-multi-storeyed residential RCC structures	98
<b>Table 21.5</b>	Assistance under package 4A for repair and strengthening of multi-storeyed buildings	98
<b>Table 21.6</b>	Assistance under package 4B for repair and strengthening of low-rise, load-bearing residential buildings	99
<b>Table 21.7</b>	Assistance under package 5 for repair and reconstruction of load-bearing structure houses in the four towns of Kutch	99
<b>Table 22</b>	Removal of debris by different agencies	101
<b>Table 23</b>	Components and estimated cost of the WB project: Phase I and II	106
<b>Table 23.1</b>	Components and estimated cost of the ADB-funded project	107
<b>Table 24</b>	Estimated overall cost of reconstruction	110
<b>Table 25</b>	Progress of housing reconstruction as of January 2004	127
<b>Table 25.1</b>	Year-wise cumulative progress in housing restoration	128
<b>Table 26</b>	Progress of reconstruction of educational facilities as of January 2004	130
<b>Table 26.1</b>	Year-wise progress of restoration of classrooms (Rural areas)	131
<b>Table 27</b>	Progress of reconstruction of health facilities as of January 2004	136
<b>Table 28</b>	Progress of reconstruction of public buildings, roads, dams and water supply schemes as of January 2004	138
<b>Table 29</b>	Progress in urban infrastructure as of January 2004	143
<b>Table 29.1</b>	Some more aspects of urban infrastructure	143
<b>Table 30</b>	Progress of livelihood restoration as of January 2004	146
<b>Table 31</b>	Progress of activities taken up by NGOs as of January 2004	161
<b>Table 32</b>	IEC activities	182
<b>Table 33</b>	Disaster management capacity building	183
<b>Table 34</b>	Emergency equipment	184
<b>Table 35</b>	Plans and workshops	184
<b>Table 36</b>	Magnitude, death toll and economic loss in the context of some recent earthquakes in different countries	211
<b>Table 37</b>	Reconstruction strategy in the context of recent earthquakes in some countries	211

## List of Charts

<b>Chart 1</b>	Formal and informal organizational interactions for the reconstruction and rehabilitation work	119
<b>Chart 2</b>	Organizational structure of the GSDMA	120
<b>Chart 3</b>	Cumulative progress of repair of houses	129
<b>Chart 4</b>	Cumulative progress of reconstruction of houses	129
<b>Chart 5</b>	Year-wise progress of classroom repairs	131
<b>Chart 6</b>	Cumulative progress in classroom reconstruction	134
<b>Chart 7</b>	Some findings of the benefit monitoring survey	189

## Conversion

1 Crore	=	10 Million
10 Lakh	=	1 Million
1 Lakh	=	100,000



# Foreword

Gujarat earthquake of 2001, measuring 7.7 Mw resulted in colossal loss of life and property. Despite having negative consequences in the form of loss of lives, damage to property, infrastructure etc., it also offered an opportunity to draw lessons, which ultimately helped in formulating forward looking policies pertaining to disaster management in the country, especially related to earthquakes.

In the present book, Dr. P.K. Mishra, the author, former Agriculture Secretary, Govt. of India and presently Chairman Gujarat Electricity Regulatory Commission, made a thorough analysis of each and every aspect of earthquake management; starting from disaster response to reconstruction, rehabilitation and recovery, focusing on lessons learnt and emphasizing on how to improve the system for better results. The book is highly acclaimed not only in disaster management sector, but in other sectors too. The book, in real sense, focuses on lessons learnt from the earthquake, reflecting a common concern in building disaster resilient country and reducing human, social, economic and environmental losses.

First published in 2005, the book continues to be much demand. NIDM is pleased to reprint the book, which will certainly help in further dissemination of knowledge and experience for effective disaster management in the country.



**Satendra**  
**Executive Director**  
**NIDM**

01 September 2012  
New Delhi

# Foreword

The earthquake that shattered the peace of Gujarat on 26 January 2001, and the devastation caused, jolted the nation into recognizing the urgent need for a new and improved approach to managing disasters in India. Though benumbed at the colossal damage to lives, assets and livelihood, the nation quickly rallied behind the affected people to help rebuild lives and the state.

Like every disaster, the Kutch earthquake of 2001 also threw up many issues, concerns and lessons that needed to be learnt so as to not repeat the mistakes. Moreover, each person's perspective in dealing with the disaster varied, throwing up new critical issues. In order to learn from the varied experiences and perspectives, an objective documentation was required so that the lessons learnt in the disaster were not forgotten and the mistakes not repeated in the future.

This book, titled *The Kutch Earthquake 2001: Recollections, Lessons and Insights*, admirably fills up the gap of documentation of the lessons and insights gained by the people who handled the aftermath of the disaster. The book is not only about mere recollections of the disaster but effectively pinpoints the strengths, lacunae and new initiatives taken in the aftermath of the disaster. Being in the forefront of all the initiatives, covering a gamut of issues, from setting up a new and improved institutional mechanism to ensuring adequate community participation, the author's diverse experience has brought out the best of administrative and academic expertise gained in the field.

This book will be very helpful for disaster management professionals, governments, researchers and students in this field, as well as multilateral and bilateral agencies and policy makers.

NIDM is happy to publish this comprehensive document, which I trust, will guide us to learn our lessons well and lead us to be a better prepared and more resilient nation.

**S.P. Gaur**  
**Executive Director**  
**NIDM**

14 January 2005  
New Delhi

## Preface

Major disasters occur time and again, necessitating emergency measures. Comprising success stories as well as failures, these relief and reconstruction measures hold valuable lessons for the future. However, much of the experiences, insights and lessons are lost as time passes because they are not documented in a way that can be retrieved and utilized when needed.

The Kutch earthquake of 26 January 2001, was one of the most severe disasters in recent times. In spite of the immediate sense of shock, confusion, helplessness and grief, the government and the community rose to the occasion and quickly responded to the event that had overwhelmed them. The scale of the rescue and relief operation was unprecedented. In the days and months that followed, a holistic and comprehensive reconstruction and rehabilitation programme was put in place. A new organization, the Gujarat State Disaster Management Authority (GSDMA), emerged. Its performance was widely acclaimed both nationally and internationally. The GSDMA received the prestigious Sasakawa Award Certificate of Merit from the United Nations and the Green Award from the World Bank. It also received a Gold Award, the highest award of the Commonwealth Association for Public Administration and Management (CAPAM) for ‘Innovation in Governance’.

Numerous reports and documents on the Kutch earthquake have appeared in recent times. Some of them are in the nature of a reconnaissance survey. Others are merely technical reports. Some also focus on the achievements of particular organizations. There are, of course, press reports, some of which are highly critical.

This book tries to revisit the first few hours, weeks and months after the earthquake. It describes how the stakeholders and the system responded

to the challenges despite many constraints. It analyses how a comprehensive and all-encompassing reconstruction programme was conceptualized, formulated and implemented. An attempt is also made to objectively appraise the performance during the period of three years from January 2001, in an international context. The focus is on both the quantitative and qualitative aspects. The idea is to document important aspects and initiatives for future reference. Chapters I, II, IX and X together provide a glimpse of what this book tries to address.

About a year after the earthquake, a workshop was organized in Ahmedabad to enable some key functionaries and non-governmental organizations (NGOs) to describe how they felt and responded during the immediate aftermath of the earthquake and to draw lessons for the future. Chapter II contains the descriptions given by 11 individuals who were working in the government (at district, state and national levels), with NGOs or with professional associations. I thank all of them for sharing their experiences.

During the first three years after the earthquake, many presentations on the progress of relief and rehabilitation work were made on various occasions and at different forums. Officers of the GSDMA, particularly, M. Sahu, V.S. Gadhvi, V. Thiruppugazh and a few young executives, made sincere, dedicated and innovative efforts in this regard. A lot of work was done by the Tata Consultancy Services (TCS), which was engaged by the GSDMA to outsource certain activities in preparing reports, documents and presentations. A number of reports were thus prepared from time to time. The KPMG also undertook a benefit-monitoring study. I have drawn extensively from all these documents and reports, in addition to my own experience as CEO, GSDMA, from March 2001 to May 2004.

Santosh Kumar, Professor of Disaster Management, National Institute of Disaster Management (NIDM), New Delhi, offered not only useful comments on an earlier draft but also gave me tremendous encouragement. Madhavan Nambiar and S.P. Gaur, former and present Executive Directors of the NIDM, showed immense enthusiasm for the publication of this document.

L. Mansingh, who was Chief Coordinator of Relief Operations, Kutch, had prepared a report on the rescue and relief work in Kutch district during the first few months after the earthquake. Divay Gupta of the

Indian National Trust for Art and Cultural Heritage (INTACH) provided a brief note on damage to heritage structures. Krishna S. Vasta had prepared a paper containing an international comparison of earthquake reconstruction work in selected countries. I have drawn material from these reports.

M. Srikant and Aparna Sonwane of TCS helped me in preparing a number of tables and charts. P.R. Sompura and J.G. Pandya made available data from various sources. Hemang Jani made useful comments on an earlier version of the manuscript. Madhuchhanda Mishra suggested some improvements in the introductory chapter. K.S. Sugathan, Sankabhai Patel and L.G. Ambujakshan in Gandhinagar; and Satnam Kaur and Sanjay Raghuvanshi in New Delhi, provided typing and related assistance.

I thank Leela Kirloskar who edited the manuscript and Arvind Passi of Magnum Publishing, who contributed with publishing inputs.

I am indebted to the above institutions and individuals who contributed directly and indirectly to this work. However, any error of analysis or interpretation remains entirely my responsibility.

This book contains recollections, descriptions and some analyses. I would be grateful if readers could offer their comments and suggestions which will be extremely valuable and useful for a more comprehensive documentation.

Just before this book went to press, on 26 December 2004, a massive undersea earthquake triggered a Tsunami—the deadliest in living memory—that devastated the coastline of many countries in Asia and Africa including Indonesia, Thailand, Sri Lanka and India, causing the deaths of over 150,000 people, leaving millions more homeless.

The lessons and insights described in this book become extremely relevant to the present situation. Even though the nature and geographic location of the impact of the Tsunami tragedy are different from those of the Kutch earthquake, the basic approach and strategy are relevant to the reconstruction and rehabilitation efforts that will require a tremendous amount of resources, initiatives and innovation.

**Pramod K. Mishra**

New Delhi

12 January 2005



# I | Introduction

Friday, 26 January 2001, was a calm and bright winter morning. I was Principal Secretary, Agriculture at that time. I had just switched on the television, at my residence in Gandhinagar, to watch the national programme on the Republic Day parade in New Delhi, which had already commenced. Hearing some rattling sounds from the windows, I went into the drawing room and saw that flower vases and other household paraphernalia were shaking. The floor began to heave in an alarming way. I realized that it was an earthquake and told my wife to come out of the house with me immediately. We rushed to the garden and stood there on the lawn. The earth continued to heave and move for quite some time. We thought that it would be over in a few seconds but the ground beneath our feet felt as if it was alive, moving and shifting like a huge animal. It was difficult to keep one's balance while the ground was undulating like an enormous wave.

Our car was parked in the driveway, hardly 10 feet away from us. It kept moving back and forth, as if a giant hand was pushing it. It was a sight I cannot forget: a static car moving alternately in opposite directions. This continued for less than two minutes but it felt like eternity. Then, it finally stopped.

I went inside the house 10 minutes later and called a senior officer of the India Meteorological Department (IMD), New Delhi at his residence. He told me that he was about to start for his office to analyse the data received and to check on the magnitude of the earthquake.

The earthquake occurred at 8.46 a.m. and lasted for 110 seconds. The Republic Day parade in New Delhi had already commenced. At the state capital and at district headquarters, flag-hoisting ceremonies were



yet to begin. Some people were watching the programme on television. Many others were on their way to, or at the venue of local programmes. School students were participating in processions in some areas, and many had gathered to hoist the national flag at other places.

As the earth shook, some people understood that it was an earthquake; many others did not comprehend what was happening. Within minutes, however, everyone realized that an unusual event had taken place. People, including those holding public offices, had to respond. They did so with alacrity.

Over three years have elapsed since then. Those initial moments of shock and surprise gave rise to a sense of grief and loss—loss of near and dear ones, as well as of all that many people had. Not only were the people affected but so was the system. Both the private as well as the public sector were stunned and overwhelmed during the first few hours and even days. Subsequently there was a perception of failure, particularly in the media, and a phase of blame game and acrimony.

But the system had its strengths, people their resilience and the society its compassion and benevolence. Rescue and relief operations were undertaken on a massive scale. The transition from relief to reconstruction was brief. A holistic and comprehensive reconstruction and rehabilitation programme—possibly the largest ever introduced—was put in place within a short time.

The spectacular progress of implementation of the programme, in terms of its size and quality, was widely acclaimed by international experts and multilateral agencies. The GSDMA received the Sasakawa Award Certificate of Merit in October 2003, based on its performance during a short period of two and a half years. In April 2004 it also received the Green Award from the World Bank for incorporating and effectively implementing environmental aspects with the reconstruction efforts. On 27 October 2004, an international conference with about 400 participants was held at Singapore. Here, the GSDMA received the Gold Award, which is the highest award of the CAPAM for 'Innovation in Governance'. The award committee observed that the massive earthquake rehabilitation and reconstruction programme was a paradigm shift from the conventional

approach of response, post-disaster mitigation and preparedness. Each of the various initiatives like the owner-driven reconstruction programme, the role and involvement of community, the transparency and equity procedure, and various capacity-building initiatives taken up during the programme was regarded as innovation in governance by itself.

This book attempts to revisit the first few hours, weeks and months after the massive Kutch earthquake of 2001. It describes how the system—the government, the people and the society—tried to cope with one of the most severe disasters in recent memory. It is a story of how, in response to one of the greatest challenges of our time, a holistic reconstruction programme was conceptualized, formulated and implemented. There are many lessons and insights for the future. There is a need to improve upon our practices, procedures and preparedness on a sustainable basis. Needless to say, it is a saga of a journey from a perception of failure to a reality of success.

## II | Some Recollections

The response of a system or organization depends a great deal on how the persons concerned respond to a situation. The present chapter briefly describes how some of the key functionaries felt and responded during the first few minutes and hours of the earthquake. This can provide a backdrop and some insights to understand how the administration responded during the immediate aftermath of the devastation.

### ***B.R. Patel, Director of Relief, Revenue Department, Gandhinagar***

B.R. Patel, who was on the parade ground, felt the earth shaking alarmingly. Without wasting a second, he rushed to the state control room of the Revenue Department located in the Sachivalaya premises at Gandhinagar. He reached there at about 9.05 a.m. and had it opened. He then sent for officers and staff and contacted a senior officer of the IMD, who had already left for his office in New Delhi. In the meantime, senior officers, including the Commissioner of Relief and Principal Secretary, Revenue, reached the control room. The control room (emergency operations centre) became operational by 9.30 a.m.

The Collector of the Sabarkantha district was the first to call the control room and say that the situation was under control and that there was no need to worry. The Collector of Patan also provided the information that the town of Bhachau in Kutch district was destroyed and that about 4,000 people had died. Based on this assessment, it was estimated that thousands more could have perished. Districts such as Sabarkantha, Panchmahals, Mehsana, Gandhinagar, Kheda and Anand were each asked to send 50 truckloads of firewood and 50–60 water tankers to the affected districts. Mother Dairy was requested to supply milk.

The satellite telephone in the state control room was used to try and contact Bhuj. Some time later, probably less than an hour after the earthquake, the telecommunication system in the Gandhinagar and Ahmedabad area broke down. In addition to the complete breakdown of the landline telephone system, cellular networks also collapsed. Communication, even between Gandhinagar and Ahmedabad, became impossible. Initial communication between the state control room and Bhuj indicated that the situation was serious. By 11.30 a.m., it was clear that the Bhuj area had been completely devastated by the earthquake. Information also trickled in from sources other than the official channels. Some senior officers who had worked in Bhuj earlier, received information from various sources regarding the devastation.

Prior to receiving information on the massive scale of destruction in Bhuj, the state control room received information from nearby districts such as Sabarkantha and Patan, on the impact of the earthquake in those districts. In fact, the District Collector of Patan informed the state control room that Kutch had been severely affected. Injured people from the areas of Kutch close to the Patan district had started coming to the nearby towns.

In a short time, many senior officers reached the state control room and offered their services for emergency duties.

Search and rescue operations need a large number of equipment such as bulldozers, cranes, and concrete cutters. Efforts were made to mobilize such equipment from any sources that were available.

### ***C.K. Koshy, Principal Secretary, Revenue Department***

While Koshy was hurriedly eating breakfast so that he could leave in time for the Republic Day parade, he felt the earthquake. He and his wife rushed out of the house. Koshy then got into his car and left for the parade ground. When he reached the parade ground, a senior officer informed him that the Chief Secretary had left a message for him to go to the control room. So he literally turned around, got back into the car and drove to the control room. He reached the control room within 15 minutes after the earthquake had stopped. He tried to contact the IMD for more

details and was told that it was somewhere in Kutch. The most useful piece of equipment was the satellite phone backed by the police wireless. In the beginning, small glimpses of the magnitude of the tragedy started coming in sporadically and in fragments.

***Kamal Dayani, Collector and District Magistrate, Kutch***

At about 8.45 a.m., Dayani was at Ummad Bhavan (the government circuit house) to receive Sureshchandra Mehta, Minister of Industry, for the Republic Day function scheduled at 9 a.m. at the police ground, Bhuj. Suddenly, he heard an unusual sound from the floor of the building and the rattling noise of glass breaking. He did not know what was happening.

Along with the Minister, he rushed out of the circuit house. They thought it was a terrorist attack on Republic Day. Then they saw some parts of the building falling down. People outside the building were saying that it was an earthquake. This is when he realized what was happening.

He, along with the Minister, rushed to the police ground. On the way they could not gauge the magnitude of the tragedy. When they arrived at the police ground, there were only a few people who had gathered, so they had a symbolic flag hoisting. Then they went to the Civil Hospital as it was reported that people were rushing to the hospital. They discovered that the Civil Hospital had collapsed. Then he rushed to the Collectorate to instruct his assistant to set up the satellite phone, as all the landlines and mobile phones had stopped working.

Then, along with the District Development Officer (DDO), he went to the army hospital and advised the medical officer in charge to receive casualties and mobilize their staff in large numbers. By the time he came out of the army hospital, he found that people had started arriving there with the injured. As it was a small hospital, it was soon overwhelmed. Consequently, it was decided to start a medical camp at a bigger place. Jubilee Ground was selected for the purpose and the Chief District Medical Officer was asked to liaise with private doctors of the town.

Dayani returned to the Collectorate. The Minister and other officials had already informed the Chief Minister and other senior officers in Gandhinagar about the occurrence of the earthquake. Soon after, it was



**Damaged office of the Collector and District Magistrate at Bhuj**

impossible to communicate with the state capital as all communication systems broke down. The magnitude of the tragedy was yet to be known because of the disruption of communication with other towns of the district. They believed that only Bhuj town had been affected.

In a short time, people started coming from various parts of Bhuj asking for help to rescue their near and dear ones from the rubble. The Collector and other officials felt helpless, as they did not have any means with them except to console the people and assure them that they were mobilizing manpower and machines for the purpose.

The Collector, the Superintendent of Police (SP) and the Executive Engineer, Roads and Buildings, decided to mobilize equipment such as excavators, cutters and dumpers through civil contractors. It was not easy to get such equipment quickly because the owners of the equipment were themselves affected and it was difficult to locate drivers for vehicles to move the equipment. The executive engineer could only arrange limited equipment.

More people started arriving at the Collectorate and at the office of the SP, asking for help to rescue their relatives. Even with a limited number of machines and equipment, teams were sent along with the people who had come for help. Thus, the rescue operation commenced though totally inadequate, given the magnitude of the tragedy. There were too many suggestions from too many people. Dayani felt that in spite of great efforts by the administration, nothing concrete was visible. Initially, people were helping themselves and their communities.

After some time it was decided to send two senior officers to Gandhidham and Mundra which are port cities of the district to bring more equipment for rescue operations. Gradually, information started trickling in that other towns of the district such as Anjar, Bhachau and Gandhidham and many villages were affected. Based on such information, senior officers were sent to those towns for coordinating the work of local officers.

Since the power system had failed they decided to procure generator sets for the purpose of lighting, especially for the places where medical camps had been organized. Petrol/diesel outlets were not functioning

because of the lack of electricity. It was difficult to locate the owners of these outlets. Some petrol pumps were operated manually. By the evening, electricity had been arranged at some places. The mercury was dipping as time passed. People were demanding tents for temporary shelter. Most people spent that cold night of 26 January 2001, under the open sky.

The next day, more officials and others arrived at Bhuj to extend their help. People who had been affected continued to gather near the control room, asking for rescue teams. The Collector and other officers were helpless because of the dearth of trained people with equipment such as concrete cutters and gas cutters. Yet, sincere efforts were made to carry on rescue operations with whatever resources that were available. Efforts were also directed to other functions such as provision of food, medical services, transportation, electricity and temporary shelters. Medical teams that started arriving from other parts of the state were deployed at various places.

On the third day, rescue teams from various countries and international organizations started arriving. They were very well equipped and self-sufficient. There was great demand for such teams.

Communication was still weak. Damage to the Surajbari Bridge disrupted road communication. However, the airport, in spite of some damage, remained functional. This facilitated the flow of supplies from various parts of the country and abroad.

### ***Vivek Srivastav, SP, Kutch***

Vivek was in the police parade ground in Bhuj when the earthquake occurred. The parade was scheduled to be held at 9 a.m. Suresh Chandra Mehta, Minister of Industries, and the Collector, were yet to arrive. He found it difficult even to stand. Some people fell on the ground. The police headquarters collapsed with an explosion of dust. People started moving away from the parade ground. The electricity went off and mobile phones stopped working. People were told that it was safest to stay on the parade ground. Meanwhile, the Minister as well as the Collector arrived for the function. Seeing the seriousness of the situation, it was decided to limit the Republic Day programme to only hoisting the national flag and



singing the national anthem. The Minister returned to the Collectorate after attending the brief function.

The Collector and the SP decided to briefly survey the town. They observed that the entire walled city was a heap of rubble. They walked around the devastated area for some time and even saw some limbs in the debris. When they went back to the Collectorate, they found that the first floor had collapsed. They decided that the SP would handle the search and rescue operations, and that the Collector would focus on relief and supply. A wireless set was installed in the district magistrate's office to communicate with the police control room.

The SP then visited the circuit house, the Collector's residence and his own residence, all of which had been severely damaged. When he reached his own office, he saw that the first floor had collapsed and the ground floor had many cracks. Immediately, the Very High Frequency (VHF) set in the control room was removed, placed on a table outside and a temporary control room was set up in the open. Similarly a High Frequency (HF) set was brought out to communicate with Gandhinagar. A message was dispatched at 9.15 a.m. to Gandhinagar giving the details of the destruction, which would however, take a few hours to reach.

In the meantime, people began pouring into the Collector's office and the SP's office, asking for help. The Additional Superintendent of Police was sent to the Brigadier to arrange for help from the army.

At Jubilee Ground, a tent had been erected and doctors were already working—all this within two hours of the incident. As there was a dearth of medicines, a team of police officers was sent to break open the chemists' premises and procure any medicines that were available.

There were many dead bodies. A decision was taken to dispense with the *panchnama*. A police officer and a revenue officer were posted at every cremation ground so that they could take down the names of the dead bodies brought there, along with the names of two witnesses. A detailed investigation would be undertaken later.

Information on damage in other areas of the district also started coming in. A community kitchen was started on the police parade ground by the police families because all the houses on the police line had collapsed.

***Himanshu Bhatt, Additional Superintendent of Police, Kutch***

Bhatt was in his vehicle when the earthquake occurred. After the parade, he was sent as an emissary to the army camp. He met the Brigadier who was in his garden and requested him for immediate help. Without insisting on any formality, within 45 minutes, a platoon was sent to the SP's control room. Thus, personal interactions helped. On his way back he met Rajiv Topno, the DDO. They visited some parts of the city and Jubilee Ground, and identified areas for people to assemble.

At around 6 p.m., a commando requested Bhatt to permit him to go to his house to check on his family. Bhatt accompanied him and was happy to learn that the commando's family was safe and sound.

***Rajiv Topno, DDO, Kutch***

When the earthquake began, Topno was in his car which was quite old and dilapidated. Initially, therefore, when his car started shaking, he did not understand what was happening. He instructed his driver to pull the vehicle over to the side of the road to check. The driver replied that there was nothing wrong with the car and that the ground itself was shaking. Topno then saw the police headquarters building adjoining the road shaking with a loud rumbling sound. People were running helter-skelter, desperate to reach the safety of open ground. The tremor was succeeded by a deathly silence, which lasted for over 10 seconds followed by the desperate cries of anguish as people tried to extricate themselves from the debris amidst the billowing clouds of dust. It was 8.50 a.m. when Topno finally made it to the parade ground.

Pandemonium reigned supreme in the parade ground. Topno immediately headed back to the city and towards the District Panchayat premises. The entire three-storey administrative block, which also housed his chamber, had collapsed. The remaining two blocks looked as if the slightest push would send them tumbling over. The employees were huddled together, incoherent but safe. After instructing them to look for the Chief District Health Officer, he left for his bungalow, meandering through the rubble-strewn street.

Topno was relieved to see that his wife was safe and sound but his house was in shambles. Blocks of masonry had fallen outwards and the roof was precariously balanced. Scrambling through the rubble, he managed to collect some clothes and items of daily use but did not have the courage to fully inspect the damage inside.

As he stood by the entrance to the bungalow, he saw a man of about 35 years of age, pulling a hand-cart loaded with the mangled and bloody remains of what must have been his family. Seated on the cart was also a small girl, presumably his daughter, seriously injured and crying uncontrollably.

After some time, he reached the collectorate. The buildings were in shambles and people were milling about the premises. The enormity of the catastrophe and the situation made it difficult for the Collector, the SP and the DDO to determine a course of action immediately. They felt that no amount of training would have prepared them for tackling a situation where the administrative machinery of the district itself was affected. It was decided then and there that the police would take up the task of rescue operations and the revenue and *panchayat* administration would concentrate on providing medical assistance and relief.

The military hospital was the only functioning medical facility in the vicinity which was soon overwhelmed by the deluge of dead, dying and injured persons. Fortunately, by 11 a.m., a few enterprising private doctors had begun medical relief activities at an open ground which later became famous as Hospital Ground. Though there was only a ramshackle hut, the doctors there continued their efforts with whatever little equipment and medical supply that was available. The district administration also concentrated its efforts to provide medical supplies. Medical stores were opened and supplies diverted to the ground. A team of runners was deployed to obtain the supplies from the *panchayat's* medical store near the Ayna Mahal area, one of the worst affected parts of the city. Soon, the parade ground became the centre of medical relief and became a full-fledged field hospital. Topno left the area at about 4 p.m.

It was only at about 5 p.m., when he was trying to review the intermittent damage reports pertaining to the rural areas at the district

panchayat office, that he received the news that most parts of Gujarat had been hit by a severe earthquake and that Kutch had been severely affected. Upon meeting the Collector he was given the encouraging news that relief materials were being dispatched to Kutch. They then proceeded to the field hospital, which by then had stabilized.

The air was thick with the smell of burning flesh and smoke. By 7 p.m., temporary lighting arrangements were provided to the hospital ground and new teams of doctors had arrived.

It was about midnight when he reached the *taluka panchayat* office after obtaining a cardigan from his wife, awaiting the relief truck which had been dispatched, accompanied by some of his employees. The night was bitterly cold as he lay huddled in his vehicle trying to grab some rest, but sleep was elusive and his thoughts were racing. He realized how fortunate he was to have survived this cataclysm but was apprehensive of the coming days. Then the first truckload arrived. It was 4.30 a.m. and another day had begun.<sup>1</sup>

### ***M. L. Chandana, Civil Surgeon, Bhuj***

Dr Chandana was at the police parade ground at the time of the earthquake. When he returned to the district civil hospital, the building had already collapsed. Eleven staff members and 182 patients including their relatives (attendants) had died. All the staff members present were stunned and crying. In a few minutes, however, they started the rescue work. The SP and the Collector also visited the hospital. In spite of the tragedy, all the surviving staff members, as well as others, continued to do what they could to help. Within minutes of the earthquake, about 500 patients arrived at the hospital campus. It was decided to transfer the patients to Jubilee Ground, Leuva Patel hospital, the Jain hospital and the military hospital. Doctors were also made available at these hospitals. Since the medical store was not affected, medicines were made available to the above hospitals. Within a few hours, 22 patients were sent to Ahmedabad in four ambulances.

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<sup>1</sup>This is based on a note prepared by Rajiv Topno describing his experiences on the day of the earthquake.

***G. Rao, Practising Surgeon, Bhuj***

By 9.30 a.m. survivors of the earthquake started arriving. Dr Rao reached Jubilee Ground. Patients started arriving in large numbers with multiple injuries like broken limbs, lacerated legs and burst abdomens. By 10 a.m., suturing materials were brought from Dr Rao's hospital, which had not been damaged. First-aid and preliminary treatment commenced soon thereafter. By 2 p.m., a tent was erected, anaesthetists were made available and surgeries started, which continued over the following four days.

The next day, i.e., 27 January, many medical teams joined in the relief efforts at Jubilee Ground and thousands of patients were attended to. The approach was to provide first-aid, ensure sterilization and transfer the patients. Facilities at Jubilee Ground continued to improve. On 28 January, a semi-permanent structure for a hospital at Jubilee Ground was proposed. On the same day, a mobile hospital from Israel was set up on the ground of the Kutchi Leuva Patel Samaj. On 29 January, the decision was taken to construct a pre-fabricated structure for the hospital. The Syntex Company was asked to execute the work. By the afternoon of 3 February 2001, the first block of the pre-fabricated structure of the hospital was made functional with all the necessary equipment.

***Janak Dave, BAPS, a Non-Governmental Organization(NGO)***

As soon as the earthquake occurred, Pramukhswami instructed Sadhu Brahmavihari Swamy to rush to Kutch with at least four truckloads of the following provisions: one with mineral water; one with milk powder, tea, and coffee, the third with blankets and shelter materials, and the fourth with a generator and diesel. All these were sent on the first day itself. By 1 p.m. on the first day they could serve cooked food to 4,000 people and at night, to 20,000 people.

***M. F. Dastoor, Divisional Fire Officer, Ahmedabad Municipal Corporation***

Dastoor was at the police stadium preparing for the Republic Day parade. As soon as the earthquake occurred, he left the stadium and went to the headquarters. The first call he received was at the police stadium

from a fellow officer of the municipal corporation informing him that two buildings had collapsed right in front of his house. He took the required equipment with him, including two new rescue vehicles which had been recently procured. There were many calls the whole day.

In the evening they were called to help demolish the Shradha apartment building. They realized that the search operation here had not been effective. Since the ceiling of the second floor was just two feet above the ground, they were able to dig only a small hole. Searching further, they retrieved the body of a boy crushed between concrete structures. After removing the body, they heard the groan of his mother. One rescuer sat inside a small hole, used a rocking hammer and cut open five beams under the concrete structure, which took 10 hours. The operation had started at 8 p.m. and continued till the woman was rescued at 6 a.m. the next day. At the hospital, three of her limbs had to be amputated; she survived for just a week.

***Anil Sinha, Additional Central Relief Commissioner, New Delhi***

Sinha was at his residence in New Delhi when he felt the earthquake. He saw people rushing out of the neighbouring houses. He got in touch with the Deputy Director of the IMD and asked what had happened, who in turn reported after some time that a major earthquake had occurred near Ahmedabad. The National Crisis Management Committee (NCMC) met at 3 p.m. In the meantime, the Cabinet Secretary had already interacted with several secretaries, asking them to mobilize resources. From the meeting, Sinha went to the airport. When he reached there at 5.30 p.m., he found that about 30 doctors from the All India Institute of Medical Sciences (AIIMS) and Safdarjung Hospital had gathered. All of them reached Bhuj around 8.30 p.m. About two hours elapsed by the time they reached the Collectorate, because it took some time to get a bus to travel from the airport to the Collectorate. The Collector was working under a tree. They also met G. Subba Rao, Additional Chief Secretary and Ashok Bhatt, Minister of Health. The doctors who were accompanying Sinha had brought some medicines and equipment but they were not equipped for their own needs. This created logistical problems. Sinha slept in a car for a few

hours during the night. He returned to Delhi the next day for the meeting of the NCMC and gave them a first-hand account of the situation in Kutch. It was the first time a clear picture of the disaster, its enormity and severity, had been reported.

## III | The Aftermath

### The State Capital

In Gandhinagar, senior officers were present at the venue of the Republic Day parade. The flag-hoisting ceremony was completed quickly. News about the collapse of buildings in Ahmedabad had started trickling in. Keshubhai Patel, Chief Minister of Gujarat and other senior officers went to the police control room at the office of the Commissioner of Police, Ahmedabad. On a holiday it would have taken quite some time for senior officers to assemble at a place consequent upon such an event. This problem did not arise because many of them were already present at the parade ground.

It was reported that a large number of buildings—including high-rise ones and those with reinforced concrete frames—had collapsed in Ahmedabad city, about 250 km from the epicentre. Some buildings collapsed in Surat city about 340 km from the epicentre. There were reports of deaths and destruction from Surendranagar, Patan, Jamnagar and Rajkot. The district of Kutch was completely devastated. Some parts of Banaskantha were also affected. There were also reports from other places like Anand and Bhavnagar. The impact of the earthquake was even felt in distant locations such as Kolkata and Delhi.

The Chief Minister decided to send a team of senior officers headed by G. Subba Rao, Additional Chief Secretary, Finance Department, to Bhuj. They left for Bhuj at 2 p.m. Ashok Bhatt, Minister of Health, and a team of doctors also left for Bhuj. The state plane and the helicopter were deployed for their use.

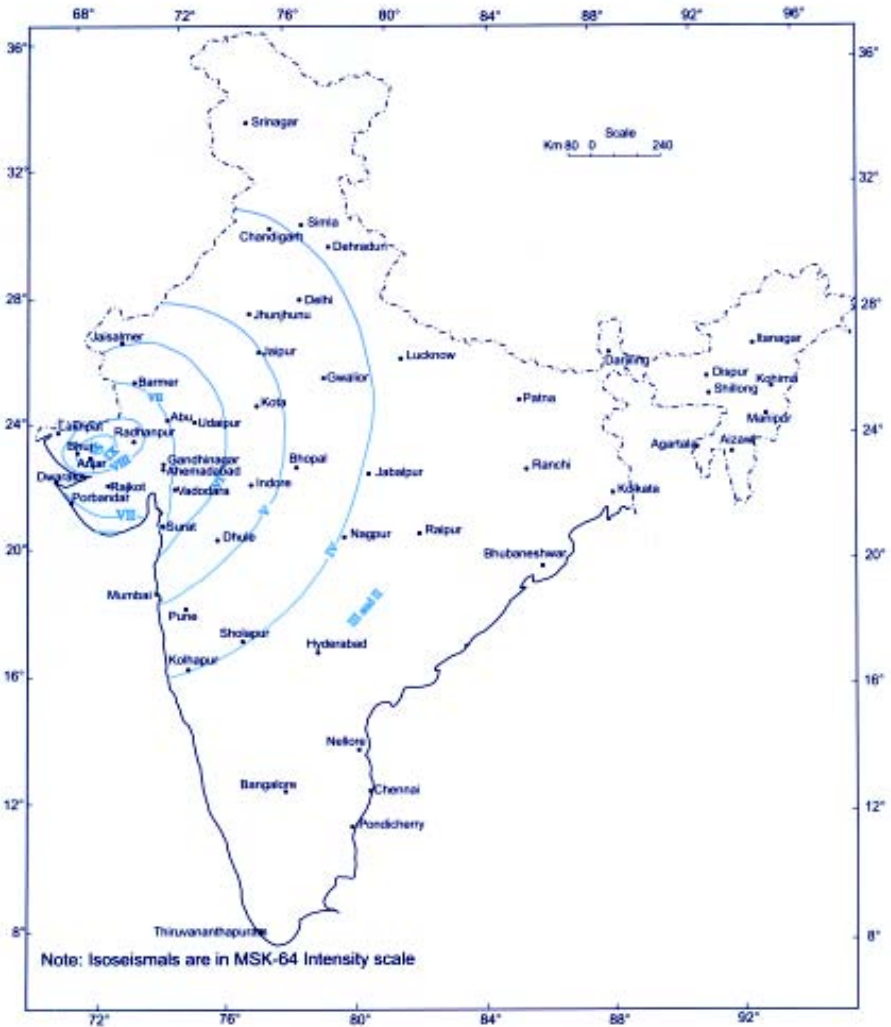
At 5 p.m., the Chief Minister reviewed the situation at the circuit house annexe, Ahmedabad. Senior officers of various departments were





**Damage to multi-storey Hare Krishna Apartments in Surat**

## Isoseismal Map of The Kutch Earthquake 2001



Source: GSI (2003)

This map is not to scale and is indicative

present. He made an appeal to the citizens, who were worried about the aftershocks, to maintain calm. All the government employees were asked to immediately report for duty, even though the next two days, Saturday and Sunday, were holidays.

In the morning of 27 January, L.N.S. Mukundan, Chief Secretary carefully reviewed the situation. A senior officer who was visiting Kutch on the day of the earthquake, had returned and provided a detailed description of the magnitude of the devastation. More information about death and destruction also poured in.

The state government offices remained open on both Saturday and Sunday (27 and 28 January 2001). The Secretariat remained open and many employees were present. Those from the affected areas of Ahmedabad could not come. However, there was a sense of fear among those who attended office. Many of them were seen moving outside the building, where they felt safer.

Messages came from New Delhi about the arrival of rescue and relief teams from different countries. Arrangements were to be made for a large number of flights, which would land at Ahmedabad and Bhuj. Many members of the rescue and relief teams from overseas had no time to obtain visas. The necessary formalities were completed in coordination with the relevant government agencies.

## **The City of Ahmedabad**

In Ahmedabad, city officials had already assembled for the Republic Day parade. Their first response was to immediately evacuate the stadium and move the people to the open ground in order to prevent injuries from falling structures. The programme was postponed by about 20 minutes. During that time, the Municipal Commissioner and his key officials, some revenue officers and police officers, left the venue in order to activate the response system. The flag-hoisting ceremony was completed quickly. The District Collector sent a Deputy Collector by 9.45 a.m. to requisition the army because the telephone system had broken down. The first column was in place by 10.30 a.m.

Four units of the Rapid Action Force (RAF), which is a part of the



**Damaged and collapsed apartments of Mansi Towers, Ahmedabad**

Central Reserve Police Force (CRPF) stationed at Ahmedabad, had swung into action immediately.

The control room started functioning mainly at two places: the fire brigade and the Ahmedabad Municipal Corporation (AMC) control room. Three municipal hospitals were activated. Three more control rooms were set up at Tagore hall, Usmanpura and Maninagar. Subsequently, a control room for the Ahmedabad Urban Development Authority (AUDA) area was also set up in the Collectorate. Officers were sent to areas such as Vastrapur, Thaltej, Ghatlodia, and Sola Road, and also to various parts of the city such as Maninagar, Paldi, Vasna, and Wadaj. Officials of the industries department visited the industrial areas of Naroda and other places, in order to check on chemical spillover problems. Vital installations such as the Indian Oil Corporation (IOC) filling station at Kali and the rebottling plant at Sanand were also checked to ascertain if there was any damage.

During the first 15 hours, the fire brigade attended to 37 emergency calls, rescued 68 people and recovered 67 bodies. In all, 1,221 army personnel were engaged in the rescue operations. The AMC took steps to procure equipment from Vadodara, Alang, Mumbai, Bangalore and Chennai. Equipment was also requisitioned from the Oil and Natural Gas Corporation (ONGC), government departments and private operators. With all these efforts, during the first day itself, 21 JCBs (a type of earth-moving machinery), 90 trucks, 14 cranes, two Poklanes and two bulldozers were pressed into service by the AMC. Similarly, in the AUDA areas, nine JCBs and three cranes became operational. During the first day itself, 72 sites in Ahmedabad were attended to. On 27 January, these efforts were further intensified, particularly with the arrival of the Swiss rescue team accompanied by their sniffer dogs. The team rescued two survivors who were detected under the debris at Mansi tower.

Rescue operations continued round-the-clock. In all, 135 persons were rescued—82 by the fire brigade and 53 by other municipal corporation staff and NGO workers. The army played an important role in many of these rescue operations. Of the persons rescued by the fire brigade, two were rescued after 99 hours and one woman even after 120 hours.

One major problem related to the 40 buildings which had collapsed and posed tremendous challenges for rescue efforts. The initial strategy



**Rescue of people at Maninagar, Ahmedabad**

was to cut concrete slabs and remove the debris, taking care to see that those trapped below were not harmed. This required tremendous patience and caution. About 270 dead bodies were retrieved from the debris during this first week. In addition to the buildings which had collapsed, a number of buildings which were declared dangerous to the public had to be pulled down.

All the three major hospitals, viz. Sheth Vadilal Sarabhai General Hospital, Sheth L.G. Municipal Hospital and Smt S.C.L. Municipal General Hospital, treated numerous patients. Similarly, the government-run civil hospital received a large number of patients.

Most of the residents, especially those in low-rise and high-rise buildings, were traumatized by the disaster. Many of the families preferred to sleep outside: on the lawns, in cars, with relatives and friends, and even on the roads. In order to alleviate their sufferings, officials of the Collectorate arranged 172 night shelters which were run either fully by the government or by NGOs. About 21,000 persons stayed in these shelters. In all, 248 night shelters were opened and over 30,000 persons took shelter in them. The removal of debris continued to be a priority.

Meanwhile, officials of the AMC and AUDA commenced survey and certification of buildings.

In all, 226 teams supervised by 30 deputy collectors were constituted on 27 January to survey damage and distribute relief to the affected persons.

During the second and third day after the earthquake, the issue of tackling dangerous structures and their demolition emerged. A meeting was held by the Municipal Commissioner; Chairman, AUDA; and Collector, Ahmedabad. They decided to pool the resources of experts from the Centre for Environmental Planning and Technology (CEPT), L.D. Engineering College, AMC and AUDA, to undertake a technical survey of the affected buildings. Expert teams visited 84 buildings, out of which 69 were identified as dangerous. These were demolished and 15 more buildings were examined by structural engineers with equipment to assess their safety.

In the meantime, instructions were issued by the state government that steps should be taken to inform people about the safety of their buildings. On 29 January, a meeting was held with A.S. Arya, an



**Rescue work in Ahmedabad**



international expert. The methodology for the survey of damaged building and proper classification was decided. Arya suggested an appropriate classification which would take into account Reinforced Cement Concrete (RCC) structures. The CEPT was identified as a nodal agency to mobilize structural engineers from all over India in order to undertake the survey of buildings and create confidence among the people. A format for the survey was devised in order to communicate to the occupants the category of damage to the buildings.

In Ahmedabad city, 80 buildings with 1,021 flats, and 82 other houses collapsed. In all, 1,103 units or families were affected by collapsed structures in the city. Many more were affected by damaged structures. More damage occurred on the right side of the Sabarmati river, which is a relatively newly developed area. The older area, including the walled city area, was much less affected. The buildings that had collapsed were mainly three to five-storey buildings, or taller ones, and had been constructed during the last two or three decades.

In retrospect, the district administration felt that it was a unique experience for them and that many lessons could be learnt. It took two or three days to mobilize the necessary equipment. Equipment such as life sensors, cranes and sniffer dogs could have enabled more effective rescue operations. At one point, 85 locations had to be attended to, and it was indeed overwhelming for the fire brigade to respond simultaneously to all the calls. In spite of all these limitations, all the personnel were mobilized.

## **The City of Bhuj and Kutch District**

In Bhuj, the flag-hoisting ceremony was to be held at 9 a.m. Sureshchandra Mehta, Minister of Industry, Gujarat, who was to take the salute, was about to start from the circuit house for the venue of the programme when the earthquake occurred. Some parts of the circuit house and the adjoining collectorate building were severely damaged. Some parts even collapsed. The flag-hoisting ceremony in Bhuj was completed very quickly.

In addition to the office of the District Collector, his own residence was severely damaged. In fact, the District Collector, senior district officers

and the state-level officers who reached Bhuj within hours of the earthquake, had to work in the open. They also spent the first two or three nights outdoors. The office building of the district *panchayat*, which is an important organization for development activities of the district, collapsed. Since the DDO's residence was severely damaged, he had to take shelter in a tent for weeks. The situation was similar for many other district-level officers, including police officers, and those at sub-divisions and *talukas*. In Anjar, the residential building of the sub-divisional officer collapsed. He and his family members who had just come out of the house to start for the Republic Day function, miraculously survived. Some other officers such as Mamlatdar, Anjar, were not so lucky. He died while travelling to the parade ground.

The district hospital at Bhuj, a 281-bed facility, was completely destroyed. It functioned as a referral hospital in the district, offering medical services such as surgery, gynaecology, paediatrics and orthopaedics. With the collapse of the building, 193 people, including 11 staff members, died. Located in the same premises were a nursing school and its hospital, an auxiliary nurse and midwife training school, district tuberculosis hospital, a mental hospital and staff quarters, all of which were destroyed or suffered major damage. With such devastation, the immediate task was to arrange for the treatment of orthopaedic and spinal injury cases. The military hospital at Bhuj provided emergency care round the clock and carried out about 3,000 major and 6,000 minor operations. It provided medical treatment to 12,254 patients.

The medical services provided at the makeshift hospital that was set up in Jubilee Ground in Bhuj were basically life-saving measures. After initial treatment, patients were shifted to hospitals outside Kutch, and even outside Gujarat. About 450 patients were airlifted to other places.

Initially, there was a shortage of wood required for cremation in Bhuj and other areas. At many places one could see volunteers cremating dead bodies after extricating them from the debris. The scene was similar at places such as Bhachau, Anjar and Rapar. Hospitals were becoming overcrowded and cremation grounds working day and night.

A large number of government employees were among the people who were traumatized by personal loss. Many had lost their near and dear



**Wood for the purpose of funerals**

ones. Their homes were also damaged. These reasons affected the ability of the administration to undertake immediate rescue and relief work.

There are also numerous examples of government employees who showed exemplary dedication, courage and commitment. In spite of personal tragedy, they continued to perform their duties and undertake rescue and relief activities. A sub-divisional officer in Surendranagar district continued to perform his duties for several hours even after he had come to know that his father and his only son had died due to collapse of a building in Ahmedabad.

A number of police stations in Kutch were devastated. Police officers also suffered loss and damage. Yet they played an important role. The local police, with the help of citizens, rescued hundreds of people who were trapped. It was the local police, led by the Additional Superintendent of Police, who were the first to enter the walled city of Bhuj to extract bodies from the debris during the first few hours of the tragedy. At Khavda village, the local police inspector cordoned the children at the parade ground, thereby preventing them from running into the falling debris. Later, he led the rescue operation in other parts of the village thereby minimizing injuries and casualties. The police sub-inspector at Adhoi left his family under the debris at the police line and went to the village to rescue people. The police sub-inspector at Bhachau witnessed the death of his inspector and barely managed to save his own life by breaking open the window of the vehicle that he was trapped in. He remained continuously on duty for several hours. There were other such cases where officials under severe stress and adverse circumstances performed their duty admirably.

Army personnel stationed at Bhuj and Gandhidham quickly geared themselves to provide assistance to the civilian population. Within 45 minutes of the disaster, the two army units sent out 14 and six columns respectively. On the first day, the army rescued 110 people and recovered 116 dead bodies at Bhuj. Similarly, it rescued 108 people and recovered 58 dead bodies in Gandhidham. The military hospital, being the only well-equipped hospital in Bhuj and adjoining areas, treated thousands of civilians. That included 155 operations on the first day itself. The Army Commander, Southern Command flew in from Pune, along with four surgical units. Having assessed the situation, additional medical personnel, equipment



**A collapsed building at Bhuj**

and infantry units were moved to Kutch for providing relief. The army restored arterial road communications of major towns and villages.<sup>2</sup>

The team of 30 doctors from AIIMS and Safdarjung hospital, New Delhi arrived in Bhuj on the night of 26 January 2001. During the next few days a large number of doctors also arrived from many parts of the country. Many came without equipment. The doctors faced difficulties regarding their food and accommodation. Subsequently, it was realized that though there was no dearth of doctors, there was a shortage of paramedics and surgical instruments. An important lesson learned here is that teams of doctors who arrive in disaster-struck areas should come well equipped with paramedical staff, equipment and food.

There were medical teams from France, Japan, Norway, Finland and Korea. The International Red Cross Society set up a hospital which functioned as a substitute to the destroyed district hospital. The Israel team also set up a field hospital at Bhuj. The medical team from Denmark established a hospital at Gandhidham. Similarly, a hospital was set up by Ukraine at Bhachau. Japanese medical units were operating from Madhapar and Kukma (Table 1). It may be noted that the international teams took a few days to set up hospitals, by which time many of the patients had been shifted to other places. Furthermore, it was difficult for the foreign doctors to communicate with the patients because of language problems. It is necessary to strengthen the local emergency medical system so as to provide immediate relief services.

**Table 1: Emergency hospitals**

<b>Number</b>	<b>Remarks</b>
350-bed hospital	Red Cross & Red Crescent Societies of Norway, Finland & Germany
70-bed hospital	Israel
2 field hospitals	France
2 hospitals	By Ukrain in Bhachau, Denmark in Gandhidham
80-bed hospital	In Bhuj by the state govt and the Indian Medical Association

<sup>2</sup>These details are from a report prepared by L. Mansingh, Chief Coordinator of Relief Operations, Kutch.



**Hotel Madhuban, Gandhidham**

## **State-level Response**

Thousands of people who were trapped had to be rescued. The area affected was larger than that of states like Tamil Nadu and Karnataka. In fact, it was larger than the geographical area of countries such as Bulgaria, Austria, Greece, Portugal and Cuba. With the affected population spread over a wide area, the task of rescue and relief was extremely difficult.

During the first three or four days, a number of meetings were held by the Chief Secretary and the Chief Minister. Though rescue and relief work was the main concern, the issue of temporary shelter also had to be addressed.

There were seven Indian Administrative Service (IAS) officers who were assigned to special duties at the state-level control room. Other officials who were deputed to coordinate with various agencies sending relief materials and personnel by air included two IAS officers who were assigned duties at Ahmedabad airport, one at Mumbai airport and one at Bhuj airport.

Two senior IAS officers were appointed as coordinators for Anjar; one each for Bhuj, Bhachau, Rapar, Gandhidham, Ahmedabad and Rajkot. G. Subba Rao was in overall charge of relief operations in Kutch district for the first few days. L. Mansingh was subsequently appointed as Chief Coordinator and stationed at Bhuj. He was delegated with the powers of the state government in financial and other matters.

Thus, senior officers were sent to the affected areas. This was in addition to ministers and secretaries in charge of the respective districts. The state government appointed additional collectors and additional DDOs for the 17 worst-affected *talukas*. They were given the powers of District Collectors and DDOs so as to take expeditious decisions.

During the first few days, mobilization of men, material and equipment was the main focus. The other aspect was the visit of VIPs and teams from other states and countries. All these posed enormous problems of logistics and coordination.

The state administration had to cope with the problem of sending men, material and equipment to various places. For the purpose of rescue, equipment such as bulldozers, cranes and concrete cutters were required



in cities such as Ahmedabad and in remote areas like Kutch and Jamnagar. Hundreds of villages and towns had been devastated by the earthquake. Every site required cranes and earth-moving equipment. These were mobilized from government departments such as the irrigation department, roads and buildings department, Sardar Sarovar Narmada Nigam and the Gujarat State Land Development Corporation (GSLDC). Various industrial houses also mobilized equipment. Even the neighbouring states of Rajasthan and Maharashtra sent equipment.

The requirement of personnel, technical and non-technical, was massive. It was necessary to deploy a large number of doctors and paramedical staff.

Tables 2, 3, 4 and 5 indicate the mobilization of personnel and equipment during the first few days of the tragedy.

**Table 2: Personnel in rescue and relief work**

<b>Personnel</b>	<b>Number</b>
Technical	2,104
Non-technical	6,213
Unskilled	13,355

**Table 3: Rescue equipment deployed during the immediate aftermath of the earthquake**

<b>Equipment</b>	<b>Kutch</b>	<b>Others</b>	<b>Total</b>
JCBs/cranes	831	321	1,152
Bull Dozers/excavators	395	148	543
Dumpers/trucks	2,679	174	2,853
Gas cutters	614	287	901

From the above tables, one can gauge the magnitude of the task. Mobilizing and transporting such a large number of heavy equipment to the affected areas, which were widespread, posed a complex problem of logistics.

**Table 4: Mobilization of buses for rescue and relief work**

<b>No. of buses</b>	<b>Mobilized for</b>
760	Doctors, volunteers, police personnel, medicines
1,978	12,115 injured and their relatives to reach various hospitals
319	Free transport of earthquake-affected population within Kutch

**Table 5: Medical personnel and vehicles**

<b>Personnel</b>	<b>Kutch</b>	<b>Others</b>	<b>Total</b>
Medical officers	250	1,584	1,834
Specialist doctors	400	363	763
Paramedical staff	1,000	1,500	2,500
Jeeps/ambulances	1,603	362	1,965

During the first few days, 107 administrative officers, 11,000 other staff, 3,000 police personnel and 2,500 Home Guards were deployed. The armed forces organized large-scale rescue efforts, including eight engineering regiments, 36 columns, 48 IAF aircrafts/helicopters and 953 sorties. The Border Security Force (BSF), the CRPF and RAF participated in a big way. Over 5,000 trucks, cranes, bulldozers and gas cutters etc., were mobilized for the rescue efforts.

Within two days of the earthquake, Kutch, which was the worst-affected district, had 450 medical teams including 245 in rural areas. The teams consisted of about 200 specialists, 450 doctors, 785 paramedics and 81 ambulances.

In order to prevent the outbreak of epidemics, an elaborate system of surveillance was instituted throughout the affected area. Expert teams from the National Institute of Communicable Diseases (NICD) prescribed preventive measures.

The water system was monitored for its chlorine level and the presence of bacteria, to prevent water-born diseases. Medical experts from the



**Medical camp at village Ratnal**

United Nations Children’s Fund (UNICEF) and the World Health Organization (WHO) assisted the local authorities in these efforts.

The next important issue was the supply of relief materials and arrangement for temporary shelters. The winter is severe in Kutch and other affected areas. Even those whose houses had not been severely damaged were too scared to sleep inside buildings and preferred to sleep outside. The state government had to purchase a large number of tents and other temporary sheds within a short time. This was in addition to those provided by other states and countries.

Cash doles were disbursed by the Government of Gujarat to over 900,000 families and assistance for household kits was given to 372,000 families (Table 6). Tents, tarpaulins and plastic sheets were given to 348,000 families for temporary shelter.

**Table 6: Distribution of emergency assistance**

<b>Relief measures</b>	<b>Number</b>	<b>Rs (Crore)</b>
Cash doles	911,063 Families	73.75
Household kits	372,027 Families	41.23
Death compensation	13,378 Cases	121.25
Injury assistance	19,648 Cases	17.12

The Gujarat Electricity Board (GEB) deployed 220 engineers and skilled staff in the affected areas for restoration of the power supply. By 5 February 2001, i.e., 10 days after the earthquake, 80 per cent of the services were restored. By the end of that month, services had been completely restored.

The immediate need was to restore the water supply. Measures were taken to supply water through tankers and repair of pipelines immediately. Table 7 indicates the position of restoration of the water supply to towns and villages as on 19 February 2001.

**Table 7: Water supply restored in towns and villages as of 19 Feb. 2001**

District	Towns affected	Villages affected	Town supply restored		Village supply restored	
			Pipes	Tanker	Pipes	Tanker
Kutch	10	884	3	7	580	273
Rajkot	02	125	1	1	83	35
Jamnagar	02	92	1	1	43	49
Ahmedabad	01	00	1	0	0	0
Surendranagar	03	239	3	0	0	10
<b>Total</b>	<b>18</b>	<b>1,340</b>	<b>9</b>	<b>9</b>	<b>706</b>	<b>367</b>

Relief materials were pouring in from everywhere. There was, no doubt, tremendous need for relief materials, including food, clothing, shelter and other necessities. However, problems were faced in managing the distribution. Some materials which were sent by trucks had to be unloaded and sorted. In many cases, it took a lot of time to find out what was in the trucks. Often, there were many items that were not needed. For example, people in rural areas did not wear jeans, etc., which remained unutilized. Further, some medicines, though sent in large quantities, were not required. Another problem to be tackled was which items and what quantities were to be sent to different villages. A number of voluntary agencies and other organizations brought relief materials. Some of them got in touch with the district administration and were directed to appropriate places. Others went to the villages directly.

Bhuj was in the news. Thousands of vehicles carrying relief materials and rescue teams travelled to Kutch. Initially, most of the relief teams headed towards Bhuj and Anjar. At a later stage it was discovered that Bhachau, located on the way, was also in need of relief materials. There were traffic jams on the road leading to Bhuj. It became much worse as people from Kutch, who panicked due to the aftershocks, started going to other districts and even to other states by state transport buses and other vehicles. All these created tremendous problems for traffic. The old Surajbari bridge which was damaged, was closed for the first few days. The only road which led to Kutch was the one via Mehsana and Radhanpur.

In the meantime, private individuals filed criminal cases against builders and engineers. The state government initiated measures against builders,



Relief materials at Bhachau

contractors and structural engineers associated with the buildings that collapsed resulting in death and injuries. Action was also taken against some municipal officers who were in charge of approving plans. Many builders and engineers went underground. As can be seen from Table 8, 119 offences with 484 accused were registered at various places in the state; 253 persons were also arrested. Of the accused persons, 80 were government officials. One municipal official was arrested. By the end of 2003, charge sheets were filed in the courts in respect of 75 offences.

**Table 8: Police cases filed after the Kutch earthquake**

<b>Town/District</b>	<b>No. of offences registered</b>	<b>No. of accused</b>	<b>No. of persons arrested</b>	<b>Cases charge-sheeted in courts</b>	<b>Officials involved</b>
Ahmedabad City	61	269	99	49	68
Surat City	1	18	18	1	0
Rajkot City	3	2	2	1	0
Supdt of Police, Ahmedabad Rural	2	11	5	2	0
Surendranagar	1	3	0	0	2
Rajkot Rural	2	5	0	0	4
Bhavnagar	14	3	0	0	3
Junagadh	1	4	4	1	0
Kutch-Bhuj	32	163	119	19	3
Navsari	2	6	6	2	0
<b>TOTAL</b>	<b>119</b>	<b>484</b>	<b>253</b>	<b>75</b>	<b>80</b>

### **Assistance by the Government of India and State Governments**

The Gujarat state government was in constant touch with the Government of India, right from the beginning. The cabinet secretary convened a meeting of the NCMC at 3.00 p.m. on 26 January 2001. Senior officers and service chiefs attended the meeting. It was decided to help move relief materials and equipment to Bhuj. The cabinet secretary contacted the chief secretaries of Rajasthan and Maharashtra and requested



**Rescue activity by army jawans at Bhuj**



them to send medical teams and relief materials to the earthquake-affected areas. The Prime Minister convened an emergency meeting of the Cabinet at 5.00 p.m. on 26 January 2001 and reviewed the initiatives of the NCMC. The three service chiefs who were present briefed the Cabinet. The Prime Minister announced immediate relief of Rs 500 crores. He also cancelled his visit to Malaysia and Japan.

An Empowered Group of Ministers (EGOM) under the chairmanship of the Union Home Minister, was constituted on 30 January 2001. The group held meetings on 30 January, 2 February and 7 February, to review the relief and rescue measures.

An all-party meeting was held on 3 February 2001, chaired by the then Prime Minister, Atal Bihari Vajpayee. It was proposed to set up a National Committee on Disaster Management. The Government of India, by a notification of 13 February 2001, set up a National Committee comprising 35 members with the Prime Minister as Chairman and Sharad Pawar, Member of Parliament, as Vice-Chairman. The other members were the Union Ministers of Home, Defence, Finance, Agriculture, Textiles, Urban Development and Parliamentary Affairs, Deputy Chairman of the Planning Commission, Principal Scientific Advisor, the Chief Minister of Gujarat, representatives of national parties and state parties. The Cabinet Secretary was the member-secretary of the National Committee. It was envisaged that the National Committee would:

- Suggest short-term, medium-term and long-term steps for relief, rehabilitation and reconstruction in the earthquake-affected areas of Gujarat;
- Deliberate on the necessary institutional and legislative measures needed for the effective and long-term strategy to deal with major calamities in future; and
- Look into the parameters that should define a national calamity.

The Government of Gujarat made a presentation on 28 February 2001 in New Delhi to the National Committee on Disaster Management. It covered various aspects of the earthquake, its impact and progress of relief and rehabilitation work.

The Gujarat government also presented a memorandum in February 2001 to the Government of India on the earthquake damage and requested for central assistance. Further details and updated information were sent to the Government of India during the middle of March, 2001.

Earlier, in August 1999, the Government of India had set up a High Power Committee on disaster management comprising experts, with J.C. Pant, former Union Secretary (Agriculture) as the Chairman. The committee had interacted with a wide cross-section of the governmental system, NGOs and other stakeholders. The committee was in the process of finalizing its report. With the setting up of the National Committee, the High Power Committee became the working group of the National Committee.

All central ministries/departments and public sector undertakings were requested to deploy their machinery for providing the maximum possible assistance.

L.K. Advani, Union Home Minister at that time, visited Ahmedabad on 28 January 2001, to review the rescue and relief operations. Subsequently, the Prime Minister and Union Ministers of Defence, Agriculture, Power, Telecommunication, Urban Development, Health and Information & Broadcasting (I&B) visited the affected areas.

On clearance from the Indian Air Force (IAF) on the suitability of the runway at Bhuj to receive light aircraft, one AN-32 aircraft took off from Delhi at 7 p.m. on 26 January 2001, along with Anil Sinha, Additional Central Relief Commissioner and a team of 30 doctors with medical equipment and medicine. Engineers from the Department of Telecommunications (DOT) with satellite phones and IMD officials with seismographic equipment also accompanied this team.

The Air Force pressed into service six IL-76, 18 AN-32, four Avros, four Dorniers and 16 helicopters. They made 953 sorties, carrying relief materials, tents, equipment, food items, rescue teams and injured persons. The army deployed a large number of troops in the Bhuj and Ahmedabad sectors. In addition, three columns of the 68 Engineers Regiment were deployed for technical inspection of buildings that were rendered unsafe. A large number of vehicles and equipment were also deployed. They



**Army jawans undertaking rescue work at Bhuj**

rescued 478 persons, evacuated 484 seriously injured persons and recovered 2,260 dead bodies. The navy dispatched a team of 30 men with INMARSAT satellite phones. The INS Ganga carried relief materials to Kandla and two naval ships were converted into hospital ships where surgeries were performed. A Dornier operated between Mumbai and Kandla carrying fresh water.

The Union Home Ministry released a number of companies of the central paramilitary forces for rescue and relief work. During the first few days, 47 of these, such as the RAF, CRPF and BSF, provided rescue and relief services. A number of ministries such as Chemicals and Petrochemicals, External Affairs, Food and Public Distribution, Health, Finance, Mines, Petroleum, Power, Railways, Shipping, Social Justice and Empowerment, Rural Housing, Telecommunication, Urban Development and Women and Child Development, participated in providing immediate relief.

The Ministry of Railways deployed special trains with relief materials from Mumbai, Madras, Kolkata and New Delhi to Ahmedabad. The Ministry of Power arranged for 19 generator sets for utilization by the GEB in the Kutch district. The Powergrid Corporation and the National Thermal Power Corporation (NTPC) assisted in repairing and re-commissioning of 10 sub-stations of the GEB. The Power Finance Corporation sanctioned a loan of Rs 100 crores for the repair and reconstruction of transmission and distribution systems. The Rural Electrification Corporation also sanctioned a loan of Rs 100 crores.

Many state governments spontaneously offered relief assistance, both in cash and kind, including Andhra Pradesh, Assam, Bihar, Chattisgarh, Delhi, Dadra and Nagar Haveli, Goa, Himachal Pradesh, Haryana, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Nagaland, Orissa, Punjab, Pondichery, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, Uttaranchal, and West Bengal. Food, blankets, medicines, medical personnel, water tankers, equipment etc., were sent by various state governments and union territories. Many of them also contributed to the Gujarat Chief Minister's Relief Fund. Some states sent not only equipment and material but also senior officials and supporting staff to undertake relief work. Some states continue to participate in the reconstruction work.

## **Assistance by the Domestic and International Community**

The Government of India did not appeal for international assistance. However, as a matter of policy and as a departure from earlier practices, assistance offered was accepted. The United Nations Disaster Assessment and Coordination (UNDAC) team visited the earthquake-affected areas as advised by the Office of the Coordination of Humanitarian Affairs (OCHA) on 27 January 2001, in consultation with the Government of India, to assist the Indian authorities and the UN with the coordination of international assistance. The UNDAC team established an On-Site Operations and Coordination Center (OSOCC) at Bhuj to facilitate coordination of relief activities. The OSOCC was located within the premises of the office of the Collector, Kutch. It became the focal point for international coordination and for information sharing, both for government officials and NGOs. A report of 20 February 2001 prepared by the UNDAC team provides the following details:

Search and rescue teams from abroad began their operation at 2300 hours on 27 January, when the Swiss search and rescue team arrived by air, closely followed by teams from the UK, Russia and Turkey. The Swiss rescue team consisted of 52 members and 12 sniffer dogs. As soon as they arrived in Ahmedabad they immediately proceeded to the site of the nearest multi-storeyed building in Ahmedabad and started their rescue efforts. They rescued eight people during their operation. There were two teams from the UK. The UK search and rescue team comprised 69 people with equipment, who rescued six survivors and recovered two dead bodies. The British International SAR and dog team had eight members, one dog and sundry equipment. A total of 26 teams arrived in Gujarat by 2 February (Table 9).

The first teams began to depart on 1 February and by 15 February almost all had left. As there was no possibility of rescuing more survivors by then, the remaining teams were deployed on more general relief tasks, some helping with the recovery of bodies, others with debris clearance, relief and medical support, as well as providing assistance to local teams.

**Table 9: International search and rescue, and medical teams**

<b>Country</b>	<b>Manpower</b>
Bulgaria	137 persons and trauma kits
Denmark	Medical team
France	32 persons, 9 dogs and equipment
Germany	30 persons and 6 dogs
Hungary	52 persons and one dog
Israel	100 persons and equipment
Italy/Spain	11 persons and 10 dogs
Japan	58 persons
Mexico	6 persons including one doctor and paramedics
Netherlands	Doctors with medical equipment
Poland	15 persons including 10 firemen and 2 doctors
Russia	76 persons and equipment
South Africa	31 persons, 2 dogs and equipment
South Korea	36 persons (including 23 doctors) and medical supplies
Switzerland	52 persons and 12 dogs
Turkey	27 persons and equipment
UK	75 persons, 1 dog and equipment
Ukraine	Team with mobile hospital
USA	10 persons

**Source:** Report of UNDAC Team and Government of Gujarat (Revenue Department) presentation.

Initially, the relief provided consisted of mostly medical supplies and medical teams but subsequently other supplies arrived. By 10 February 2001, relief had arrived from 38 countries as well as UN agencies and many international NGOs. In fact, by 12 April 2001, OSSOC registered the presence of over 245 organizations and agencies, including at least 99 international NGOs, 55 national NGOs, 20 donor government teams, 10 UN and inter-governmental organizations and Red Cross representatives from 10 countries.

More than 50 Red Cross/Red Crescent members responded in support of the Indian Red Cross, starting with the deployment of the following Emergency Response Units (ERUs):



**Rescue and relief team from abroad**

- A 350-bed Norwegian and Finnish Red Cross emergency response referral hospital;
- A German Red Cross water and sanitation ERU;
- A Japanese Red Cross emergency response primary health care unit;
- A British Red Cross logistic ERU and distribution team; and
- A Spanish Red Cross mobile medical clinic.

While the emergency response primary health-care unit and the mobile clinic withdrew at the end of March, the emergency response referral hospital was gradually integrated into the local health system.

Israel sent equipment and personnel in seven aircrafts and also set up a civil hospital at Bhuj. It was a self-contained 70-bed medical unit with a laboratory, an X-ray unit, sleeping quarters and logistics group. It was equipped to treat about 1000 patients every day.

Most of the international organizations such as the United Nations Development Program (UNDP), WHO, UNICEF, World Food Programme (WFP), International Labour Organization (ILO) and the International Migration Organization (IMO) participated in relief operations. The United States Agency for International Development (USAID) and the Department for International Development (DFID)) also played an important role.

There were 250 flights from over 50 countries carrying relief materials; in all, 12 countries sent rescue teams.

The Government of Gujarat facilitated the participation of international agencies and NGOs. Officers were assigned coordination work in Mumbai, Delhi, Ahmedabad and Bhuj.

NGOs such as Ramkrishna Mission, Sewa Bharti, Mata Amritanandmayi Math, BAPS, Kutch Navnirman Abhiyan, Kutch Jain Samaj, Caritas India and many others, played important roles in providing relief to the affected people. There was spontaneous response from the corporate sector. Reliance, the Tata Group, Larsen & Toubro (L&T), Gujarat Narmada Valley Fertilizers Company Limited (GNFC), Gujarat State Financial Corporation (GSFC), Zydus Cadila, Hinduja Foundation, public sector banks, Indian Airlines, the Gems and Jewellery Merchants' Association,





**Rescue work with modern equipment at Bhuj**

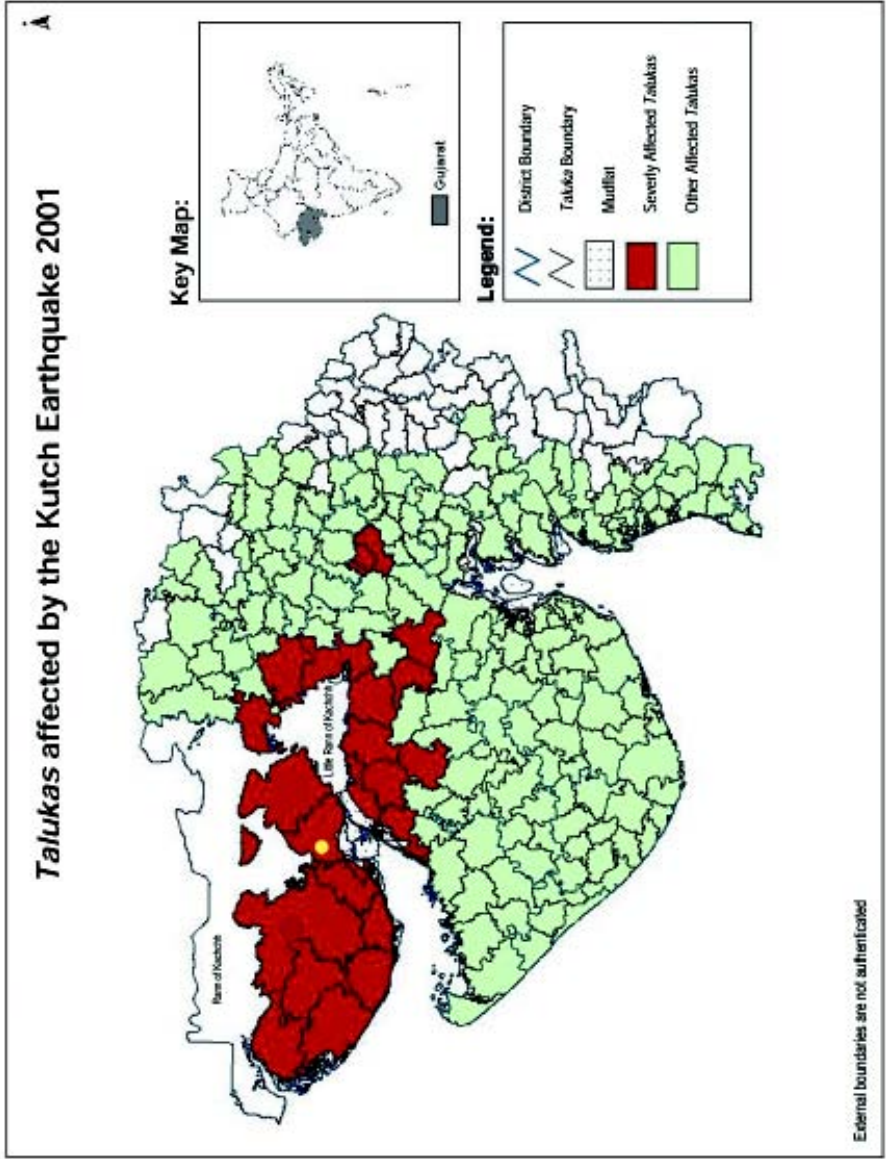
the Videocon Group, the Federation of Indian Chambers of Commerce and Industry (FICCI), Care, the Confederation of Indian Industry (CII) and a number of public sector undertakings, played an important role in both relief and rehabilitation.

### Damage and Destruction: Magnitude and Spread

The destruction was widespread and the area affected was vast. As per the notification of the Revenue Department, 21 districts out of 25 were affected in varying degrees. Over 7,000 villages were affected (Table 10). The population affected was 28 million. Five districts, namely, Kutch, Jamnagar, Surendranagar, Rajkot and Patan were severely affected. In addition, there was destruction in Ahmedabad city and to some extent, Surat.

**Table 10: Number of affected districts, talukas and villages**

Sr. No	Name of District	No. of Affected Talukas	No. of Affected villages	Population Affected
1	Ahmedabad	11	484	5,461,178
2	Amreli	11	273	864,626
3	Anand	8	112	468,725
4	Banaskantha	9	320	887,826
5	Bharuch	8	270	822,572
6	Bhavnagar	11	377	1,685,378
7	Gandhinagar	4	210	916,522
8	Jamnagar	11	685	1,902,680
9	Junagadh	13	554	1,876,736
10	Kheda	9	404	1,231,273
11	Kutch	10	890	1,523,562
12	Mehsana	9	611	1,818,445
13	Navsari	5	313	1,104,473
14	Patan	8	349	764,645
15	Porbandar	3	157	494,605
16	Rajkot	14	686	2,496,279
17	Sabarkantha	8	68	150,641
18	Surat	8	94	1,483,518
19	Surendranagar	10	659	1,512,189
20	Vadodara	6	85	205,648
21	Valsad	5	32	368,017
	<b>Total</b>	<b>181</b>	<b>7633</b>	<b>28,039,538</b>



Out of 181 *talukas*, 42 *talukas* as indicated in Table 11 were declared as severely affected *talukas*. In the five most affected districts 442 villages had more than 70 per cent of houses destroyed.

**Table 11: Severely affected *talukas* and villages**

District	Severely affected <i>talukas</i>	Number of villages with 70% or more houses destroyed
Rajkot	Morbi*, Wankaner*, Maliya*-Miyana, Tankara, Padadhari	62
Kutch	Bhuj*, Rapar*, Bhachau*, Mundra*, Anjar*, Gandhidham*, Nakhatrana, Abdasa, Lakhpat, Mandvi.	335
Surendranagar	Dhrangadhra*, Patdi*, Halvad*, Wadhawan, Limdi	13
Ahmedabad	City*, Daskroi*	
Patan	Sami*, Santalpur*, Radhanpur, Harij, Patan	6
Jamnagar	Jodiya*, Dwarka, Jamnagar City, Kalyanpur, Khambhalia, Lalpur, Jamnagar Rural, Dhrol	26
Banaskanta	Vav, Tharad, Bhabhar, Kankrej, Deodar, Deesa, Dhanera	0

**Note:** The *talukas* with asterisks were upgraded to districts and officers of the rank of additional collector and additional district development officer were appointed.

From the very first day there was tremendous demand from all quarters including the media, for data on the death and damage. All sorts of figures appeared in the press. During the first two days it was felt even by senior officials that the number of dead could be as high as 60,000. Reports of 8, 10 and 12 February 2001 of the state government indicated figures of 16,487, 16,755 and 18,603 respectively. By the end of February and the middle of March, the figures given were 20,447 and 20,005 respectively. A report by UNDAC dated February 20, gives a figure of 30,000. In fact, on the first or second day after the earthquake the then Union Defence Minister gave a statement that the death figures could be to the extent of 100,000 people.



**A woman retrieving her belongings at Ratnal village**



**Search in ruins (a village in Kutch)**

For a long time, the death figures remained about 20,000, based on the records of the police stations and hospitals. Subsequently, however, detailed verifications were undertaken. It was discovered that there were many overlaps as well as duplication of figures. The state government constituted a committee of senior officers to have the figures verified. Finally, the death figure, based on the committee's report of 7 December 2001, was given as 13,805: including 3,743 men, 5,184 women and 4,878 children. District-wise details of the death toll are given in Table 12.

**Table 12: Kutch earthquake death toll**

<b>District</b>	<b>Men</b>	<b>Women</b>	<b>Children</b>	<b>Total</b>
Ahmedabad	290	244	218	752
Anand	0	2	0	2
Banaskantha	9	13	10	32
Bharuch	3	4	2	9
Bhavnagar	2	1	1	4
Gandhinagar	2	0	6	8
Jamnagar	28	62	29	119
Junagadh	1	4	3	8
Kachchh	3,229	4,573	4,419	12,221
Navsari	7	6	4	17
Patan	11	13	14	38
Porbandar	4	3	3	10
Rajkot	106	204	119	429
Surat	25	9	12	46
Surendranagar	26	46	38	110
Vadodara	0	1	0	1
<b>Total</b>	<b>3,743</b>	<b>5,184</b>	<b>4,878</b>	<b>13,805</b>

The Kutch district accounted for about 88 per cent of the deaths. The number of people injured was estimated to be about 167,000.

Schools remained closed for about a month. A total of 31 teachers died and 95 were injured. There were 971 students who died (910 from primary schools, 37 from secondary schools, three from colleges and 21 from technical institutions); 1,051 others were injured.



**A site of liquefaction**



The incidence of death and injury to students would have been much greater had the earthquake occurred on a working day. As it was 26 January, many students were in open areas for the Republic Day programmes or at home. In Anjar, about 300 children were marching along a street as part of the Republic Day procession. They met with a tragic end when buildings collapsed from both sides of the narrow lane.

Initially, the number of houses which had collapsed and which had been damaged were estimated to be 2.69 lakhs and 5.44 lakhs respectively. As time passed, there was an increase, based on the verification of these numbers. Furthermore, some of the buildings which had earlier been indicated as residential were actually commercial premises. The number of residential premises which needed to be reconstructed thus reduced, with verification and refinement from time to time (Table 13).

**Table 13: Changes in figures of collapsed and damaged houses over time**

	10.2.2001	16.2.2001	15.3.2001	1.4.2002	31.3.2003	1.1.2004
Fully collapsed houses (lakhs)	2.68	3.30	3.71	2.38	2.45	2.15
Damaged houses (lakhs)	5.44	6.00	9.23	10.16	10.44	9.28

An important lesson is that it is unrealistic to expect accurate figures of loss and damage immediately after a disaster that is severe and widespread. It may be more rational to follow a systematic approach and a realistic time-frame.

Estimates of the magnitude of the earthquake varied. Initially, it was estimated by the IMD to be 6.9 on the Richter scale. The Geological Survey of India estimated it to be 7.6 on the moment (Mw) scale. The US Geological Survey estimated it at 7.7 on the moment (Mw) scale. The last estimate appears to be the most accepted one.

The epicentre was located at 23.40 degrees north latitude and 70.28 degrees east longitude, with a focal depth of 25 km (according to some, 18 km). Initially the IMD had identified the epicenter to be near the village of Lodai, about 20 km north-east of Bhuj (23.6 degrees north and 69.8 degrees east). Subsequently, it was located near the village of Chaubari, about 65 km to the east of Bhuj and 20 km to the north of Bhachau.

In short, the Kutch earthquake occurred at 8.46 a.m. on 26 January 2001. The magnitude was 7.7 Mw. It lasted for about two minutes. The epicenter was at Chaubari located to the north of Bhachau in the Kutch district of Gujarat, at a distance of about 250 km west of Ahmedabad.

During the first fortnight after the earthquake there were two major aftershocks of magnitudes of 5.9 and 5.3. There were, of course, many aftershocks during the first three years: 953, 149 and 53 respectively during 2001, 2002 and 2003 (Table 14).

A number of major earthquakes have occurred in India in the past. Some of these are listed in Table 15 with a view to providing a perspective to judge the severity of the Kutch earthquake of 2001.

**Table 14: Year-wise aftershocks**

<b>Sr.No.</b>	<b>Year</b>	<b>No.of aftershocks</b>
1	2001	953
2	2002	149
3	2003	53
<b>Total</b>		<b>1,155</b>



**Elongated fractures in the cultivated fields of Vondh village**

**Table 15: Significant earthquakes that have occurred in India**

<b>Earthquake</b>	<b>Year</b>	<b>Magnitude</b>	<b>Approx. death toll</b>
Bhuj (Gujarat)	1819	8.0	1,500
Bihar	1833	7.5	Hundreds
Near Cachar (Assam)	1869	7.5	Not available
Sopor (J&K)	1885	7.0	Not available
Shillong (Assam)	1897	8.7	1,500
Coimbatore (Tamil Nadu)	1900	6.0	Not available
Kangra (Himachal Pradesh)	1905	8.0	19,000
Himachal Pradesh	1906	7.0	Not available
Srimangal (Assam)	1918	7.6	Not available
Dhubri (Assam)	1930	7.1	Not available
Bihar-Nepal Border	1934	8.3	11,000
Quetta (in Pakistan)	1935	7.6	30,000
Andaman Islands	1941	8.1	Not available
Assam	1943	7.2	Not available
Arunachal Pradesh-China Border	1950	8.5	4,000
North Eastern part of India	1952	7.5	Not available
Anjar (Gujarat)	1956	7.0	115
Bullandshahar (Uttar Pradesh)	1956	6.7	Not available
Kapkote (UP)	1958	6.3	Not available
Delhi	1960	6.0	Not available
Nicobar	1967	6.2	Not available
Koyna (Maharashtra)	1967	6.5	200
Bhadrachalam (Andhra Pradesh)	1969	5.3	Not available
Bharuch (Gujarat)	1970	5.2	26
Kinnaur (Himachal Pradesh)	1975	6.2	Not available
Manipur-Myanmar Border	1988	6.6	Not available
Bihar-Nepal Border	1988	6.4	1004
Assam	1988	6.6	Not available
Uttarkashi (UP)	1991	6.6	769
Latur (Maharashtra)	1993	6.3	7,601
Jabalpur (MP)	1997	6.0	39
Chamoli (UP)	1999	6.8	103
Bhuj (Gujarat)	2001	6.9	13,805

**Sources :** IMD database and GSI (2000), p.17



**Collapsed newly constructed bus stand at Vondh village close to the epicentre of the earthquake**

Most of these earthquakes occurred in rural areas. The distinguishing feature of the 2001 earthquake in Kutch is that it affected both rural and urban areas.

The Geological Survey of India (GSI) *special publication No. 37* records the following four major earthquakes in Kutch during the last two centuries:

Year	MMI/Magnitude
1819	IX/8.3
1845	VIII/6.3
1903	VII/6.0
1956	IX/7.0

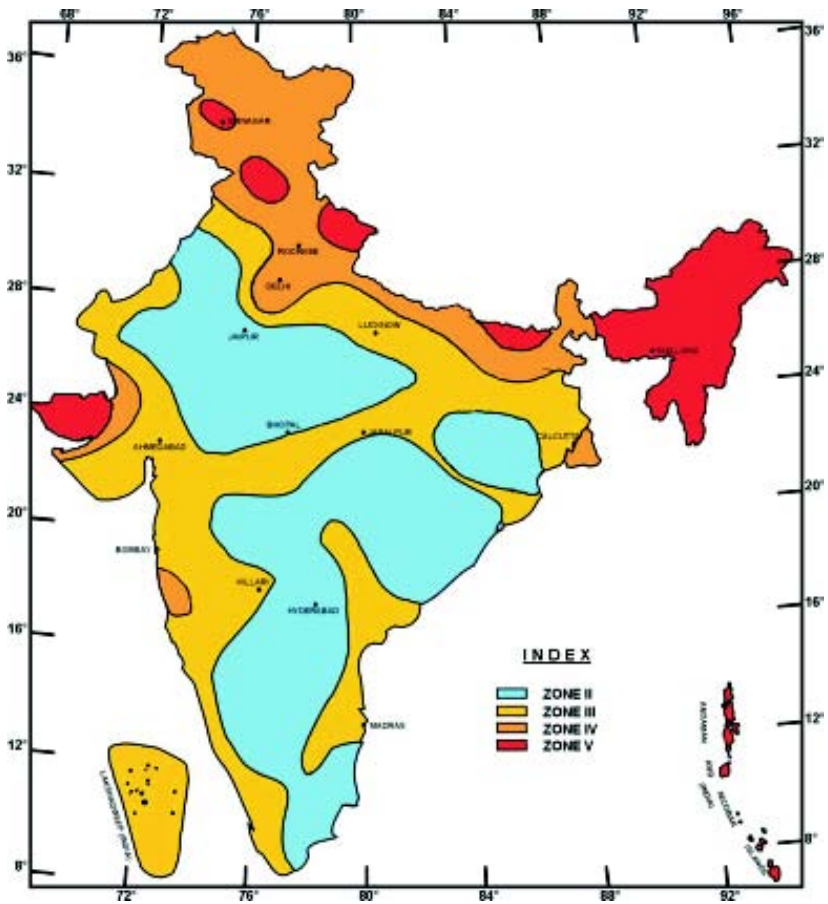
An important issue is the enforcement of seismic codes, particularly in the areas that are more vulnerable to earthquakes, for example, seismic zones IV and V. The district of Kutch is in seismic zone V. A moot point is whether there was sufficient awareness of the seismic hazards among the stakeholders in this and other areas.

A building code was introduced in India after the Quetta earthquake of 1935. However, the first formal seismic code was published in 1962. A seismic zone map of India was developed in 1962 based on past earthquakes. The map contained seven zones 0–6. The seismic zone was revised in the 1966 and 1970 editions of the Indian Seismic Code. The 1966 version also contained seven seismic zones. It is interesting to note that the Koyna earthquake of 1967 with a magnitude of 6.5, causing the death of 200 people, occurred at a place in seismic Zone I. Consequently, there was a major revision in the seismic zone map in the 1970 edition. The revised map contained five zones, by merging Zone 0 with Zone 1, and Zone 6 with Zone 5. The Latur earthquake of 1993 was of the magnitude of 6.3, with a death toll of about 7,601. Latur was located in seismic zone 1. This event again necessitated a review of the seismic zone map. The Latur area was included in Zone 3. The latest seismic zone map contains four zones.<sup>3</sup>

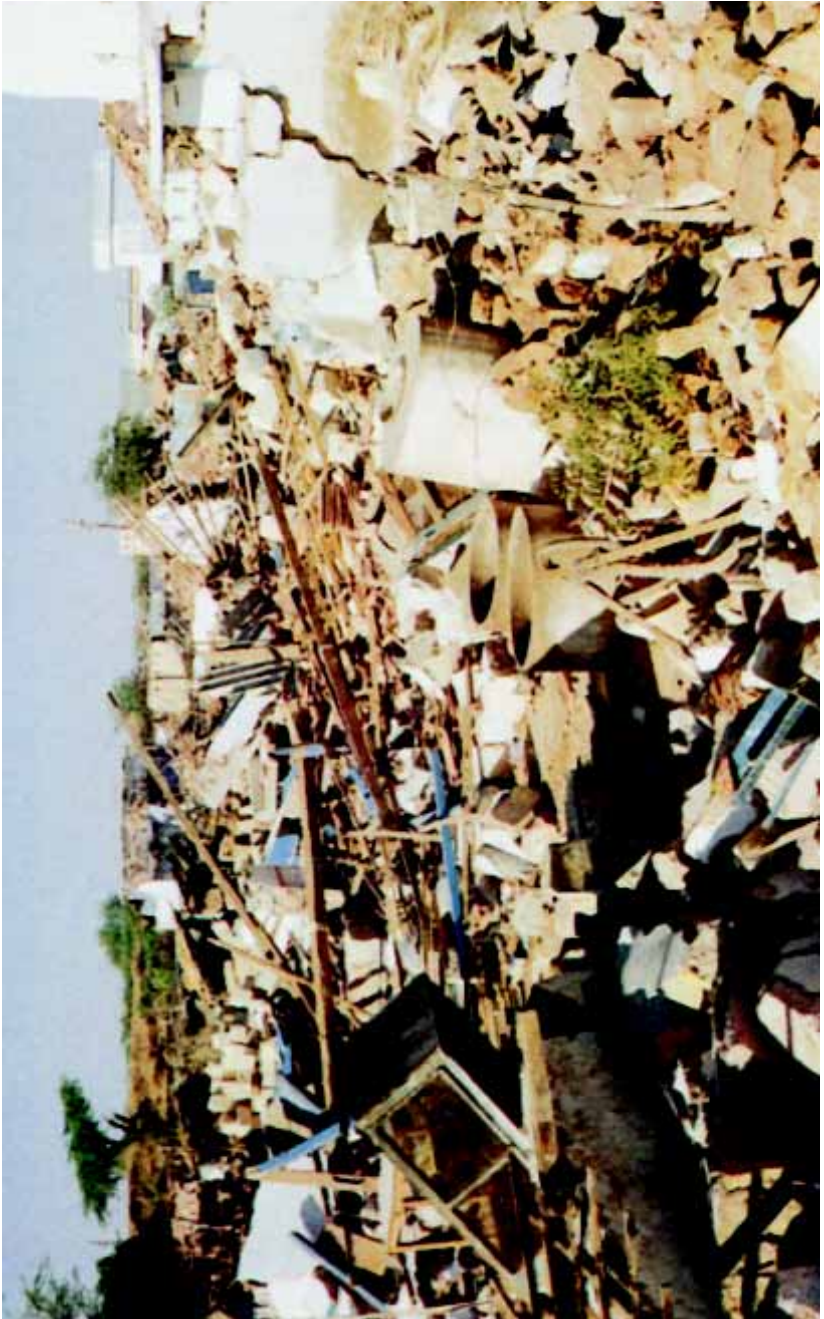
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<sup>3</sup>This is based on the details in chapter 17 of Earthquake Engineering Research Institute (2002).

## Seismic Zones of India



This map is not to scale and is indicative



**A view of the damage at Chirai village**



## **Media Perceptions**

As expected, there was widespread coverage and attention of the media on all aspects of the earthquake. They covered rescue and relief, distress of the people, losses, technical aspects, handling of the situation by the state government and so on. Most of the articles focused on individual distress, human-interest stories and deficiencies of the system. They were extremely critical of the handling of the situation by the government.

The role of the media is to bring out the facts and present the real situation. However, in this case, some sections of the media did not try to provide information with a broad perspective. They exaggerated the deficiencies and shortfalls, without highlighting, but for some exceptional cases, the excellent work done by many people in many situations. They also tried to sensationalize some aspects. In a situation like this, it is not feasible to provide relief and temporary shelter to thousands of families within hours or in a day. Instead of highlighting the efforts made to procure such materials and deliver relief to the affected persons, they adopted a negative approach. They also speculated on figures relating to death and loss.

Based on media reports, some public interest litigations were filed in the courts. A lot of time and energy of the officials were diverted to the work of compiling and furnishing information in court cases.

This was in contrast to the media coverage in the context of the attack on the World Trade Centre in the USA on 11 September 2001. There was no speculation regarding death figures, there was no pressure on the government to provide numbers and there was probably no undue criticism during the immediate aftermath of the event.

One can and should, point to the inefficiencies of the system but it should be in the context of the overall situation. Problems and deficiencies should be analysed with a proper perspective of the magnitude and spread of the disaster, and along with the work done under extremely difficult circumstances.

## **Some Experiences of the Great Hanshin-Awaji Earthquake (Japan) of 1995**

An international workshop on 'post-earthquake reconstruction experiences' was held in Gandhidham on 30 September 2003. A paper was presented here by Mashiko Murata, Project Manager, Disaster Reduction and Human Renovation Institution, Kobe, which highlights the following aspects:

- The headquarters for disaster management of local governments having been damaged, the first response was very slow. The traffic system, telecommunication system and even satellite telecommunication were disrupted. It took three days for the national government to grasp the magnitude of the damage.
- There was problem of coordination among various organizations. As the local governments were affected, they could not communicate with the national government and other agencies.
- Disruption of traffic and communication systems and lack of information caused confusion in respect of logistics relating to supply and delivery of relief materials.
- More than 80 per cent of the death was due to collapse of buildings. Most of the damaged buildings had not complied with the building codes.
- Most of the cases of rescue of people from collapsed buildings were due to the efforts of local communities.

There is an interesting book entitled *The Great Hanshin-Awaji Earthquake As Seen by a Firefighter* by Kazuhiro Yoshimoto, who was working in the Kobe City Fire department during the earthquake of 1995. He enumerates some of the problems faced immediately after the earthquake:

- Numerous supporting teams coming from other parts of the country were trapped in the traffic jams.
- Three fire stations were out of service due to total damage.
- The Fire Department took a lot of time to assess the magnitude of the disaster as almost all the teams were deployed in rescue operations.

- The supporting fire-fighting teams drawn from various parts of the country had only one communication frequency which caused a bottleneck in rescue operations.

It is interesting to look at two other observations by the same author:

The two ambulances of Hyogo Fire station were in full operation for a whole day to transport the injured citizens to the hospitals. Communication became overcharged and the ambulance phone system was down so there was no advance notice to hospitals of incoming injuries. Emergency teams found it hard to return to the fire station because roads were congested and disorderly. It took much more time to return (Yoshimoto, 2002, p. 56).

Rescue workers of other prefectures came every day to Kobe to support our efforts. It might be possible for doctors, if only for consultations officially, to accompany rescue staff on the ambulance. The Great Hanshin-Awaji Earthquake apparently caught everyone off guard. It seems no municipality made requests for doctors to ride emergency vehicles with rescue team even though there is a project that fire departments dispatch doctors in its helicopters in its emergency medical procedures in the event of the earthquake. The vulnerability in our emergency medical operation is attributable to poor lateral linkage in addition to Japanese bureaucratic sectionalism between fire and medical organizations (*ibid.*, p. 62).

In the same book, Takashi Shintani, an instructor in the Hyogo Fire Station, describes his experiences on the day of the earthquake. He concludes:

My brain no longer functioned properly. Such was January 17 to me. The thoughts that developed in my mind during the aftermath of the earthquake are countless. I regret that I didn't do more and do it better. Yet, as I look back we, the fire fighters, were powerless. What we needed the most was water and that was beyond our control. I feel deeply disappointed and shamed. We did all we could do. All the fire fighters did their best (Yoshimoto 2002, p. 54).

Many people must have felt the same way in the context of the Kutch earthquake—as well as of the Marmara (Turkey) and Chi-Chi (Taiwan) earthquakes.

## **IV Assessment of Damage and Immediate Needs**

The task of damage assessment was massive. Initially, during the first week, teams were sent to hundreds of villages to make preliminary assessments of death and damage. Subsequently, for detailed assessments, surveys were undertaken by the revenue department for housing, by the industries department for industrial units and by many other departments for their respective sectors such as roads, buildings, power system and ports. It is worthwhile to note that the sectors that suffered the heaviest damage due to the earthquake were housing and social infrastructure.

A comprehensive assessment of damages and needs was made by a Joint Assessment Team from the World Bank (WB) and the Asian Development Bank (ADB) in collaboration with the Government of Gujarat and the Government of India. The team visited Gujarat between 12–26 February 2001. It prepared a draft report on 28 February 2001, based on discussions with the Government of Gujarat and the Government of India. The report was finalized on 14 March 2001. The report contained the best possible damage assessment at the end of February 2001. The data was updated subsequently based on a more detailed review.

Assessment of damage to housing units posed the greatest challenge because of the number, complexity and the spread in terms of geographical area. Some aspects of this process are described in the following paragraphs. Then there are details, based on the report of the Joint Assessment Team, of damage to various sectors, particularly physical and social infrastructure.

### **Assessment of Damage to Houses**

The task of damage assessment was much more complex in

Ahmedabad. There was panic among the residents of even those buildings which were not damaged or had suffered minor damage. Further, even reputed professionals were not very familiar with seismic engineering aspects.

During the first three or four days, local engineers—particularly those associated with the Gujarat Institute of Civil Engineers and Architects (GICEA)—inspected many buildings and tried to classify them. Two structural engineers from Hyderabad came to Ahmedabad and made available some guidelines and booklets. In course of time, many other experts arrived. The state government also obtained some guidelines from Government of India organizations. Some pamphlets were prepared and circulated.

A.S. Arya, Professor Emeritus, Indian Institute of Technology (IIT), Roorkee and a number of other experts came to Ahmedabad. They were earlier associated with the classification of damage in the context of the Latur earthquake. In the case of Latur, most of the damaged buildings were made of stone masonry. The damage classification ranged from G0 to G5. G0 stands for ‘no damage’ and G5 for ‘collapsed buildings’. This classification was modified for Gujarat by an expert group under the chairmanship of A.S. Arya with a view to including RCC frame buildings, load-bearing masonry buildings and load-bearing wooden frame buildings.

In Ahmedabad, CEPT was requested to carry out a damage assessment survey for multi-storeyed residential buildings. As the organization did not have the adequate number of personnel for the surveys, it appealed to structural engineers from other parts of India to volunteer their services. About 160 structural engineers from various parts of the country including Gujarat, participated. In addition, about 80 postgraduate/final year undergraduate students of engineering colleges in Gujarat and 30 junior engineers participated in this project. Each damage survey team consisted of a senior structural engineer, a junior engineer (who could be a senior engineering student), one cameraman and one representative of the local authority. Each team was provided with a vehicle and a driver. The survey work continued for about three months and 5,887 buildings were surveyed. Based on the damage survey, the senior engineer of the team would submit a report with his recommendation to the CEPT. A group of engineers

from CEPT would scrutinize the report and finalize the category of damage. Buildings other than those surveyed by CEPT were surveyed by the teams deployed by the Revenue Department. They surveyed 20,160 buildings.

Another important aspect was short-term repair and retrofitting of buildings which were damaged. In many cases, such repairs were undertaken with the help of local architects and engineers. The GICEA in Ahmedabad issued some guidelines on repairing and strengthening of buildings. These measures did not effectively incorporate a scientific approach to retrofitting. About two months after the earthquake, the AMC organized a meeting of structural engineers from Ahmedabad and outside the state, and finalized some guidelines for retrofitting of structures. However, much remains to be done on this aspect because detailed guidelines, based on local conditions and sound technical knowledge, need to be formulated.

Assessment of damage in rural areas was an extremely difficult task. Thousands of villages were affected. It was necessary to complete the assessment of damage for a large number of houses within a short time. Teams were formed, each consisting of three members: an engineer, a revenue/panchayat official and a representative of an NGO/social worker. It was necessary to mobilize both technical and non-technical officials, on a large scale. Departments such as Roads and Buildings, Irrigation and Sardar Sarovar Narmada Nigam Ltd., which together account for most of the technical personnel in the government sector, had to play a crucial role.

For the purpose of damage assessment 2,051 teams comprising 2,932 technical people, 1,794 revenue officers and 2,798 others, were constituted. All of them had to be properly briefed and oriented for the complex task. It was also necessary to have uniformity in approach and methodology when such a large number of teams undertook the work in different areas. Detailed formats were prepared for the purpose of damage assessment. Guidelines were issued for detailed documentation.

Based on their visits and assessment, the teams classified houses and other structures into five categories—G-1 to G-5. Broadly, the following criteria were adopted:

<b>Damage</b>	<b>Classification</b>
Minor cracks up to ½ inch width	G-1
Upto 10%	G-2
Upto 25%	G-3
Upto 50%	G-4
Total damage	G-5

There were problems of interpretation in some cases. Remedial measures had to be taken. Clarifications had to be issued. For this purpose, there were several rounds of discussion at the state level. The meetings were held by the Chief Minister and the Chief Secretary.

There were many complaints from villages. In some cases, people complained that their properties had not been surveyed. In others, the complaint was that the properties were classified at a lower category than they should have been. There were requests for a re-survey. There was also tremendous pressure from people's representatives such as *panchayat* members and MLAs for re-survey. In some cases the re-survey was undertaken twice. At the time of the re-survey, some properties were upgraded while others were downgraded, based on additional information. The original survey report was prepared based on records, field surveys and photographs. This practice was adopted in most cases, though in some it was not feasible. Re-surveys can turn out to be an unending process. There is quite often a tendency to try to get the maximum available assistance. Therefore a cut-off date was decided. The Commissioner of Relief instructed the district collectors, by a letter of 30 June 2001, that only the applications for re-surveys received up to 15 June 2001 be considered and that the work should be completed by 7 July 2001. The matter was reconsidered by the Revenue Department on 22 October 2001; it was decided that applications for re-survey received till 15 August 2001 would be considered and the work should be completed in one month.

The damage assessment in rural areas and small towns was a challenging task because more than a million families were involved. In many cases, people had more than one house. In some cases, there were tenants. There were also multi-storeyed buildings with owners of flats/apartments. Some houses were closed and their owners lived elsewhere.

In some cases there were attempts to take undue benefits. There were also instances of activist groups who organized demonstrations by people and raised many issues.

Thus, the issues involved technical, factual and legal aspects. The task of damage and loss assessment can be baffling, especially when over a million properties and thousands of surveyors are involved. No doubt there were problems in some cases. Yet, one can say that such a gigantic task was accomplished with a reasonable degree of objectivity and promptness. It is interesting to briefly mention some findings pertaining to damage assessment:

A social impact assessment undertaken by M.S. University, Vadodara analysed, among other aspects, the process of damage assessment. It reported that the damage assessment by the Government of Gujarat for the housing sector was systematic and with a high level of transparency that ensured community participation and acceptance of the results. A team of three people ensured transparency in the assessment.

The damage assessment focused on types of houses, nature and category of damage. Aspects relating to ownership and occupation were also considered. The study concludes that the process of damage assessment was effectively handled, even though numerous issues of varied complexity arose. Of course, there were cases where the individuals did not accept the survey results and requested a re-survey. Some people delayed reconstruction with the expectation that there would be a re-survey of the damage. Sometimes, unfair means such as causing further damage were adopted. Often, people claimed assistance for more than one house. Others compared the assistance received by people in the neighbouring villages and complained of injustice and inequity. Based on a sample survey, the social impact assessment study finds that in many cases the complaints were not based on facts.

When the task is massive and the assessment is to be done over a wide area, it is but natural that problems arise. People will always have a tendency to have the damage assessed at the highest category so that they can get the maximum financial assistance. On the other hand, there were complaints regarding favouritism and corruption. Most studies and observations find that given the size of the task and magnitude of the problem, such occurrences were minimal and only by way of aberration.



## **Assessment of Damage by the Joint Assessment Team**

### **Housing**

A preliminary assessment by the Joint Assessment Team on 23 February 2001, indicated that about 400,000 dwelling units collapsed and about 500,000 were partially damaged. A subsequent estimate by the Government of Gujarat put the partially-damaged houses at 800,000. The figures were refined from time to time. It was found that a number of commercial premises had initially been counted as dwelling units. There were also changes in the category on account of the re-survey of structures in many cases. The latest numbers of collapsed and damaged dwelling units are 215,255 and 928,369 respectively.

It was estimated that the losses due to damage and destruction of houses including the value of household goods would be to the extent of Rs 5,166 crores (US \$ 1.1 billion). According to an estimate by the Government of Gujarat, it was Rs 10,000 crores. The cost of reconstruction was estimated to be Rs 5,148 crores. The Joint Assessment Team also drew the attention to additional impacts in the form of high social costs of homelessness, psychological trauma, poor health and loss of earning.

The immediate steps which were required in the context of widespread damage to housing included:

- careful and transparent damage assessment;
- provision of temporary shelters;
- debris removal;
- consultation with the people to decide whether they will reconstruct *in-situ* or relocate themselves; and
- arrangements for the appropriate construction of hazard-resistant houses.

### **Health**

There was extensive damage to health infrastructure. Two district hospitals (at Bhuj and Gandhidham), 21 Community Health Centres (CHCs),

48 Primary Health Centres (PHCs), 227 sub-centres, 800 *anganwadis*, six Integrated Child Development Schemes (ICDS) godowns, 11 Chief District Project Offices (CDPOs), 96 ayurveda dispensaries, 21 homeopathic dispensaries and one food laboratory, were completely destroyed. In addition, a number of buildings suffered major and minor damages. The total damage was estimated at Rs 219 crores. The cost of reconstruction was estimated to be Rs 279 crores. Some details are given in Table 16 below.

**Table 16: Assessment of damage to health facilities and equipment**

Type of facility	Number of facilities		Rs (Million)
	Complete	Partial	
Sub-centre	227	357	362
PHC	48	118	550
CHC	21	46	671
District/ <i>taluka</i> hospital	5	26	317
<b>ICDS:</b>			
(i) <i>Anganwadi</i> centre	800	2,180	122
(ii) CDPO office	11	4	2
(iii) Godown	6	4	4
Ayurvedic hospital/ dispensary	110	8	30
District TB Hospital/ training centre	-	8	10
Adm. building/ training centre	-	14	20
Food and drug laboratory	1	1	5
Medical colleges and speciality hospitals	-	15	55
Municipal (including AMC) hospitals	-	10	53
<b>Total</b>			<b>2,199</b>

## **Education**

Educational activities were affected in many districts on account of the damage to physical infrastructure. The worst affected districts were: Kutch, Banaskantha, Patan, Rajkot and Surendranagar. About 1,884 school buildings collapsed with 5,950 classrooms that were totally destroyed. Many school buildings were damaged. In all, 9,593 primary school buildings were damaged or destroyed. Consequently, over 42,000 schoolrooms needed to be repaired. It is interesting to note that about three-fourths of the newly constructed pre-cast structures erected for speedy construction of classrooms during 1999–2000 were either destroyed or damaged. Table 17 indicates the damage to the educational institutions.

**Table 17: Assessment of damage to educational facilities**

<b>Sector</b>	<b>Institutions affected</b>
1) Primary education	
School buildings	9593
Teacher training institutes	42
2) Kitchens for midday meal programme	1871
3) Secondary/higher secondary education	
Government schools	127
Grant-in-aid schools	1913
4) Higher education	
(universities & colleges)	47
5) Technical education	
(polytechnics & engineering colleges)	58

## **Dam safety and irrigation**

There are many small and medium earthen dams and reservoirs in Kutch and Saurashtra, which are arid zones with low rainfall. These dams and reservoirs facilitate storage and availability of water for the purpose of drinking and, to some extent, irrigation. There are 20 medium irrigation schemes and 165 minor irrigation schemes in Kutch. There was widespread



**A government school in Bhuj**

and extensive damage to earthen dams. In most cases there was cracking and displacement of the upstream sides of the dam slopes. Of 20 medium dams, 16 suffered damage, out of which five were severely damaged. Similarly, 80 out of 165 minor dams were damaged, out of which 14 were severely damaged. In the Saurashtra area, 61 dams suffered minor to moderate damage.

It was necessary to identify the dams which had become unsafe for impounding water, so as to undertake urgent repair before the monsoon (June-July 2001). The repair of other dams was also necessary in order to ensure the supply of drinking water. This work was undertaken on an urgent basis. The total cost of the damages was estimated to be Rs 186 crores. In order to repair and strengthen the dams and make them earthquake resistant it was estimated that an amount of Rs 419 crores would be required.<sup>4</sup>

### **Rural water supply**

The drinking water supply system was adversely affected in 1,340 villages of the following five districts: Banaskantha, Jamnagar, Kutch, Rajkot and Surendranagar. Out of these, 1,100 villages, particularly in Kutch, Rajkot and Jamnagar, were severely affected. In Kutch, the water supply depends mainly on ground water supplemented by surface water from Tappar and Shivilakha dams. Rajkot and Jamnagar depend on the Machhu-II dam and a few ground water schemes. Surface water schemes (dams, pumping stations, pipelines and water treatment plants) as well as ground water schemes (121 regional schemes covering 693 villages and 191 individual schemes) were affected to varying degrees. The most severely damaged facilities were: two dams, two water treatment plants, over 350 tube wells with pumping equipment and pump houses, and over 1500 km of pipelines. The RCC underground tanks and overhead tanks could withstand the impact, whereas masonry structures collapsed. Other damages were ruptures and dislocation of transmission pipelines, resulting in leakages. The total amount of damage was estimated to be Rs 233 crores. The estimated cost of reconstruction including upgrading for hazard resistant construction was around Rs 451 crores.

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<sup>4</sup> The actual requirement was less than what was estimated by the irrigation department.

## **Municipal infrastructure**

There are six municipal corporations and 143 municipalities in Gujarat. Five municipal corporations and 57 municipalities were affected by the earthquake. There were damages to urban and environmental infrastructure such as the water supply, storage system, sanitation, solid waste management, municipal roads, municipal dispensaries, street lighting, municipal administrative buildings, and other buildings such as laboratories, town halls, and municipal markets. Severe damage occurred in 14 towns of Kutch, Rajkot and Surendranagar districts. The worst affected towns were: Anjar, Bhachau, Bhuj, Gandhidham and Rapar in the Kutch district, and Morbi in the Rajkot district. The municipal infrastructure in Ahmedabad city suffered damage. The other towns which suffered losses were Mandvi (Kutch district), Wankaner (Rajkot district), Dhrangadhra, Halvad, Limdi, Surendranagar, Thangadh and Wadhwan (Surendranagar district). The damage caused was estimated to be Rs 140 crores and the replacement cost with upgrading, Rs 209 crores.

## **Public buildings and historic monuments**

The public buildings relate to the Roads and Buildings Department, the Police Department and the Department of Sports, Youth Services and Cultural Activities. They include both administrative buildings and residential quarters. As in the case of housing, most of the public buildings destroyed were located in the Kutch district. At least 12 court buildings and 12 jails and sub-jails were badly damaged. The buildings which collapsed were mostly old, one or two-storeyed structures with masonry walls. They were mainly load-bearing structures. The total damage was estimated at Rs 339 crores. The cost of reconstruction of public buildings was estimated at Rs 442 crores. The details of the damaged buildings are given in Table 18.



**Museum at Bhuj**

**Table 18: Number of public buildings affected by the earthquake**

Type of Building	Total Gujarat		Kutch District	
	Destroyed	Damaged	Destroyed	Damaged
<b>A. Administrative</b>				
Urban	137	859	120	184
Rural	57	95	53	24
Total (Buildings)	194	954	173	208
<b>B. Residential</b>				
Urban	184	901	153	24
Rural	67	118	65	95
Total (Units)	251	1,019	218	119

**Note:** The figures do not include buildings under the Police Department that are indicated in Table 18.1.

**Table 18.1: Number of police department buildings affected by the earthquake**

Type of Building	Destroyed	Damaged
Administrative	10	122
Residential	1,257	4,932

In Gujarat there are numerous heritage structures. The earthquake-affected areas, particularly Kutch, have evidence of the Indus Valley Civilization.

There are 212 protected monuments with the Archaeological Survey of India, out of which 69 structures were affected due to the earthquake: two of them completely collapsed, 25 had major damage and 42 monuments had minor damage. One of the collapsed monuments was Maharao Lakhpatji Chhatri at Bhuj. The State Department of Archaeology has indicated 330 monuments as protected monuments, out of which 101 were moderately damaged, 32 had major damage and one monument collapsed. Among these are the old temples of Kutch at Purneshwar, Kanthkot, Bhuvaneshwar Mahadev and Kera, as well as other structures such as Lakhota in Jamnagar.



There are many heritage buildings used for public purposes such as schools, hospitals, administrative buildings, museums, rest houses, police stations and officers' bungalows. There were about 3,000 such administrative buildings, out of which 954 were damaged and 194 were destroyed. As regards residential quarters, about 1,000 were damaged and 250 were destroyed. Some examples of such public buildings are the Jubilee Hospital at Bhuj, the Deputy Collector's office at Anjar, Rapar police station and the Collector's residence at Bhuj.

In addition to the above categories, there are a large number of monuments which are unprotected and unrecognized, most of which are privately owned. Reliable data on such monuments are not available. According to an estimate by INTACH, at least 10,000 such buildings and sites, which include palaces, old *havelis*, wells, *chhattries*, places of religious significance, clock towers, gateways, and pavilions, located in 250 towns and many villages, were affected by the earthquake. Some important ones are the *Darbargarh* of Kutch, Aina Mahal, Prag Mahal, the Vegetable Market, Taksal Mosque and Rudrani temple in Bhuj, and the Green Tower, Ram Malhol temple, Morvi Palace, Pratap Vilas and Sai School in Jamnagar.

According to the WB and ADB joint assessment report, out of the 329 monuments protected by the Government of Gujarat, 33 suffered major damage and a 100 suffered some damage such as major and minor cracks. Many unprotected historic buildings and monuments had been damaged or destroyed.

## **Power**

The earthquake caused extensive damage to the power supply facilities in Kutch and other districts such as Banaskanta, Jamnagar, Rajkot and Surendranagar. Some power stations sustained minor losses, but transmission and distribution systems suffered severe damages.

The Kutch Lignite Thermal Power Station at Panandro in Kutch district sustained some minor damage. The building for the Diesel Generator (DG) set at Bhuj was also damaged. Cracks developed in the Sikka Thermal Power Station building, damaging equipment and overhead tanks. There was also some damage at the Dhuvaran Thermal Power Station.

There was damage to the 220-KV sub-stations at Anjar, Nakhatrana and Nani Kakhar, two 132-KV sub-stations at Samakhiali and Bhuj and 44 sub-stations of 66 KV in Bhuj, Rajkot, Surendranagar and Jamnagar circles. The most severe damage was to the 220 KV sub-station at Anjar and about 20 66-KV sub-stations in the Bhuj circle. The control rooms collapsed damaging the control panels and battery banks underneath. Power transformers were detached and toppled over.

In addition to the power transmission system there was extensive damage to the distribution system affecting most of the villages in the region. The total loss to the power sector was estimated to be Rs 186 crores. The cost of reconstruction and upgradation was estimated at Rs 456 crores.

### **Transport infrastructure**

Transport infrastructure includes roads, bridges, rail, port and airport infrastructure. The transport sector suffered relatively less, compared to the other sectors.

In the road sector, maximum damage was caused to bridges and culverts. The old Surajbari bridge, which had been constructed in the 1960s, suffered significant damage during the earthquake. The bridge was closed to traffic for the first two days. It was temporarily restored for slow and single-lane traffic. Five weeks after the earthquake, the New Surajbari bridge was commissioned.

The railway infrastructure suffered relatively minor destruction. Most of the damage was to buildings— stations and staff quarters—with some minor damage to structures and signaling infrastructure. Rail links which had been discontinued were restored quickly.

With regard to ports, there was significant damage to the Kandla port. Five of the 10 dry cargo jetties developed major cracks. The oil jetty and a small wharf were damaged. Some mechanical and electrical equipment were also damaged. Twelve of the 40 ports managed by the Gujarat Maritime Board were damaged; the Navlakhi port was the most affected. Most of the marine structures, cargo handling equipment, storage facilities, residential/office buildings, roads, bridges, etc., were destroyed.



**Highway to Bhuj**



**A disrupted rail track in Navalakhi port area**



**Railway station at Bhachau**

The airport at Bhuj suffered some damage to the runway and major destruction to the old terminal building. However, there was already a new terminal building under construction, which was made operational in September 2003. There was some damage to the terminal building at the airport at Kandla and very minor damage to other airports such as those at Rajkot and Porbandar.

The damage to the transport sector was assessed at about Rs 233 crores for roads; Rs 79 crores for railways; Rs 198 crores for ports; and Rs 19 crores for airports.

### **Telecommunication**

There was extensive damage to the telecommunication system. About 80,000 lines were out of commission due to the collapse of telephone exchange buildings. In Bhuj, Jamnagar, Rajkot and Surendranagar, 179 exchange buildings and 146 staff quarters were destroyed. The amount of damage to telecommunication facilities was estimated to be Rs 51 crores. The total reconstruction cost was estimated at Rs 121 crores.

Extensive damage to telecom buildings affected the communication system. The exchanges at Bhachau, Khavda, Nakhatrana and Rapar were set up in tents. In Nakhatrana and Rapar, facilities were restored in the original buildings after the main exchange was restored. Due to the severe damage to the original buildings, two exchanges were set up in tents, 10 exchanges in other locations and eight exchanges were set up in nearby buildings.

### **Agriculture and livestock**

Agriculture had been severely affected by two consecutive years of drought. The earthquake added to the plight of the farmers. According to the estimate of the Government of Gujarat, the total loss of assets was estimated at Rs 544 crores. The Joint Assessment Team estimated the loss of assets in private sector agriculture and livestock at Rs 509 crores. Major asset losses related to irrigation assets such as bore wells, pump houses and water storage tanks. There was damage also to storage bins,



**Damage to the telephone exchange in Khayda village**

farm implements, plant protection equipment, stored output and inputs and livestock. The damage to public sector assets was estimated at Rs 35 crores, which included public buildings of the Agriculture Department, Gujarat Agricultural University and animal husbandry units. Output losses due to the earthquake were estimated to be about Rs 228 crores. Such losses were due to the delay in picking the standing crops of cotton and castor, the lack of irrigation at a critical stage, and the lack of farm storage facilities.

### **Industry**

Damage to industrial units mostly occurred in Kutch, Rajkot, Jamnagar, Bhavnagar and Surendranagar. This related to industrial buildings, machinery and inventory. The damage was initially estimated at Rs 340 crores. According to the Joint Assessment Report, there were losses to about 3,000 small-scale industrial units and a number of medium and large-scale enterprises.<sup>5</sup>

Gandhidham and Kutch have many wood-based industries. The Kandla Free Trade Zone and the Gujarat Industrial Development Corporation (GIDC) estate also house many industries. Bhachau has a number of salt units. The GIDC estates at Bhuj and Anjar also suffered severe damage. In Rajkot, there was damage to buildings, chimneys and kilns of ceramic industries at Morbi and Wankaner. Similar damage occurred in the Surendranagar district. Some of the structures belonging to the Indian Farmers Fertilizer Cooperative Ltd (IFFCO) at Kandla were also damaged. In this context, it is important to note that a large number of people in Kutch and other areas affected by the earthquake earn their livelihood from handicraft and handlooms.

### **Service sector**

The five most affected districts, namely, Kutch, Rajkot, Jamnagar, Patan and Surendranagar, have a large number of commercial and trade establishments. They include wholesale and retail shops, restaurants and hotels. There are large shopping areas in Gandhidham. All these establishments were damaged. The total losses were estimated at Rs 1,163 crore. The output loss was estimated at Rs 1,748 crore.

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<sup>5</sup>A later estimate by the Government of Gujarat indicates that in 19 districts 9736 small industrial units and 125 medium/large industries were affected, the estimated damage being Rs. 406 crores and Rs. 314 crores respectively.





**A factory near Bhachau**



**A damaged factory on Rapar road**

## Overall Assessment of Asset Losses and Reconstruction Cost

The overall estimates of asset losses and reconstruction cost prepared by the Joint Assessment Team are given in Table 19.

**Table 19: Sector-wise asset losses and reconstruction costs (Rs Crore)**

Sector	Asset Losses	Reconstruction cost
Housing	5,166	5,148
Health	219	279
Education	670	837
<b>Sub total: Social sectors</b>	<b>6,054</b>	<b>6,264</b>
Irrigation	186	419
Rural water supply	233	451
Municipal infrastructure	140	209
Public buildings and monuments	339	442
Power	186	456
Transport	321	358
Ports	98	121
Telecommunications	51	121
<b>Sub total: Infrastructure</b>	<b>1,553</b>	<b>2,576</b>
Agriculture and livestock	544	344
Industry	339	205
Services	1,163	930
<b>Sub total: Productive sectors</b>	<b>2,046</b>	<b>1,479</b>
<b>Sub total: Environment</b>	<b>256</b>	<b>256</b>
<b>Grand Total</b>	<b>9,909</b>	<b>10,575</b>

Source: WB and ADB (2001), p. 12.

According to the WB/ADB Joint Assessment Team, the asset losses were estimated at Rs 9,909 crores and reconstruction cost at Rs 10,575 crores. On the other hand, the Government of Gujarat placed the losses at Rs 15,308 crores and reconstruction cost at Rs 11,499 crores. The difference was mainly due to the estimated loss in respect of the housing sector, which, according to the Government of Gujarat estimate, was Rs 10,000 crores against the WB estimate of Rs 5,166 crores.

The actual expenditure on housing is likely to be much less than what is estimated. This is because the housing packages envisage assistance to the extent of the minimum requirement for housing. They do not compensate the entire loss. In fact, middle class and high-income families got much less than what they lost due to the earthquake—less than even what they spent on reconstruction.

The total financial loss includes primary loss (loss of assets), secondary loss (loss of output due to disruption of economic activities) and tertiary loss because of the long-term effects on the economy. Table 20 indicates these three types of losses as estimated by the Government of Gujarat.

**Table 20: Total financial loss (Rs Crore)**

<b>Type of loss</b>	<b>Financial loss</b>
Primary loss	15,308
Secondary loss	3,048
Tertiary loss	10,067

**Source:** Government of Gujarat

## V | Transition from Relief to Recovery

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The Government of Gujarat tried to ensure that the transition from the relief phase to recovery was smooth and brief. Even when short-term rescue and relief operations were being undertaken, medium and long-term recovery aspects were analysed. Rehabilitation schemes, or packages, were also formulated.

### **Shelter**

Gradually, the issue of interim shelter and reconstruction of houses was brought up. People cannot live in tents for a very long time. It was necessary to provide interim shelters till permanent houses were constructed. Many alternatives were explored. Presentations, even to the State Cabinet, were made by experts and specialized agencies.

For the purpose of interim accommodation, land was identified at Bhuj and infrastructure such as road, water supply and electricity were provided. Similar sites were identified at Bhachau and Anjar. Those who did not like the sites identified, were given other options for interim accommodation. Some people opted for galvanized iron sheets, some for cash assistance and others for rented premises. The Government of Gujarat provided assistance in the form of materials and cash to about 218,000 families. NGOs supplemented the efforts by providing interim shelter to about 7,000 families.

A few weeks later, the issue of permanent shelter and reconstruction programmes came to the fore. On the one hand, experts advised that the policy of housing and the overall reconstruction should be analysed in

depth before a final policy was announced. On the other hand, there was tremendous pressure from the people and the media asking the government to announce its policy of assistance for reconstruction. Housing packages or schemes were to be conceptualized and finalized. A task force was constituted to formulate schemes for reconstruction of houses on 7 February 2001. K. V. Bhanujan, a retired IAS officer with prior experience in disaster management, was appointed chairman of this task force. Other members were principal secretaries of departments such as health, revenue, urban development, finance and roads and buildings.

During the immediate aftermath of the disaster, numerous meetings were held and many hours of discussion took place. The Chief Minister of Gujarat and senior cabinet ministers participated in all those deliberations.

The above-mentioned task force analysed various aspects of rehabilitation and reconstruction and prepared some schemes for housing. The schemes were examined by the GSDMA, which forwarded the schemes for the issuance of a government order. On 23 February 2001, four government resolutions were issued sanctioning packages or schemes 1, 2, 3, 4-A and 4-B. Subsequently, another government resolution was issued on 24 April 2001, announcing a fifth package for the four towns of Bhuj, Bhachau, Anjar and Rapar. Thus, five schemes were announced in less than a month of the earthquake and another housing scheme, within three months.

Package 1 is meant for villages with more than 70 per cent of structures damaged. Such villages could be relocated with the consent of the villagers. For this purpose, the *Gram Sabha* or the Village Council would pass a resolution. Different categories of households such as landless labourers, marginal farmers, small farmers and other farmers are entitled to plots of different sizes and construction areas (Table 21). The state government assistance covers the cost of construction of houses (@ Rs 2,400 per sq. mt), cost of land acquisition and cost of primary infrastructure. It was estimated that the cost of setting up a village of 200 families would be about Rs 3 crores.

**Table 21: Plot size and construction area in package 1 meant for relocation of villages**

S.No.	Category	Plot area sq.m	Construction area sq.m
1.	Landless agricultural labourers	100	30
2.	Marginal farmers (up to 1 hectare landholding)	150	40
3.	Small farmers (between 1 to 4 hectares landholding), small traders, artisans and others	250	40
4.	Farmers with more than 4 hectares landholding	400	50

Package 2 is for villages that are located in seismic zones IV and V and for *in-situ* reconstruction, i.e., those villages that are not to be relocated. Details of assistance for completely damaged and partially damaged houses are given in Tables 21.1 and 21.2. For completely damaged houses, assistance is disbursed in three installments: 40 per cent at the preparatory level, 40 per cent when the construction reaches the lintel level and the remaining 20 per cent, after completion of construction.

**Table 21.1: Assistance under package 2 for destroyed houses**

S.No.	Type of Damage	Assistance
1.	Completely destroyed hut	Rs 40,000 per unit
2.	<u>Completely destroyed house:</u>	
(a)	the existing built-up area is up to 25 sq.m	Up to Rs 50,000
(b)	the existing built-up area is up to 35 sq.m	Up to Rs 70,000
(c)	the existing built-up area is up to 45 sq.m	Up to Rs 90,000

**Table 21.2: Assistance under package 2 for partially-damaged houses**

S.No.	Type of damage	Assistance
1.	If there are cracks of at least ½ inch width	Up to Rs 3,000
2.	Damage up to 10%	Up to Rs 7,000
3.	Damage up to 25%	Up to Rs 15,000
4.	Damage up to 50%	Up to Rs 30,000

Package 3 is for villages which are outside seismic zones IV and V. The details of assistance are given in Table 21.3.

**Table 21.3: Assistance under package 3 for destroyed and partially-damaged houses**

S.No.	Type of Damage	Assistance
1.	Completely destroyed hut	Rs 7,000
2.	Partially-damaged hut	Rs 2,000
<u>Destroyed/partially-damaged houses:</u>		
3.	If there are cracks of at least 1/2 inch width	Up to Rs 2,000
4.	For repair of damage up to 10%	Up to Rs 5,000
5.	For repair of damage up to 25%	Up to Rs 10,000
6.	For repair of damage up to 50%	Up to Rs 20,000
7.	Completely damaged <i>kachcha/pucca</i> houses	Up to Rs 40,000

Package 4 is for urban areas excluding the four towns of Kutch. It has two components: one for buildings with RCC structures (4A) and the other for buildings with load-bearing structures (4B).

In Package 4A, for collapsed buildings or those pulled down for safety reasons, assistance at the rate of Rs 3,500 per sq. m, up to 50 sq.m (up to Rs 1,75,000) is paid. For repair of non-multi-storeyed RCC buildings, assistance was provided as per Table 21.4. Details of assistance in respect of multi-storeyed residential buildings (low-rise and high-rise) are given in



Table 21.5. For this purpose, low-rise buildings are those up to ground plus three storeys or open ground storey plus four storeys with a building height limitation of 15 m.

**Table 21.4: Assistance under package 4A for repair and strengthening of non-multi-storeyed residential RCC structures**

S.No.	Type of damage	Assistance
1.	More than ½ inch width cracks	Up to Rs 2,000
2.	10% or more damage	Up to Rs 5,000
3.	25% or more damage	Up to Rs 10,000
4.	50% or more damage	Up to Rs 20,000

**Table 21.5: Assistance under package 4A for repair and strengthening of multi-storeyed buildings**

S.No.	Type of damage	Assistance
1.	Buildings placed in Category G-2	
(a)	Low-rise buildings	Up to Rs 50,000
(b)	High-rise buildings	Up to Rs 100,000
2.	Buildings placed in Category G-3	
(a)	Low-rise buildings	Up to Rs 200,000
(b)	High-rise buildings	Up to Rs 400,000
3.	Buildings placed in Category G-4	
(a)	Low-rise buildings	Up to Rs 400,000
(b)	High-rise buildings	Up to Rs 800,000

Package 4 B is meant for load-bearing structure buildings. For buildings which have collapsed or been pulled down due to safety reasons, assistance is at the rate of Rs 2800 per sq.m for up to 50 sq.m (i.e., up to a total of Rs 140,000). For collapsed huts, the assistance is up to a maximum of Rs 2000. For repairs and strengthening assistance, see Table 21.6.

**Table: 21.6: Assistance under package 4B for repair and strengthening of low-rise, load-bearing residential buildings**

S.No.	Type of damage	Assistance
1.	More than ½ inch width cracks	Up to Rs 2,000
2.	10% or more damage	Up to Rs 5,000
3.	25% or more damage	Up to Rs 10,000
4.	50% or more damage	Up to Rs 20,000

Package 5 is for the four towns of Kutch: Bhuj, Anjar, Bhachau and Rapar. In these towns construction of buildings with a maximum height of up to ground plus two storeys are permitted. For load-bearing construction, the assistance is as per Table 21.7 below:

**Table 21.7: Assistance under package 5 for repair and reconstruction of load-bearing structure houses in the four towns of Kutch**

Damage category	Assistance
G5	Rs 3000 per sq.m up to a maximum of Rs 1,50,000
G4	Up to Rs 45,000
G3	Up to Rs 30,000
G2	Up to Rs 15,000
G1	Up to Rs 8,000
Fully collapsed hut	Rs 7,000

For completely collapsed RCC buildings, the cash assistance is at the rate of Rs 3000 per sq.m up to 50 sq.m (i.e., up to a total of Rs 1,50,000). For damaged RCC buildings, the assistance is the same as in package 4A, meant for other urban towns.

It was also envisaged to provide housing assistance to the relevant groups of affected persons under the Indira Awas Yojana and other ongoing housing programmes.

## **Removal of Debris**

The removal of debris was a critical issue. In the beginning, some amount of debris had to be removed in order to enable vehicles to move to the affected areas for facilitating rescue operations. However, the systematic removal of debris started only after a few days. Initially, people did not want the debris to be removed. Many of them wanted to search for their household goods and other belongings. They felt that they would not be able to recover their belongings if debris were removed. A decision was taken by the state government after a few days to take up debris removal in a big way. This was necessary in order to bring about normalcy and to prevent the outbreak of disease.

The Roads and Buildings Department undertook the clearance of debris from Bhuj city and rural areas, with the assistance of the Army, the Gujarat Mineral Development Corporation (GMDC), Surat Municipal Corporation and the Gujarat Ship Breaking Association. The Irrigation Department was given the responsibility of the debris removal work in Bhachau *taluka*. During this operation, the Government of Maharashtra, the Bombay Municipal Corporation, the ONGC, Sardar Sarovar Narmada Nigam Limited (SSNNL) and Army units collaborated by providing equipment and personnel. In Anjar city, the work was undertaken by Reliance Industries, SSNNL and private contractors. The Kandla Port Trust took up debris clearance work in the Gandhidham area. It engaged some private contractors also for this purpose. In Rapar *taluka* the Irrigation Department, the GMDC, the Roads and Building Department and the Government of Haryana took up the clearance of debris in various areas.

Thus, the work of removal of debris was undertaken through many agencies. In the first phase, the work was completed in respect of roads and public places. Some debris remained in the interior areas of cities, especially of Bhuj because there were narrow lanes and no vehicle could pass through them. The work had to be done manually. As people commenced repair work and tried to replace some parts of the damaged structures there was more debris. Some buildings which were dangerous for public safety had to be pulled down by controlled demolition. Debris was also lying in private premises, both in urban and rural areas.

In the rural areas, debris was removed through drought relief work particularly in the villages of Kutch. For this purpose, a daily wage of Rs 40 was paid per person, in addition to the reimbursement of expenditure on tractor trolleys used for removal of debris. Subsequently, in the month of October 2001, it was found that debris was still lying in some villages. A programme was initiated to remove debris through village-level committees. A government resolution was issued to that effect.

It is estimated that about 109 lakh MT of debris was removed by various agencies as indicated in Table 22.

**Table 22: Removal of debris by different agencies**

<b>Agency</b>	<b>Debris in lakh MT</b>
Roads & Buildings Deptt	20.48
Irrigation Deptt	18.72
Kandla Port Trust	4.06
Government buildings	4.66
Drought relief work	20.48
Village committee/ village <i>panchayat</i>	40.41
<b>Total</b>	<b>108.81</b>

In some cases, irregularities in the removal of debris was noticed. Disciplinary action was taken against 276 employees: 5, 40 and 231 respectively of class 1, 2 and 3 categories. Of these employees, 29 were removed from service.

Even during the removal of debris through village committees, irregularities were noticed and criminal cases were filed against officials and a number of non-officials. These cases involved 738 people.

However, it may be noted that looking to the magnitude and spread of the work, such cases of irregularities cannot be considered significant.

## **Emergency Measures for Social Infrastructure**

The immediate requirement was to re-start educational institutions and ensure that there was no delay in the commencement of the next educational session. As the first step, primary schools were started in clusters of villages. About 300 such clusters were established in the affected districts. Personnel from non-affected districts were deployed so as to resume educational activities. Tents, water facilities, mats, teaching and learning material etc., were provided. Secondary schools were made functional in tents.

Over 8,000 schoolrooms had been destroyed due to the earthquake. It was realized quite early that unless steps were taken to provide temporary structures, it would be difficult to continue teaching at schools when the new academic session began. Temporary structures—including tents provided by UNICEF—were arranged for over 10,000 classrooms so that all the schools were reopened by the middle of June 2001. A detailed plan for the repair and reconstruction of schools was prepared. Repair work of 42,678 schoolrooms was undertaken through village-level civil works committees comprising the village *Sarpanch*, a school teacher and a village-level official.

Medical and health centres—civil hospitals, CHCs, PHCs, dispensaries and so on—were made operational with temporary structures.

Government offices were made functional in temporary shelters, rented premises and, in some cases, repaired buildings. Several interim structures were constructed for office and residential purposes.

In the Kutch district, three dams meant for the supply of drinking water were among those damaged due to the earthquake. Urgent repair of the three dams was completed before the monsoon season of 2001. Keeping in view the safety aspect, repair work for 60 other dams in the Kutch and Saurashtra areas was completed on time. A Dam Safety Panel of experts was set up and long-term measures for strengthening of dams were initiated.

Many buildings in Ahmedabad and other towns collapsed when the earthquake struck. A technical committee of experts was constituted to advise the government on changes to be made in the general development

control regulations. After a series of discussions and interactions with professionals, architects and engineers, a set of regulations incorporating provisions on structural safety were notified in March 2001. Some amendments were made in May 2001. The idea was to implement and enforce the provisions of the National Building Codes and ISI standards.

## **Creating a New Organizational Structure**

The Government of Gujarat decided, keeping in view the Orissa State Disaster Management Authority created after the super cyclone of 1999, to constitute a separate agency, i.e., the GSDMA, for executing and coordinating the complex task of reconstruction and rehabilitation. The government issued a resolution on 8 February 2001, in less than two weeks after the earthquake, to this effect. The GSDMA was registered as a society under the Societies Registration Act. M. Sahu, an officer of the rank of Secretary to the Government, and who was working at that time as the Managing Director, Gujarat Informatics Ltd (GIL), was appointed as the Chief Executive Officer of the GSDMA. Sahu, with the assistance of J.G. Pandya, an officer of the rank of Additional Collector, and Sanjay Joshi, a gazetted officer from the Commissionerate of Rural Development, started operating from the office of the GIL. Arvind Joshi, an IAS officer, joined on 28 February 2001. V. Thiruppugazh, who was working as Collector, Sabarkantha was appointed to the GSDMA on 1 March 2001.

A Task Force was set up, headed by the author, who was then Principal Secretary, Department of Agriculture. It comprised national-level experts, representatives of NGOs and some senior officers of the state government. The Task Force was to suggest effective measures for the preparation of a long-term disaster management plan. It was envisaged that the Task Force would address the following issues:

- To suggest effective measures for preparedness so as to organize prompt rescue and relief in the event of natural disasters. This would include the formation of specialized groups for rescue operations, equipment and training of personnel.
- To review the present status of disaster management plans, particularly at state/district/*taluka* level.

- To ensure the preparation of appropriate disaster management plans for different types of disasters.

During the next few days, support staff were appointed, a few on deputation from the government and most others on a contract basis. In the meantime, on 15 March 2001, the state government appointed the author as the Chief Executive Officer (CEO) of the GSDMA. M. Sahu and P. Pannervel functioned as Additional Chief Executive Officers.

Office space was leased on the fifth floor of the Udyog Bhavan, from the Gujarat Industrial Investment Corporation. Thus, the GSDMA, even while identifying office premises and staff, became functional and commenced the complex task of reconstruction and rehabilitation in the aftermath of the earthquake.

The creation of the GSDMA was a momentous decision. The Government of India had played an important role in suggesting the creation of such an organization along the lines of that created in Orissa after the super cyclone of 1999. As described later in this book, the progress of reconstruction and rehabilitation has been widely acclaimed, both nationally and internationally. The creation of a new organizational structure contributed immensely to such an outstanding achievement. The other and possibly more important factor, was the appointment of some of the most dedicated, hardworking and capable officers to the GSDMA.

## **Financing of Relief and Rehabilitation Work**

The Government of Gujarat has a Calamity Relief Fund (CRF) of Rs 891.84 crores shared in the ratio 75:25 by the Government of India and the state government for the period between 2000–01 to 2004–05. The state government is also entitled to allocation from the National Calamity Contingency fund (NCCF) in case there is a calamity of rare severity. Initially, the Government of India released Rs 830 crores from the NCCF in two installments of Rs 500 and Rs 330 crores. The Ministry of Agriculture (GOI) deputed a central team to assess the requirement of the state government to meet the relief expenditure, after receiving the memorandum from the Government of Gujarat. Based on the NCCF norms and the preliminary assessment carried out, the team recommended

an assistance of Rs 1938.64 crores from the NCCF. After considering the report of the central team, the Government of India decided to allocate an amount of Rs 1467.37 crores from the NCCF.

Immediately after the earthquake, the ADB and the WB came forward to fund the massive reconstruction programme. In fact, the interactions with these organizations commenced within days of the earthquake. They were prepared to send their team immediately. It was mutually agreed, keeping in view the immediate task of rescue and relief, to have the team in Gujarat on 12 February 2001. The joint assessment team that arrived consisted of about 50 members. They spent 15 days visiting the affected areas and interacting with the departments concerned.

The WB and the ADB sanctioned loans in less than three months after the earthquake. The Government of India also promptly provided financial assistance. Several state governments came forward to participate in the reconstruction work in different villages. The UN agencies in India (such as UNDP, FAO, UNICEF and UNESCO), multilateral and bilateral agencies, NGOs and the corporate sector, participated in the relief and reconstruction work.

The WB and the ADB announced, respectively, US \$ 1 billion and US \$ 500 million for the Gujarat Earthquake Reconstruction Programme (GERP). In course of time, however, the state government and the GSDMA decided to take lesser amounts: US \$ 703 million from the WB and US \$ 350 million from the ADB.

The WB financing focuses on five broad areas: housing, social sector, infrastructure, community participation support and disaster management capacity building. The ADB funding focuses on housing, urban/rural infrastructure, power, livelihood rehabilitation, consulting services and incremental administrative support, and multi-hazard disaster preparedness and mitigation. Though some sectors are common to both, it was ensured that there was no overlapping in terms of functional and geographical areas.

The WB-funded project is implemented in two phases. Phase I envisages a project cost of Rs 1405.80 crores and Phase II envisages Rs 2031.78 crores (Table 23); the figures include the counterpart funding of the Government of Gujarat. The project components funded by the ADB are shown in Table 23.1.



**Table 23: Components and estimated cost (Rs crore) of the WB project: Phase I and II**

<b>Component</b>	<b>Phase I</b>	<b>Phase II</b>	<b>Total</b>
<b>A. Housing</b>			
Rubble Removal	8.70	0.00	8.70
Temporary Shelters	77.60	0.00	77.60
Permanent Houses	1,162.20	634.56	1,796.76
<b>Total Housing</b>	<b>1,248.50</b>	<b>634.56</b>	<b>1,883.06</b>
<b>B. Health</b>	0.42	0.00	0.42
<b>C. Public Infrastructure</b>			
Education			
<i>i.</i> Primary Education	0.00	3.05	3.05
<i>ii.</i> Technical Education	0.77	64.79	65.56
<i>iii.</i> Municipal & Corporation Schools	6.98	7.10	14.08
<b>Total Education</b>	<b>7.75</b>	<b>74.93</b>	<b>82.69</b>
Public Buildings			
<i>i.</i> State R & B	22.90	176.58	199.48
<i>ii.</i> Panchayat	6.19	37.80	43.99
<i>iii.</i> Police Housing	0.24	34.34	34.58
<i>iv.</i> Other Buildings & Urban Local Bodies	0.05	7.82	7.87
<i>v.</i> Seismological Institute, GIDM & other Buildings	0.00	65.00	65.00
<b>Total Public Buildings</b>	<b>29.38</b>	<b>321.54</b>	<b>350.92</b>
Retrofitting			
<i>i.</i> State R & B	0.00	120.05	120.05
<i>ii.</i> Panchayat	0.00	18.90	18.90
<i>iii.</i> Health Buildings & other Public Infrastructure	0.00	63.50	63.50
<b>Total Retrofitting</b>	<b>0.00</b>	<b>202.45</b>	<b>202.45</b>

Contd

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Roads and Bridges	75.64	373.18	448.82
Dam Safety and Irrigation	19.72	226.69	246.41
<b>TOTAL PUBLIC INFRASTRUCTURE</b>	<b>132.49</b>	<b>1,198.80</b>	<b>1,331.29</b>
D. Community Participation	0.58	35.00	35.58
E. Disaster Management Capacity Building	5.40	240.00	245.40
F. Project Management	0.00	25.00	25.00
<b>GRAND TOTAL</b>	<b>1,387.39</b>	<b>2,133.36</b>	<b>3,520.75</b>

Source: GSDMA (2002), p.7.

**Table 23.1: Components and estimated cost (Rs crore) of the ADB-funded project**

Component/Implementing Agency	ADB Allocation	GoG Counterpart funding	Total
Housing	69.17	17.29	86.46
Gujarat Urban Development Co. Ltd	321.77	96.11	417.88
Municipal Corporations			
<i>Jamnagar Municipal Corporation</i>	<i>2.03</i>	<i>0.60</i>	<i>2.63</i>
<i>Ahmedabad Municipal Corporation</i>	<i>28.40</i>	<i>8.48</i>	<i>36.88</i>
<i>Baroda Municipal Corporation</i>	<i>2.44</i>	<i>0.73</i>	<i>3.17</i>
<i>Rajkot Municipal Corporation</i>	<i>12.00</i>	<i>3.59</i>	<i>15.59</i>
Municipal Corporations (Total)	44.87	13.40	58.27

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Ahmedabad Urban Development Authority	48.37	14.45	62.82
Roads & Buildings Department	144.94	43.29	188.23
Gujarat Water Supply and Sewerage Board (GWSSB)/Gujarat Water Infrastructure Ltd (GWIL)	570.68	191.48	762.16
GEB	145.33	65.86	211.19
Social Justice, Women and Child Development (WCD)	9.18	0.00	9.18
Cottage & Other Industries	36.40	0.00	36.40
Disaster Management	101.20	0.00	101.20
Consultancy & Incremental Costs	68.56	0.00	68.56
Front-end Fee	24.25	0.00	24.25
<b>Total</b>	<b>1,584.72</b>	<b>441.88</b>	<b>2,026.60</b>

Source: GSDMA

The assistance given by the Government of India from the NCCF was utilized for immediate relief such as ex-gratia payment for death, temporary shelters, cash doles, assistance to the injured and similar activities. The WB and the ADB funded medium and long-term project components. Though both covered activities such as housing, infrastructure and disaster management, the areas were clearly demarcated. For instance, the power sector was included only in the ADB fund.

People of the Hyogo prefecture in Japan, who had experienced the ravages of the Kobe earthquake, empathized with the victims of the Kutch earthquake. They resolved to do something more than raising donations—

they decided to set up a task-specific fund for a rehabilitation project involving children. The Hyogo Prefecture Disaster Relief Fund Raising Committee was set up to mobilize donations. The people of Hyogo, especially children, went out into the streets to collect funds.

An agreement between the above committee and the GSDMA was signed on 24 September 2001, in order to create a fund—the Hyogo-Gujarat Friendship Fund—with an initial corpus of 175 million Yen (Rs 6.5 crores). A School Earthquake Safety Project was prepared. A Committee under the chairmanship of A. S. Arya, Professor Emeritus, IIT, Roorkee, was constituted to carry out functions such as the approval of plans and monitoring the implementation of the project. Ten sub-projects, mostly schools and hostels, were undertaken. The work involved repair, construction and introduction of a disaster-preparedness curriculum.

The Government of The Netherlands gave financial assistance for the repair of 42,678 and reconstruction of 4,675 primary schoolrooms, with an overall cost of Rs 177 crores. In addition, it funded a community-based project, for the development of water resources and sanitation in the earthquake affected areas, implemented by the Water and Sanitation Management Organization at an estimated cost of Rs 148 crores.

The European Commission provided funds in the form of a grant for reconstruction of 973 and repair of 1,139 health facilities including CHCs, PHCs, dispensaries and *anganwadis*, at an estimated cost of Rs 170 crores.

The International Fund for Agricultural Development (IFAD) sanctioned a livelihood security project for the earthquake affected rural households with a total estimated cost of US\$ 24 million. The amount of loan from the IFAD was US\$ 15 million and co-financing from the World Food Programme (WFP) US\$ 4.9 million. The project is implemented by the Self-Employed Women's Association (SEWA), which is to contribute an amount of US\$ 1.7 million. The contribution of the borrower, i.e., the Government of India is Rs 1.7 million and that of the beneficiaries Rs 0.7 million. The project envisages covering beneficiaries in about 400 villages in 12 *talukas* of three districts.

Government of India ministries such as Rural Development, Power, Social Justice and Empowerment and Education, provided financial assistance for reconstruction work.

The Prime Minister's National Relief Fund (PMNRF) made available Rs 150 crores for the reconstruction and retrofitting of 132 government and government-aided secondary and higher secondary school buildings in the severely-affected districts, and Rs 114 crores for rebuilding the district civil hospital (GK General Hospital) at Bhuj. This was in addition to the PMNRF fund for immediate relief.

Members of Parliament came forward to allocate funds from the Member of Parliament Local Area Development (MPLAD) Scheme for the purposes of undertaking the reconstruction work, particularly in rural areas. From the Lok Sabha, 153 members allocated Rs 22 crore and 163 members of the Rajya Sabha allocated about Rs 27 crores for this purpose. The funds were utilized for constructing primary schools, community halls, work sheds, marketing centres, PHCs, dispensaries, ashram schools, one vocational training institute and one *Dharamshala*. In all, 851 tasks were undertaken, implemented through Government of India agencies, namely the Housing and Urban Development Corporation (HUDCO) and the National Building Construction Corporation (NBCC). Most of them have been completed.

The overall cost of reconstruction was estimated to be Rs 7,836 crores, as given in Table 24.

**Table 24: Estimated overall cost of reconstruction (Rs crore)**

Sector	Sub-sector	Reconstruction Cost
Housing	Damaged Houses	1,180.69
	Destroyed Houses	946.75
	Temporary Shelter	100.00
	Rubble Removal	25.00
	<b>SUB TOTAL</b>	<b>2,261.44</b>
Health	-	358.13
Education	-	760.62

*Contd*

*Contd*

Infrastructure	Dam Safety and Irrigation	348.63
	Public Buildings and Those of Other Government Undertakings	331.74
	Roads and Bridges	330.00
	Retrofitting	84.34
	Urban Infrastructure	604.50
	Rural Infrastructure	418.50
	Power	325.50
	<b>SUB TOTAL</b>	<b>2,443.21</b>
	Industries	Small, Medium and Large
Rural and Cottage		189.13
Agriculture		199.66
Tourism		36.00
<b>SUB TOTAL</b>		<b>899.79</b>
Services		400.00
Social Empowerment		250.00
Support Structure	Multi-hazard Disaster Preparedness	330.30
	Consultancy and Administration Support	69.75
	Community Participation	60.00
	<b>SUB TOTAL</b>	<b>463.05</b>
	<b>GRAND TOTAL</b>	<b>7,836.24</b>

**Note:** The above cost does not include that of the work done by NGOs.

# VI Reconstruction and Rehabilitation Policy of the State Government

## A Holistic Approach

The Government of Gujarat introduced a holistic and extensive reconstruction and rehabilitation programme designed to address the needs of the affected people comprehensively. It encompassed a number of sectors such as housing, physical infrastructure, social infrastructure (education and health), urban reconstruction, livelihood restoration, social rehabilitation, community participation and long-term disaster management. A reconstruction and rehabilitation policy was announced by the GOG. (GOG, 2001)

The GERP, which was a comprehensive earthquake rehabilitation and reconstruction programme,<sup>6</sup> was introduced with state government funding as well as with assistance from the Government of India, the WB, the ADB, the Government of Netherlands and the European Union. The GERP has the following objectives:

- (i) promoting sustainable recovery in disaster-affected areas; and
- (ii) laying the foundation for sustainable disaster management capacity in Gujarat.

The following development outcomes are expected to be achieved:

- Vulnerability reduction through infrastructure built to disaster-resistant standards.
- Increased risk awareness and preparedness of communities to natural hazards through access to more sustainable incomes and enhanced knowledge of hazards and disaster reduction techniques.
- Enhanced emergency preparedness and response capacity of the relevant entities.

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<sup>6</sup>It is also known as the Gujarat Emergency Earthquake Reconstruction Program (GEERP) and Gujarat Earthquake Reconstruction and Rehabilitation Program (GERRP). In this book the expression Gujarat Earthquake Reconstruction Programme (GERP) is used.

## **Components of the Programme**

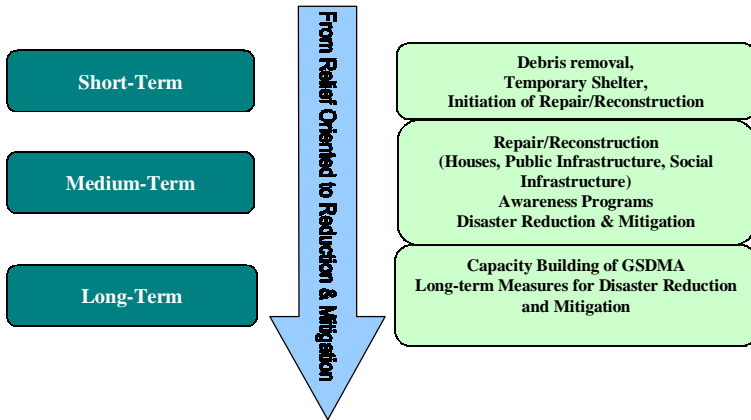
The reconstruction and rehabilitation programme addresses, as enumerated in the relevant document, the following tasks:

- Build, retrofit, repair and strengthen houses, schools, buildings in the health sector and public buildings affected by the earthquake, through the application of earthquake-resistant technology.
- Revive the local economy by providing assistance for agriculture, industries, small business, handicrafts, and regenerate livelihood for the people.
- Rebuild and upgrade community and social infrastructure, improve education and health systems, and strengthen social protection measures for weaker sections of the population.
- Provide health support to the people injured by the earthquake on a long-term basis and psychological counselling for the people traumatized by the disaster .
- Restore lifeline infrastructure of transport networks and utility infrastructure of power and water supply, and reduce their vulnerability to natural disasters.
- Support gender empowerment through involving women at all stages in the programme implementation.
- Provide support for the children affected by the earthquake, and alleviate social deprivation through an integrated nutrition and education strategy.
- Implement a comprehensive disaster management programme, improving the disaster preparedness and emergency response capacity of the government to deal with different types of disasters.
- Reduce vulnerability through long-term mitigation programmes through structural and non-structural measures and improve people's resilience through diversification of sources of income generation and asset building.



The focus during the short, medium and long-term phases of the GEERP included:

- Immediate needs such as temporary shelters before the onset of the monsoon, debris removal, repair of houses, repair of public buildings and emergency repair of irrigation structures.
- Repair and reconstruction work in the medium-term phase. There was emphasis on reconstruction of houses, public infrastructure, social infrastructure and initiating efforts towards disaster reduction and mitigation.
- Further strengthening of capacity-building efforts towards disaster reduction and mitigation, and implementation of a risk transfer mechanism in the long-term phase.



## **Schemes for Various Sectors**

The state government announced the following schemes for the restoration of industrial units, cottage industry, trade and commercial activities:

- For the small, medium and big industrial units located in seismic zones IV and V, cash assistance at the rate of 60 per cent of the total investment and up to a maximum of Rs 60 lakhs, working capital loan from banks with no interest for two years, exemption from electricity duty and from stamp duty.

- A scheme was announced for salt-pan workers with benefits ranging from Rs 3,000 to 5,000.
- Cabin owners and shop owners whose properties were damaged were to be paid Rs 3,000 and 6,000 respectively.
- For cottage industries and artisans schemes for subsidy assistance to self-employed persons at the rate of 60 per cent of loans and up to Rs 2 lakhs, working capital assistance to handloom weavers at the rate of Rs 10,000 per handloom weaver, revolving funds for providing working capital etc., were announced.
- Work shed for artisans on a temporary basis and permanent work sheds.
- Handlooms, handicraft tools, and toolkits for artisans for restoration of livelihood.

The state government also announced a package for rehabilitating damaged heritage buildings. The scale of assistance was with a limit of Rs 2 lakhs for each building. If the entire building was being used for a recognized school, college or library, or was on a long-term lease to the government/local bodies, assistance was given up to Rs 5 lakhs. Assistance was to be given only to those individuals who intended to restore their properties as heritage buildings.

The Reserve Bank of India (RBI) announced, on 9 February 2001, a special relief package, to be provided by banks, for persons and businesses affected by the earthquake. The following are some of the components of the package:

- No demand for recovery of loans to be made for two years in respect of standard assets.
- As regards loans not classified as standard assets, no penalties to be levied in the event of non-receipt of repayment during the next two years.
- Loan up to a limit of Rs 1 lakh, at an interest rate not exceeding the prime lending rate, to small traders, small business, self-employed and small road-transporters for restoration of their business.

- Loans up to Rs 2 lakhs, at an interest rate not exceeding the prime lending rate, for repair and reconstruction of houses/shops damaged by the earthquake.
- Sanction of additional limits and rescheduling of existing limits in respect of small scale industry, business, trade and other industries.
- Settlement of claims made by a nominee of a depositor who has lost his life due to the earthquake would be completed within 48 hours.
- In case of agricultural loans, banks would not recover either principal or interest from the affected persons for a period of two years and reschedule the amounts not collected during the two years for a period of seven years.
- The existing limit of Rs 1,000 for grant of consumption loan was raised to Rs 2,000 per eligible beneficiary.

The RBI advised the Dena Bank, which is the lead bank for Gujarat, to convene the meeting of the State Level Bankers' Committee every month in order to monitor the implementation of the above relief measures.

## **Incentives and Tax Exemptions**

In the wake of the Gujarat earthquake, the Government of India announced certain tax exemptions for encouraging rehabilitation and reconstruction work:

- 100 per cent reduction allowed under the Income Tax Act, 1961, in respect of contribution to the Gujarat Earthquake Rehabilitation and Reconstruction Fund.
- 100 per cent reduction allowed in respect of the contribution made by an income tax assessee to any trust/NGO/institution for providing relief to the victims of the Gujarat earthquake.
- Exemption under the relevant provisions of the Income Tax Act, 1961, given to NGOs and charitable trusts for receipt and utilization of donations for providing relief to the earthquake victims.
- Organizations were given exemption from the provisions of the Foreign

Contribution (Regulation) Act 1976, to accept foreign contributions during a prescribed time-frame in cash and kind for providing relief to the earthquake victims without obtaining formal approval from the Government of India.

- Exemption from central excise duty in respect of cement and steel utilized for relief and reconstruction work.
- Exemption from payment of excise duty on goods manufactured by new industrial units commissioned in Kutch district till 31 July 2003. The period was subsequently extended by one year and again up to December 2004. It has now been further extended till December 2005. The exemption is available for a period of five years from the commencement of commercial production.

Similarly, the Government of Gujarat announced some incentives as follows:

- Exemption/deferment of sales tax to new industrial units in Kutch district that invest 50 per cent of the project cost before 31 October 2004 and commence production by 31 October 2005. The incentive is available for five years for units with an investment up to Rs 10 crores; for seven years for units with an investment of Rs 10–50 crores; and for 10 years for investment exceeding Rs 50 crores.
- Remission of stamp duty for registration in respect of purchase of land for rehabilitation projects, instruments executed for securing repayment of loans and advances made to individuals affected by the earthquake in favour of institutions, and instruments of conveyance in favour of affected persons, whose residential premises were partially or fully destroyed, for the purchase of property up to Rs 3 lakhs.
- Exemption from royalty levied on building materials such as cement, clay, and building stone used for reconstruction in the earthquake-affected Kutch district.
- Exemption from sales tax on goods such as cement, steel, asbestos sheets, galvanized and corrugated iron sheets, and wooden poles purchased for the purpose of earthquake-related work.
- Exemption from payment of octroi duty to industrial units in Kutch.

Tax incentives in the district of Kutch have attracted a number of industries. Eighty projects with an investment of Rs 499 crores have already been commissioned; 71 projects with an estimated investment of Rs 4281 crores were at various stages of implementation by the end of March 2004. Thus, 151 new industrial projects with an investment of Rs 4785 crores were located in Kutch district by March 2004, consequent upon the tax incentives for the district. A sectoral analysis of the projects already commissioned indicates that engineering industries account for 50 per cent of the investment, followed by chemicals with 27 per cent and minerals, 12 per cent. Among the projects under implementation, engineering, mineral, chemical and textile sectors account for respectively 29, 21, 20 and 12 per cent of the investment. These projects are expected to generate employment opportunities—direct and indirect—to 119,495 people.

## **Organizational Arrangements**

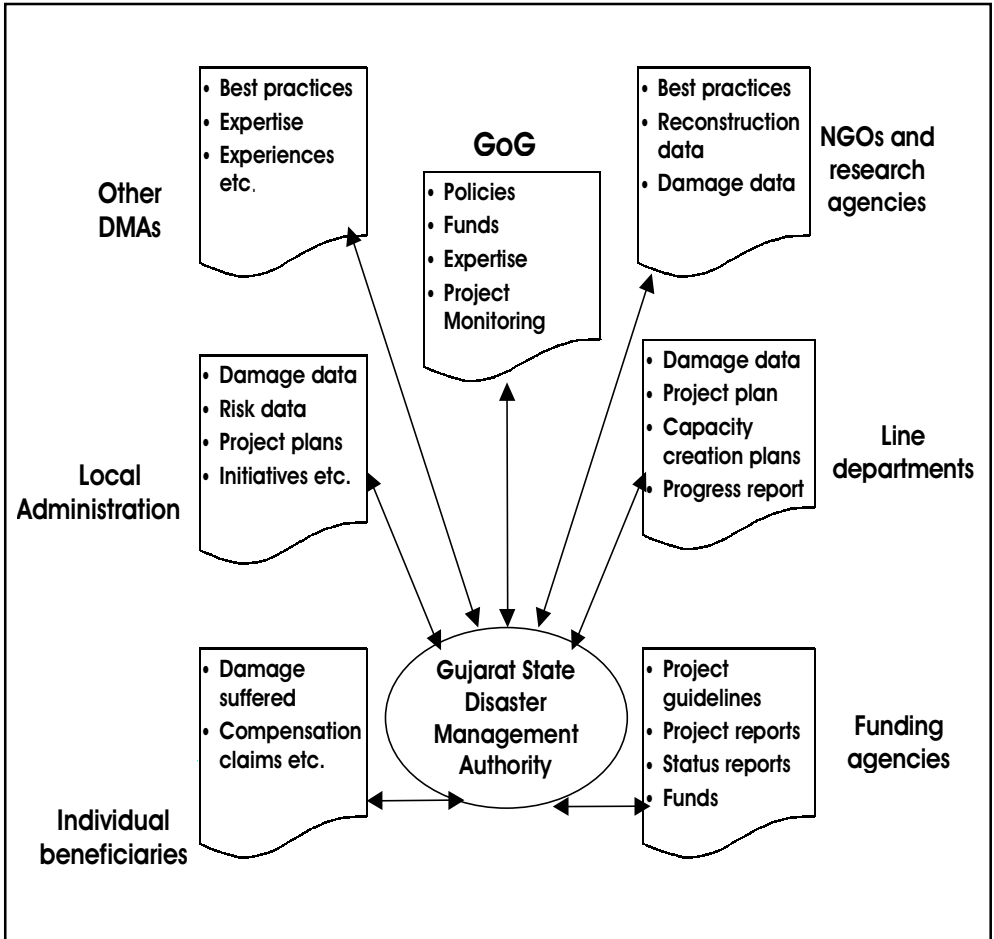
As discussed earlier, the rehabilitation and reconstruction programme is very comprehensive and holistic. It necessitated the involvement and participation of a number of departments and agencies. This means there is a need for an integrated and coordinated approach. The GSDMA was thus set up as the coordinating agency. However, in view of the complexity of the task, it became necessary to have the involvement of the highest political executive. This was ensured through the Governing Body of the GSDMA with the Chief Minister as Chairman. An operational manual was prepared to expedite the process of sanction of works undertaken by various departments.

In addition to government departments and agencies, a number of expert institutions and individuals were associated. There were interactions with national and international organizations. All these posed challenges but also provided immense opportunities for organizational initiatives and innovation.

A mechanism for coordination with NGOs was developed in the form of a Public-Private Partnership Programme. An elaborate system of people's participation starting from the village level to the state level was also put in place.

Chart 1 below indicates the elaborate organizational structure, encompassing both formal and informal interactions.

**Chart 1: Formal and informal organizational interactions for the reconstruction and rehabilitation work**

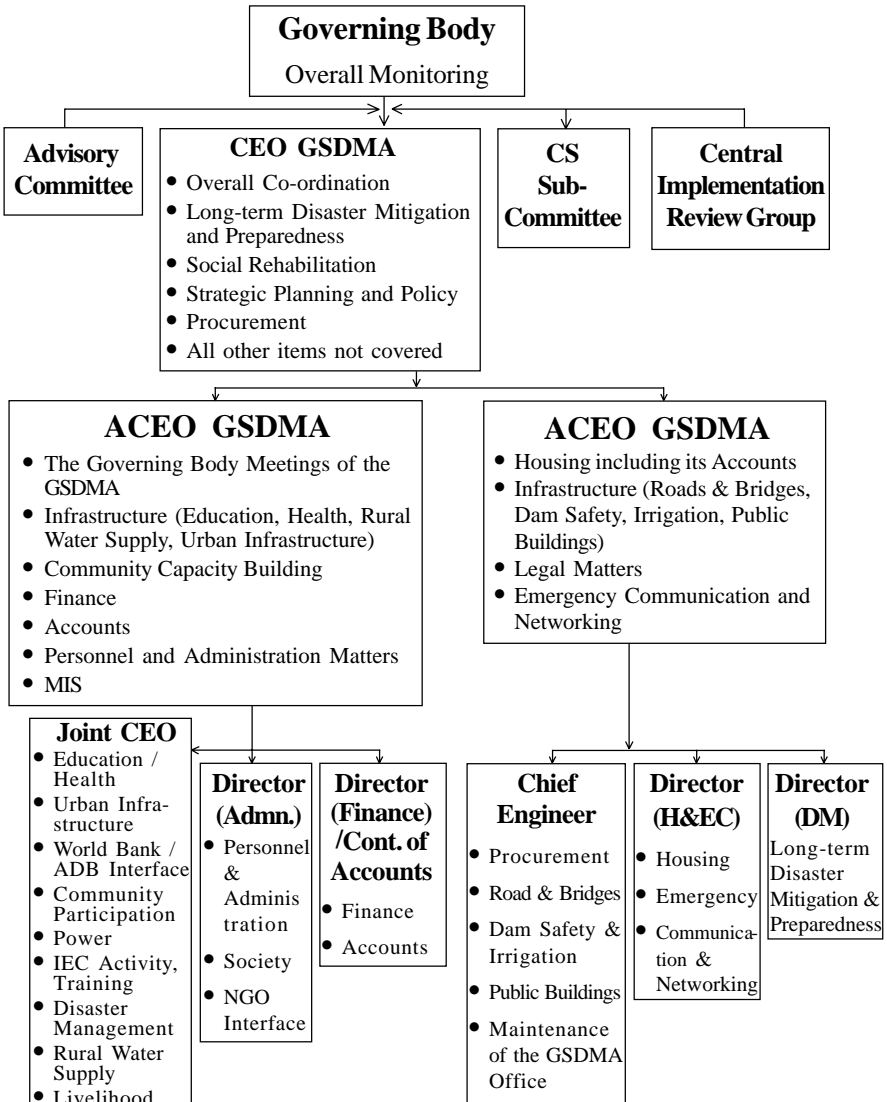


## Organizational Structure of the GSDMA

It is useful to describe the organizational structure and administrative arrangements for the implementation of the rehabilitation and reconstruction programme.

The GSDMA was initially registered as a society under the Societies Registration Act. The organization structure is shown in Chart 2.

**Chart 2: Organizational structure of the GSDMA**



The Chief Executive Officer of the GSDMA is responsible for the overall management and implementation of the programme. The implementation of works and procurement of goods for specific projects are the responsibility of the line departments, with the overall coordination and monitoring by the GSDMA.

The core staff of the GSDMA is from the administrative services and government departments. It also draws the services of professionals by way of outsourcing. Specialized activities are usually outsourced. This has helped the GSDMA to be responsive to changing needs and priorities. The senior management team originally consisted of a Chief Executive officer, two Additional Chief Executive Officers, a Joint Chief Executive Officer, a Chief Engineer, a Controller of Accounts and two Directors. At present there is only one Additional Chief Executive Officer.

The following are the main functions of the GSDMA in the context of the programme:

- Develop approach, policy guidelines and action plans for meeting the objectives of the programme;
- Obtain funds for rehabilitation and resettlement and to ensure optimum utilization of these funds made available from national and international agencies;
- Prepare programmes and plans to mitigate the impact of disasters as a strategy for long-term disaster preparedness; and
- Overall coordination and monitoring with the implementing line departments for the procurement of works, goods and services for the specific components of the public sector infrastructure.

Each line department implementing different components of the programme, for example, Roads and Buildings, Education, Water Resources, Water Supply, and Municipal Corporations, formed a project implementation cell to monitor and manage the programme. At the field level, the engineering departments and divisions, wherever necessary, strengthened the structure to undertake the work. In some cases additional staff was provided.



For the effective implementation of the programme, a four-tier institutional framework was constituted. In addition, some committees were formed so as to provide expert advice and facilitate people's participation. Furthermore, a grievance redressal mechanism was put in place.

#### *State level*

The Governing Body of the GSDMA, consisting of the Chief Minister as the chairman and some senior ministers and secretaries as members, is the apex body. It formulates policies and guidelines. A Central Implementation Review Group (CIRG) under the chairmanship of the Chief Secretary was also formed in order to monitor and facilitate implementation. The CIRG includes experts from various fields as members. A sub-committee under the chairmanship of the Chief Secretary was set up in order to monitor components of the programme funded by sources other than the WB and the ADB .

To enable the GSDMA to have expert advice and guidance from prominent citizens and experts in various fields and to ensure accountability and people's participation, a state-level advisory committee was formed. It was headed by Y.K. Alagh, an eminent economist, and included leading persons in the fields of industry, finance, social services, administration and management as members.

#### *District level*

At the district level, an executive committee under the chairmanship of the District Collector implements, monitors and coordinates the programme. An advisory committee consisting of officers and non-officials was also formed in order to advise the district administration on various aspects of the programme.

#### *Taluka level*

In the worst affected *talukas*, additional collectors and additional DDOs, with the delegated powers of collectors and DDOs respectively, were appointed with a view to speeding up the process of implementation.

### *Village level*

At the village level, a committee chaired by an officer not below the rank of Deputy *Mamlatdar* monitors the implementation of the programme and coordinates various activities. A village-level committee consisting of non-officials and officials was also formed.

## **Grievance Redressal Mechanism**

The Government of Gujarat developed a grievance redressal mechanism to provide forums for affected persons to express their grievances. A committee at the village level and a committee at the district level were constituted, not only for strengthening the system of programme implementation but also for grievance redressal. Furthermore, the District Judge was declared as an Ombudsman to receive complaints and petitions directly from the public. He also hears grievances and issues directions to the administration. During the period till October 2003, 47,156 petitions were received by the ombudsmen in various districts, out of which 46,182 (99 per cent) have been addressed.

The problems of the four towns of Kutch—Anjar, Bhachau, Bhuj and Rapar—were more complex. Four area development authorities were formed and officers of the rank of additional collectors were appointed as CEOs. Initially, officers of the rank of secretary to the government were appointed as chairmen. Later, the district collector and the DDO were appointed as chairmen of the respective area development authorities. The authorities are in overall charge of planning, preparing and implementing regulations and for creation of infrastructure. They undertake town planning and planning for infrastructure. They can levy service charges for the new services.

The area development authorities were created because it was felt that the local municipalities were not in a position to undertake the massive task of planning of the urban areas and their new infrastructure. However, the municipalities are expected to undertake, at a later stage, services such as water supply, sewerage, and health. The construction of infrastructure was undertaken by the Gujarat Urban Development Company (GUDC).

## **Mechanism for Community Participation**

There is a three-tier arrangement for facilitating community participation at different levels. They are: the Gram Navrachna Samiti at the village level, the District Advisory Committee at the district level and the State Advisory Committee at the state level.

The Gram Navrachna Samiti has a Deputy Collector/*Mamlatdar*/*Taluka* Development Officer (TDO)/Deputy *Mamlatdar*/ Deputy TDO as Chairman. The members are the *Sarpanch*, a former *Sarpanch*, a woman member, a member from backward castes, a member from a minority community, the headmaster of the primary school and a representative of an NGO. The *Talati* or the village-level functionary is the member-secretary. The Gram Navrachna Samiti is responsible for the overall supervision of the reconstruction programme in the village. The idea is to ensure the representation of all segments of the village community in the finalization of design, building material and construction technology. The Gram Navrachna Samiti is, however, guided by the Gram Sabha, or the village council.

At the district level, the District Advisory Committee is headed by the minister in charge of the district. The district collector is the vice-chairman. Members include MPs, MLAs, presidents of district panchayats, five representatives of NGOs and the relevant district-level officers. The additional collector is the member-secretary.

The District Advisory Committee is to coordinate the public-private partnership programme and address all the problems and constraints in the implementation of the programme.

As already mentioned, the State Advisory Committee comprises distinguished members from different fields.

## **Focus on Effective Implementation**

The reconstruction programme gathered momentum quickly and continued to make good progress. Narendra Modi, who became Chief Minister of Gujarat during the first part of October 2001, reviewed the progress. He felt that it would be worthwhile to provide a push and

accelerate the process, so that by 26 January 2002, i.e., one year after the earthquake, the progress would be significant. It was decided to assign the task of monitoring the progress of some of the most affected *talukas* to senior Secretaries to the state government. Eleven Secretaries were asked to visit the respective *talukas* for three days, from Friday to Sunday each week till the end of January 2002. Every Monday, the Chief Minister used to hold review meetings with the Secretaries and others concerned.

Based on their field visits and suggestions, many issues of policy and operation were resolved. This accelerated the process of reconstruction and rehabilitation further.

## VII Progress of Reconstruction and Rehabilitation Work

As mentioned earlier, the rehabilitation and reconstruction programme is comprehensive and covers many sectors. This chapter provides a brief overview of the progress of important activities during the first three years, i.e., till January 2004.

### Housing

The reconstruction of houses is probably the most innovative aspect of the Gujarat reconstruction programme. It has been a participatory programme with an emphasis on multi-hazard resistant construction and capacity building.

The basic approach is owner-driven reconstruction. People reconstruct their houses themselves, with the assistance and facilitation of the government. In addition, NGOs have undertaken construction of some houses under the public-private partnership programme.

By the end of January 2004, 901,150 out of 928,369 houses were repaired. Reconstruction of 186,967 out of 215,255 houses, i.e., 87 per cent, was completed. Overall, 95 per cent of the repair and reconstruction of houses was completed.

Houses which had not been completed were mostly in three towns of Kutch, where it took some time to complete various surveys and town planning. In some cases, house-owners living outside the state did not start reconstruction work (Table 25).

**Table 25: Progress of housing reconstruction as of January 2004**

<b>Component</b>	<b>Target</b>	<b>Completed</b>	<b>WIP*</b>	<b>% completed</b>
<b>All Areas</b>				
Repair	928,369	901,150	27,219	<b>97</b>
Reconstruction	215,255	186,967	28,288	<b>87</b>
<b>Total</b>	<b>1,143,624</b>	<b>1,088,117</b>	<b>55,507</b>	<b>95</b>
<b>Rural</b>				
Repair	715,373	689,699	25,674	<b>96</b>
Reconstruction	187,920	173,600	14,320	<b>92</b>
<b>Total</b>	<b>903,293</b>	<b>863,299</b>	<b>39,994</b>	<b>96</b>
<b>Urban</b>				
Repair	212,996	211,451	1,545	<b>99</b>
Reconstruction	27,335	13,367	13,968	<b>49</b>
<b>Total</b>	<b>240,331</b>	<b>224,818</b>	<b>15,513</b>	<b>94</b>
<b>Rural - Kutch</b>				
Repair	186,267	183,242	3,025	<b>98</b>
Reconstruction	107,440	107,105	335	<b>100</b>
<b>Total</b>	<b>293,707</b>	<b>290,347</b>	<b>3,360</b>	<b>99</b>
<b>Urban - Kutch</b>				
Repair	52,016	51,602	414	<b>99</b>
Reconstruction	18,133	4,819	13,314	<b>27</b>
<b>Total</b>	<b>70,149</b>	<b>56,421</b>	<b>13,728</b>	<b>80</b>

\* WIP means work in progress.

Under the public-private partnership programme, 42,528 houses were to be reconstructed, out of which 41,902 houses have been completed. Thus, NGOs have participated in 20 per cent of the houses to be reconstructed. The percentage will be lower if all the houses to be repaired and reconstructed are considered.

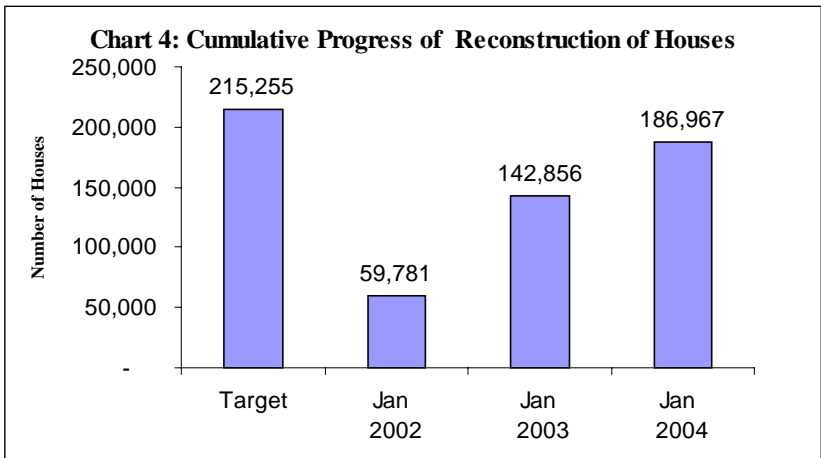
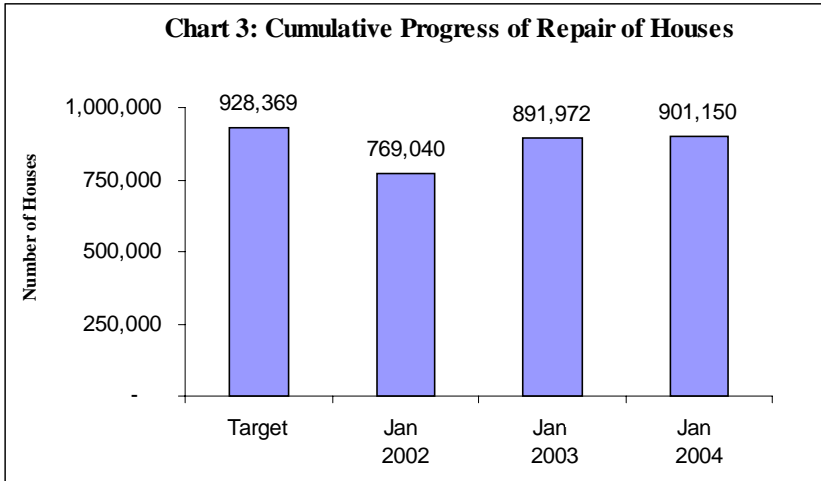
The number of housing units for reconstruction in urban areas is 27,335, out of which 49 per cent have been completed. The main reason for the relatively slow performance of urban housing is the town-planning related procedures in the four towns of Kutch district. In three of the four towns, namely, Bhuj, Anjar and Bhachau, houses are being constructed both in the town planning areas and on relocation sites. In the town planning areas, which are parts of existing towns, the task is more complex because the work involves the survey of a large number of plots, widening of roads, re-allocation of plots and so on. In the three towns where town planning has been undertaken, 65–82 per cent of the plots have been handed over to the beneficiaries. As regards relocation sites in the three towns, plot allocation is almost complete. Building permissions have been given to most of the people who have applied for it.

One constraint is that in many cases, the beneficiaries do not ask for building permission. Some of them have found it difficult to get building plans prepared by engineers because of the non-availability of engineers and the cost involved. The district administration has undertaken extension and facilitation activities to ensure the availability of engineers, to arrange preparation of building plans and to motivate people to come forward to get these preliminary activities completed quickly. For quick approval of plans, standard designs have been prepared.

A remarkable aspect of the reconstruction of houses is that the progress has been steady and consistent. During the first year, 59,781 houses were completed. During the second year, the figure reached 142,858. By January 2004, the cumulative progress was 186,967 (Table 25.1 and Charts 3 and 4). Most of the repair work was completed during the first year. The achievement during the first year itself has been much better than that of similar programmes in India and elsewhere.

**Table 25.1: Year-wise cumulative progress in housing restoration**

<b>Component</b>	<b>Target</b>	<b>Jan 2002</b>	<b>Jan 2003</b>	<b>Jan 2004</b>
Repair	928,369	769,040	891,972	901,150
Reconstruction	215,255	59,781	142,856	186,967





## Education

The 42,678 classrooms of primary schools which needed to be repaired, were completed mostly during the first year itself. The reconstruction of 7,469 schoolrooms out of 8,212 destroyed, i.e., 91 per cent, has been completed. Of the additional 3,938 schoolrooms taken up by NGOs, 3,810 have also been completed. The repair work was undertaken through village civil works committees, which was an excellent example of people's participation.

The reconstruction of 448 Mid Day Meal kitchen sheds and the repair of 13 such sheds, have been completed. The reconstruction of six Teachers' Training Institutes (TTI) has also been completed. As regards secondary education, repair work of 2,070 schools out of 2,141 and reconstruction of 130 out of 145 have been completed. In respect of municipal schools, the repair of 1,206 classrooms out of 1,514, and the reconstruction of 121 classrooms out of 153, have been completed (Table 26, Table 26.1, Chart 5 and Chart 6).

**Table 26: Progress of reconstruction of educational facilities as of January 2004**

Component	Target	Completed	WIP*	Yet to commence	% completed
<b>Primary Education</b>					
Repair of Classrooms	42,678	42,678	–	–	<b>100</b>
Reconstruction of Classrooms	8,212	7,469	810	–	<b>91</b>
Reconstruction of Additional Classrooms	3,938	3,810	128	–	<b>97</b>
Repair of MDMs	13	13	–	–	<b>100</b>
Reconstruction of MDMs	448	448	–	–	<b>100</b>
Reconstruction of TTIs	6	6	–	–	<b>10</b>
<b>Technical Education</b>					
Repair of Colleges	22	4	5	13	<b>18</b>
Reconstruction of Colleges	2	0	2	–	<b>0</b>

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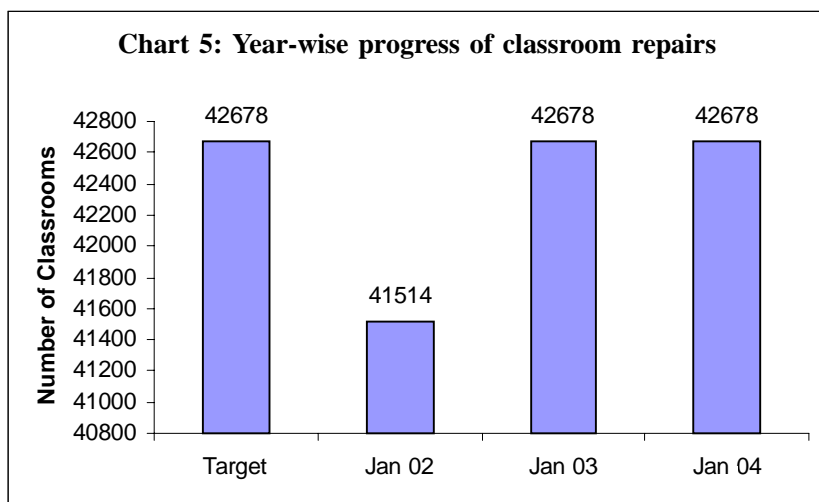
<b>Secondary Education</b>					
Repair of Schools	2,141	2,070	43	28	<b>97</b>
Reconstruction of Schools	145	130	12	3	<b>90</b>
<b>Higher Education</b>					
Repair of Colleges	151	121	20	10	<b>80</b>
Reconstruction of Colleges	2	0	2	0	<b>0</b>
<b>Municipal Schools</b>					
Repair of Classrooms	1,514	1,206	–	308	<b>80</b>
Reconstruction of Classrooms	153	121	20	0	<b>79</b>

\* WIP means work in progress.

**Table 26.1: Year-wise progress of restoration of classrooms (Rural areas)**

Component	Target	Jan 2002	Jan 2003	Jan 2003
Repair of Classrooms	42,678	41,514	42,678	42,678
Reconstruction of Classrooms	8,212	1,792	6,658	7,469

**Chart 5: Year-wise progress of classroom repairs**

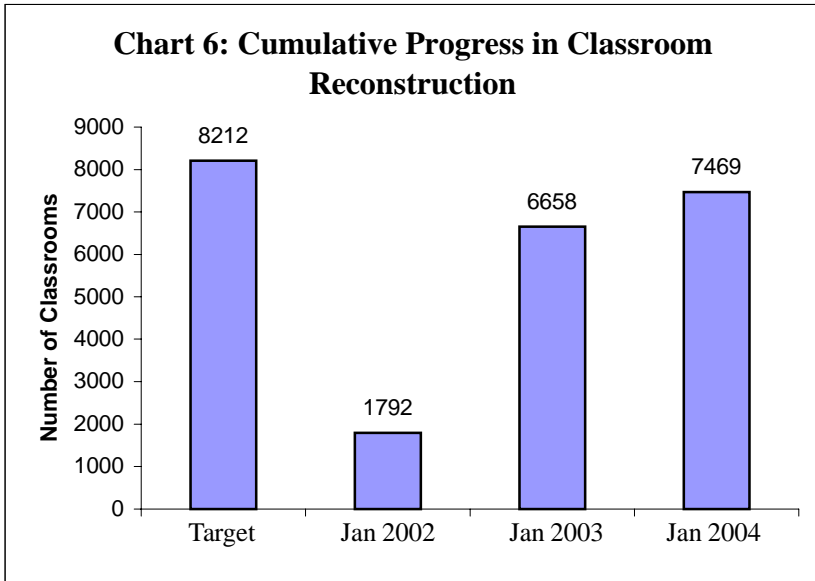




A reconstructed school building at Moti Rudrani village



**Modia Primary School Reconstructed**



For technical education infrastructure, the major work involved the reconstruction of the engineering college and the polytechnic at Bhuj. There has been some delay in hiring consultants and undertaking preliminary work. The work has gained momentum from March 2004.

## Health

All hospitals and health facilities were made functional within a short time after the earthquake with temporary and alternative structures.

The Bhuj civil hospital which had collapsed has been reconstructed, with the assistance of the Prime Minister's Relief Fund, at a cost of about Rs 114 crores. The new building for the Bhuj hospital adopted the base isolation technology that was developed in New Zealand. Isolators were provided by M/s Robinson Seismic Ltd., a New Zealand-based company. Engineers from New Zealand were involved in the installation of isolators. It is a huge building with state-of-the-art equipment and was inaugurated by the Prime Minister of India on 14 January 2004.

As regards other facilities, six CHCs, 24 PHCs, 184 sub-centres, nine dispensaries and 183 *anganwadis*, have been constructed. A number



**Reconstructed Kutch district hospital—G. K. Hospital at Bhuj**

of other buildings are under construction. Further, 1,976 *anganwadis* have been repaired (Table 27).

**Table 27: Progress of reconstruction of health facilities as of Jan. 2004**

Component	Target	Completed	WIP	Yet to commence
<b>Repair</b>				
General Hospitals	5	–	–	5
CHCs	56	–	–	56
PHCs	139	–	–	139
Sub-centres	350	–	–	350
Dispensaries	12	–	–	12
Staff Quarters	695	–	–	695
<b>Reconstruction</b>				
General Hospitals	5	2	3	0
CHCs	15	6	5	4
PHCs	69	24	20	25
Sub-centres	245	184	12	49
Dispensaries	26	9	11	6
District Training Centre	1	0	1	0
Staff Quarters	621	178	46	397
<b>Anganwadi</b>				
Repair of <i>Anganwadi</i>	2,226	1,976	249	1
Reconstruction of <i>Anganwadi</i>	1,832	183	265	768

In the health sector, the reconstruction work is funded mainly by the European Union and NGOs. Most of the projects funded by NGOs have made good progress, whereas those funded by the European Union have been delayed because of elaborate procedures and other formalities. As a result, the repair work was yet to commence even by March 2004. The issues involved were resolved subsequently and the work was commenced immediately.

## Public Buildings

The repair and reconstruction of public buildings are implemented by three major agencies: the state Roads and Buildings Department, the Panchayat Department and the Gujarat State Police Housing Corporation.



**Reconstructed maternity home at Mundra**



As regards state buildings, emergency repair of all the 1,715 buildings has been completed. Major repairs of 851 buildings out of 1,187 have been completed, and repair and retrofitting works are in progress for 246 buildings. Out of 731 buildings to be reconstructed, 77 have been completed and 585 are in progress (Table 28).

**Table 28: Progress of reconstruction of public buildings, roads, dams and water supply schemes as of January 2004**

<b>Component</b>	<b>Target</b>	<b>Completed</b>	<b>WIP</b>	<b>Yet to commence</b>
<b>State R&amp;B</b>				
Emergency Repair of Buildings	1,715	1,715	0	0
Repair of Buildings	1,187	851	246	90
Reconstruction of Buildings	731	77	585	69
Retrofitting of Buildings	2,306	232	33	2,041
<b>Panchayat</b>				
Emergency Repair of Buildings	963	963	–	–
Reconstruction of Buildings	786	563	163	60
Retrofitting of Buildings	1,667	0	0	1,667
<b>Police Housing</b>				
Repair of Buildings	5,050	5,050	0	0
Reconstruction of Buildings	1,267	705	0	562
<b>Dams</b>				
Emergency Repair	245	245	–	–
Soil Samples	222	222	–	–
Preparation of Design	222	216	6	–
Review of Dams to be Strengthened-Dam Safety Review Panel (DSRP)	222	216	6	–
Strengthening of Dams	222	0	37	185
<b>Roads and Bridges</b>				
Restoration of Bridges	179	159	17	3
Strengthening of State Highways (km)	1,142	185	0	957

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Strengthening of Rural Roads (km)	3,317	1,318	106	1,893
<b>Rural Water Supply</b>				
Drilling of Tube Wells	250	250	–	–
Pipelines (km)	2,789	1,859	930	–
Reconstruction of Structures	630	445	185	–
<b>Power</b>				
Reconstruction of Buildings	200	0	200	0
Repairs to Transmission Equipment (number)	465	431	4	30
Strengthening of Transmission Line (km)	3,286	876	68	2,342
Strengthening of Distribution Lines (km)	5,390	883	3,089	1,418

In respect of panchayat buildings, all the 963 buildings which needed repair have been repaired. Of the 786 buildings to be reconstructed, 563 have been completed and 163 are in progress.

The Gujarat State Police Housing Corporation undertakes repair and reconstruction of the buildings of the police department. The repair of all 5,050 buildings has been completed. The reconstruction of 705 out of 1,267 buildings has been completed.

The programme also includes the repair and reconstruction of buildings belonging to the municipal corporations of Ahmedabad and Jamnagar. Further, the buildings of the Gujarat Institute of Desert Ecology (GUIDE) at Bhuj are being reconstructed.

It is proposed to undertake the retrofitting of public buildings located in seismic zones IV and V and other vulnerable areas. The objective is to protect such buildings against future earthquakes. The programme will include buildings where educational institutions, health facilities and important offices are located. It is envisaged to retrofit about 4,876 buildings.

## **Rural Water Supply**

This work involves restoration and strengthening of water supply systems relating to 40 towns and 1,762 villages. It envisages 250 tubewells, 2,789 km of water pipeline and 630 civil structures. About two-thirds of the work has been completed.



**Laying of water supply pipeline in Kutch district**

## **Power**

This programme covers the reconstruction of buildings and repair and strengthening of transmission and distribution systems. It is envisaged to construct 13 administrative buildings, 174 staff quarters and 13 control room buildings. Over 3,200 km of transmission lines and over 5,300 km of distribution lines are to be strengthened. Equipment such as meters, transformers, and capacitors need to be procured and installed. These activities are at various stages of progress and completion.

## **Roads and Bridges**

The emergency repair of 185 km of road was completed by August 2002. It is proposed to undertake the strengthening of 957 km of state highways during the second phase of the programme. As regards strengthening of rural roads, 1,318 km out of 3,317 km has been completed. In addition, 159 bridges out of 179 have been completed and work is in progress in respect of 17 structures.

## **Dam Safety and Irrigation**

A number of minor and medium dams located in Saurashtra and Kutch were damaged during the earthquake. Emergency repair was undertaken in respect of the 245 dams that had suffered damage immediately after the earthquake. It is proposed to strengthen 222 dams. For this purpose, DSRPs were constituted for long-term restoration and strengthening of dams. The work involves testing of soil samples, preparation of designs, a review of designs by the DSRPs, processing of bids and execution of work. Preparation of design and reviews of such designs have been completed in respect of 216 dams. The work of strengthening has commenced in respect of 37 dams.

## **Urban Infrastructure**

The work of urban infrastructure involves construction of roads, laying of water supply pipelines, providing sewerage systems and construction of municipal buildings. The work is being undertaken by the Gujarat Urban Development Company. This programme envisages 403 km of road, water pipelines of about 546 km, sewerage pipelines of about



**A part of a reconstructed road in Kutch district**

504, and 134 buildings for municipal administrative offices, municipal markets, town halls, and fire stations (Table 29). The work of urban infrastructure could begin only after the preparation of development plans, town planning and procedures relating to selection of contractors was undertaken (Table 29.1). About 40 per cent of the work has been completed (Table 29).

**Table 29: Progress in urban infrastructure as of January 2004**

Component	Target	Completed	WIP	Yet to commence	% completed
<b>14 towns of Gujarat</b>					
Construction of Roads (km)	403	181	60	162	45
Laying of Water Pipelines (km)	546	306	36	204	56
Laying of Sewage Pipelines (km)	504	194	29	281	38
Construction of Public Buildings	134	14	118	2	10

**Table 29.1: Some more aspects of urban infrastructure**

Component	Number
No. of Studies Conducted	19
No. of Public Consultations Held	180
Development Plans Completed	4 towns: Bhuj, Bhachau, Anjar, Rapar
Town Planning Completed	3 towns: Bhuj, Bhachau, Anjar
Relocation Sites	5 sites: 3 in Bhuj, 1 each in Bhachau and Anjar

## **Archives and Monuments**

The reconstruction of the archive buildings at Rajkot and Junagadh, and museum and library buildings at Bhuj, are in progress.

Financial assistance is also being provided for the restoration of private monuments which were damaged or destroyed during the earthquake.

## **Social Rehabilitation**

Measures were taken to rehabilitate orphans, widows, the aged and handicapped who were adversely affected by the earthquake. Such measures included financial assistance, residential facilities, skill upgradation, medical aid, therapy and counselling. A scheme of foster parents was introduced so that orphans could be taken care of by their relatives. Pensions were provided for the aged and for widows.

Financial assistance was given to 1,758 orphan children in the form of joint bank accounts of the district collector and the child. Under the foster parents' scheme, 71 children were provided with a monthly assistance of Rs 500 each. With the help of the National Children's Fund, 14 child lines were established. Monthly pensions were sanctioned for 999 widows and 657 old persons. Over 3,000 supportive devices were given to disabled persons. Training courses were organized for 550 destitute women.

## **Livelihood Rehabilitation**

The approach to livelihood restoration was three pronged: immediate restoration of livelihood; enhancing the skills of artisans; and empowering the artisans to market their skills. In addition, schemes for small-scale industries and agriculture were introduced. The assistance included free distribution of kits, financial assistance for damaged structures, working capital assistance, loans at subsidized interests, marketing linkages, training and farm input kits.

The following are some of the highlights of the progress (as of January 2004) of livelihood restoration (Table 30):

- 58,163 farmers were provided with input kits which contained not only seed and fertilizer but also some equipment such as spray pumps, farming tools and storage bins.
- 46,872 farmers were given financial assistance to reconstruct their farming structures such as engine rooms and storage rooms.
- 78,890 farmers were given assistance to reconstruct their irrigation assets.
- 3,212 handloom weavers were provided with looms.



**Restoring Livelihood: a woman making traditional clothes**



- Loan and assistance were given to 13,550 self-employed persons.
- Assistance was provided for shops/cabins and other service/trade activities to 16,655 persons.
- Assistance was provided to 1,629 persons with small industries.
- More than 30,000 tool kits were distributed among handicraft and handloom artisans.
- Over 27,000 tool kits were given to masons.
- Working capital assistance was given to 2,500 handloom weavers.
- A special project for the livelihood restoration of women was introduced and implemented by the Women and Child Welfare Department.
- The women's livelihood restoration project envisages covering 16,127 women, out of whom 10,663 have already received the benefit.

**Table 30: Progress of livelihood restoration as of January 2004**

Component	Beneficiaries	
	Sanctioned	Assisted
<b>Rural and cottage industry</b>		
Loan/Assistance for Self-Employed Persons	14,862	13,550
Tool Kits to Artisans	18,668	18,179
Tool Kits to Handicraft Artisans	12,934	12,652
Looms to Handloom Artisans	3,419	3,212
Toolkits for Masons	27,000	27,000
Working Capital Assistance for Handloom Weavers	3,794	2,500
Revolving Fund Scheme	8	13,892
<b>Handicraft Parks &amp; Kendras (Numbers Sanctioned)</b>		
Permanent Work Sheds	114	114
Handloom and Handicraft Park	32	4
Gramudyog Vikas Kendra	50	5

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<b>Industries</b>		
Subsidy assistance to small industries	2,162	1,629
Cash assistance to small cabins & shops	13,190	13,190
Subsidy and interest subsidy to service and trade	4,421	3,465
<b>Hotel/Restaurants (Services)</b>		
Rehabilitation of affected tourism units	69	69
<b>Agriculture</b>		
Input kits	58,163	58,163
Assistance for on-farm structure	46,872	46,871
Assistance for Irrigation assets	78,890	78,759
<b>Women's Livelihood</b>		
Women covered under Women's Livelihood Restoration Project	16,127	10,663

## **Community Preparedness, Capacity Building and Disaster Mitigation**

One of the most distinguishing features of the GERP is the focused attention on capacity building, community participation and long-term disaster management. A number of initiatives have been taken in this regard. Varied activities such as the preparation of numerous pamphlets and booklets, training programmes, workshops and sophisticated studies have been undertaken. It is difficult to quantify the progress of such activities, though one can always give figures such as the circulation of more than a million pamphlets on earthquake-resistant design, the training of about 29,000 masons, as well as numerous workshops on the subject. Some of these aspects have been described in detail in the next chapter.

## VIII Some Innovative Aspects of the Reconstruction and Rehabilitation Work

In the previous chapter, the details of progress in respect of important sectors have been given. One can see that the progress in terms of number has been remarkable. It is worthwhile to mention that there are unique and innovative features of the reconstruction work that have been carried out. Some of these are described below.

### Owner-driven Reconstruction of Houses

The most important and unique feature of the programme is perhaps the owner-driven approach to reconstruction of houses. In the entire process of reconstruction, community participation was ensured. It began from the stage of damage assessment. Damage assessment is a difficult task, as it involves a large number of houses and families spread over thousands of villages. Several damage assessment teams were deployed. As mentioned earlier, each damage assessment team consisted of three persons, of whom one was either an NGO representative, or a social worker. In order to ensure transparency, the lists of houses of different categories were displayed at a public place in the village. They were also displayed on the website of the GSDMA so that the lists were available in the public domain.

Immediately after the earthquake, it was felt that the affected people should relocate themselves to areas other than those severely affected. The decision was, however, left to the community. The Gram Sabha or village council, was to take a decision on relocation and *in-situ* reconstruction. In the event of relocation, the site was identified by the villagers themselves. It is interesting to note that there was minimum relocation because in most cases people preferred *in-situ* reconstruction. Out of the

215,255 houses that are being reconstructed only 5,720 (2.7 per cent) are fully relocated; 10,640 (5 per cent) houses are partially relocated in the sense that they are reconstructed within the same revenue village. The remaining 92.3 per cent of the houses are being reconstructed *in-situ*.

In the immediate aftermath of the earthquake and in view of the large-scale destruction, a crucial issue was how to undertake the reconstruction of such a large number of houses within a reasonable time-frame. The quality of construction was also an issue. Some experts suggested reconstruction through public sector undertakings and private contractors. It was pointed out that unless there was a unified approach to reconstruction it would not be possible to ensure timely and quality construction. After much discussion, it was decided that the basic approach would be a process of owner-driven reconstruction. The government would provide financial assistance, facilitate the availability of building materials and provide technical support. The owners would reconstruct their houses themselves.

There was no rigid or uniform design for the houses. Owners themselves could choose a design based on their needs and preferences. Financial assistance from the government was given in three installments, keeping in view the stages of construction. In most cases, the payment was made through bank accounts. About 660,000 bank accounts were opened for such payment during a period of four months. This required the massive mobilization of personnel from various departments so as to assist the banks to open the accounts within a short time. Truckloads of passbooks had to be procured from Pune and other places.

Over a thousand outlets were opened by the Gujarat State Civil Supplies Corporation and cooperative societies to supply building materials such as cement and steel at reasonable prices.

For the purpose of technical supervision and technical guidance for owner-driven reconstruction, about 1,900 engineers were recruited on a temporary basis and stationed at villages in order to ensure construction of earthquake-resistant houses. Measures for capacity building and dissemination of information were undertaken. A large number of masons and engineers were trained and over one billion pamphlets on earthquake-resistant design for repair and reconstruction were distributed. As the villagers themselves repaired and reconstructed their houses, they became

familiar with the techniques of retrofitting and multi-hazard resistant construction. This resulted in technology transfer.

The other feature of the housing programme is partnerships with NGOs. The Public-Private Partnership Programme (PPPP) was launched so as to facilitate the participation of NGOs with the government. Eighty NGOs and other agencies adopted 285 villages in five districts for construction of houses. Of these 80 agencies, 52 were local/national NGOs, 12 international NGOs, five state governments and 11 corporate bodies/state corporations. In most cases the NGO/agency and the Government of Gujarat shared the expenditure on a 50:50 basis. Under this programme, 42,528 houses are constructed (about 20 per cent). In addition, for 24 villages of the Bhachau *taluka*, the CII undertook the reconstruction of infrastructure with their own funds.

An important issue which emerged during the process of reconstruction was the problems of tenants. No doubt the housing packages did make some provisions for them. However, most of the schemes and components of the programme focused on owners. In addition to houses, shops also have tenants. With the collapse of houses, tenants were automatically displaced. In many cases, after reconstruction, owners refused to rent out the premises to tenants. In some cases, arrangements were made to allot land to tenants on payment of development charges. The problem was more acute in the case of commercial premises. In such cases, the allotment of alternative land to tenants does not satisfy them because location is crucial to commercial activities.

In some cases, people who could not produce their title and/or proof of residence were not given assistance. Some NGOs and other agencies made representations to the government on behalf of such people. In many cases, the grievances were redressed. About 1,800 legal literacy camps were organized in twenty *talukas* to provide legal aid to the victims of the earthquake. In some, they were given assistance through existing schemes such as the Indira Awas Yojana under the Rural Development Programme. In retrospect, one feels that there was a need for a more effective system of grievance redressal.

There were also instances of encroachers. They do not have ownership of land, and hence, are not entitled to any assistance. However, some

provision was made to give them some assistance, for example, the schemes meant for families below the poverty line. There were also cases of absentee owners and tenants who had been occupying the premises for decades

Another interesting feature of the housing programme is independent technical audit and quality control of the houses through a process of third-party audit, so that they conform to hazard-resistant standards. There were three agencies, namely, the National Council for Cement and Building Materials (NCCBM), the Central Building Research Institute (CBRI) and IIT, Powai, which developed a quality control manual for quality checks on the buildings being reconstructed. They also developed a training programme for engineers.

The NCCBM, a Government of India agency, was assigned the work of third-party quality audit. The organization was to inspect all the houses being constructed and 10 per cent of those which were being repaired. Such inspection commenced right from the beginning of the house reconstruction programme. The NCCBM teams visit the houses at different stages of construction, take samples to test in their laboratory and give periodical reports. In the case of non-conformity to standards, remedial measures are taken. Over 240,000 house inspections including repeat visits were done till December 2003.

In the beginning, some deficiencies were noticed by the quality control consultants. Subsequently, remedial measures were taken by the owners in many cases. The help of NGOs was taken to rectify the buildings which did not earlier conform to the guidelines, and where the owners themselves could not rectify the deficiencies.

The Government of Gujarat also issued a resolution to the effect that the houses which were reconstructed should be registered in the names of both husband and wife, so as to protect the right of the woman to the house. In the case of a widow, the house is registered in her name and not in the name of any other relative.

## **House Insurance**

Insurance is important for managing catastrophe risks. Some countries have introduced programmes that envisage providing affordable

catastrophe insurance coverage to people. The need for insurance is well accepted. However, problems arise on account of the asymmetry of information, resulting in market failures. Private insurers do not readily come forward to provide such insurance because large catastrophic events can wipe out all the reserve. Even when catastrophe insurance is available in some cases, the coverage is very low because of lack of public awareness of benefits of insurance and also lack of innovative insurance products.

It is interesting to note that the Gujarat State Disaster Management Act of 2003 explicitly mentions, in the context of disaster management, risk transfer mechanism as one of the mitigation measures: promoting adequate risk-transfer, risk-sharing and cost-sharing mechanisms [Section 4(2)(g)].

Initially, the GSDMA, in consultation with the WB team, considered three feasibility studies relating to insurance with the following objectives:

- (i) conceptualizing the optimal design for a state-wide risk transfer scheme;
- (ii) outlining the necessary regulatory framework for the operation of the Gujarat Earthquake Insurance Pool; and
- (iii) developing an actuarially sound disaster loss model to be used for setting the premium rates for catastrophe insurance coverage.

In fact, some preliminary steps relating to the selection of appropriate consulting services were taken. It was subsequently felt that a single study covering all the above aspects would be adequate. The objective of such a study would be to conceptualize and define a structure for creating an insurance pool as in some other countries such as Turkey. Further analysis revealed that Gujarat already had a mechanism for public sector insurance known as the Gujarat State Insurance Fund (GIF). At the national level, four state-owned general insurance companies in the public sector were already in existence. After liberalization, some private insurance companies also emerged. Another aspect was that the insurance regulator had prescribed a single countrywide minimum tariff for earthquake insurance. Considering all these aspects, it was felt that there was no comparative advantage for the GSDMA and the Government of Gujarat

to create an insurance pool that would compete with the existing insurers. It would be worthwhile to create awareness and encourage people to buy insurance from the above companies, as the premium rates were quite low.

It was decided that all the houses that were reconstructed would be insured. The GSDMA invited expressions of interest from insurance companies, which would be willing to co-insure with the GIF. Six companies submitted their bids of which one withdrew. Hence, five insurance companies were selected, of which IFFCO-TOKIO is a private company and the other four are public sector, general insurance companies. Different districts or parts of districts were allocated to the companies for the purpose of insurance of houses.

The insurance covers 14 types of risks including fire, earthquake, explosion, cyclone and flood. The coverage is for a period of 10 years. All the G-5 houses are to be compulsorily insured, whereas it is optional for other categories of houses. The premium rate is fixed by the Tariff Advisory Committee. The premium is Rs 349.10 for an insured sum of Rs 1 lakh. The premium amount is deducted when the third instalment is paid to the beneficiary. The amount of the sum insured ranges from Rs 50,000 to Rs 2 lakhs, keeping in view the size of the dwelling unit and location (rural or urban).

In order to spread the risk, different districts/sub-districts are allotted to different companies. An insurance company becomes the lead company for the allotted area and the other four, along with GIF, become co-insurers. The lead insurance company gets 35 per cent of the premium and the other four companies equally share 20 per cent, while the GIF gets 45 per cent. The risks are also shared in the same proportion.

Village-wise lists of insured persons are prepared and insurance is given as a group insurance. A list of insured persons is kept at the *taluka* office and each beneficiary is given a certificate indicating the insurance of his house. Even if the insurance certificate is lost, the insured will be able to make his claim based on the group insurance certificate available at the *taluka* office. In the event of a disaster affecting a large number of people, the *Taluka* Development Officer (TDO) is expected to facilitate completion of procedural formalities in respect of the insurance claims.



In order to create awareness regarding insurance of houses, a number of initiatives were taken by the GSDMA:

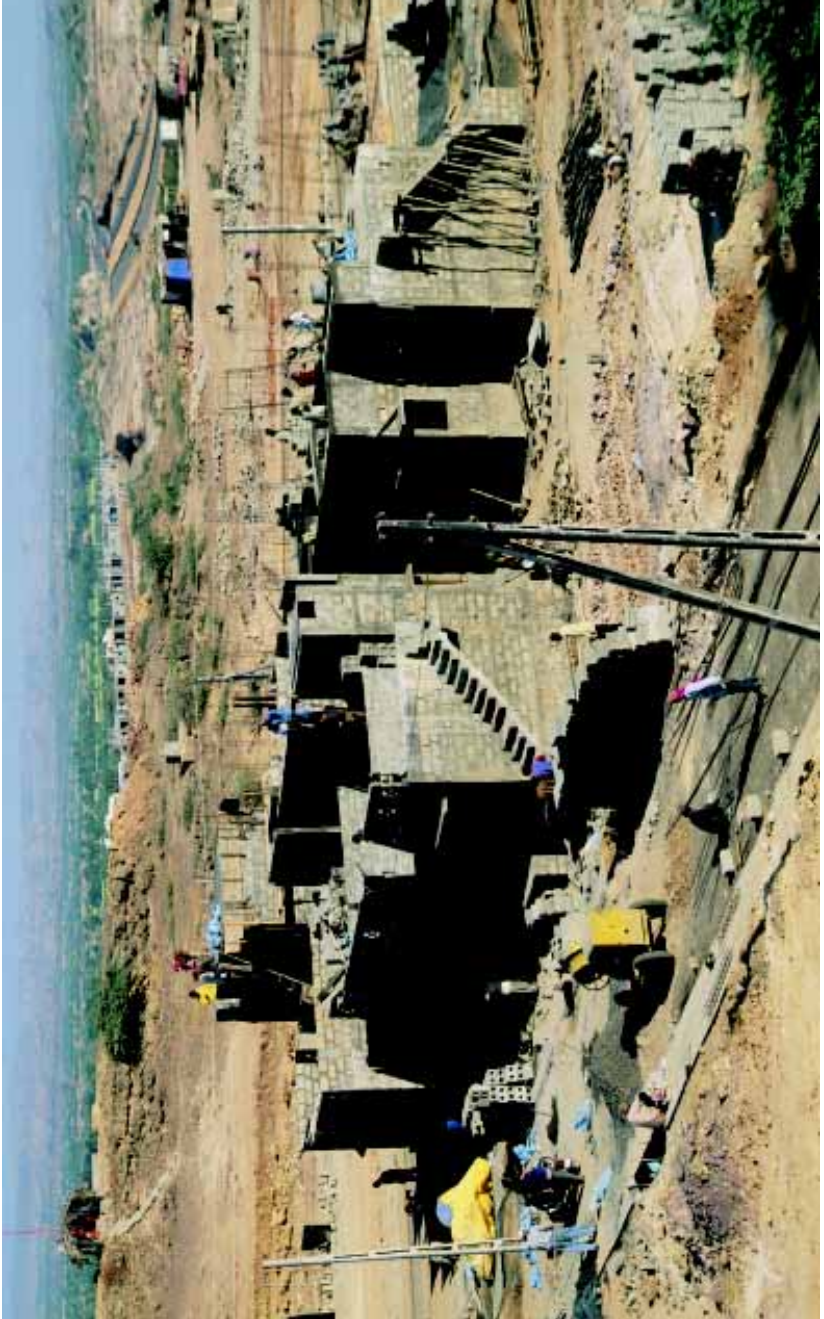
- A pamphlet indicating various aspects of insurance was given to each beneficiary.
- 5,000 posters were printed and displayed at government offices and public places to create awareness about the insurance of houses.
- Efforts were made to create awareness among women through posters and other mechanisms such as exhibitions and fairs.
- 50,000 pamphlets on insurance were distributed among people, NGOs and government officers.
- Various aspects of housing insurance were discussed in *gram sabhas* or village councils in different parts of the state.

## **Urban Reconstruction**

The approach of the Government of Gujarat and the GSDMA to urban reconstruction, particularly those of the four towns of Kutch, has been systematic and scientific.

The School of Architecture at the CEPT, Ahmedabad undertook, within the first two months after the earthquake, a study on the nature of the damage and approach to reconstruction/relocation in respect of some urban areas, particularly the inner city of Bhuj. Faculty members and students of the postgraduate programme in urban design in the School of Architecture participated in the study. They conducted field visits, interacted with the affected persons and undertook sample surveys in order to ascertain the views of the public. They analysed the nature and pattern of damage over time and in different parts of the settlement. Socio-economic aspects were also considered. They examined, based on discussions with the people, alternative approaches such as:

- (i) development on the existing footprints respecting the existing typology,  
and
- (ii) reconstitution of the plots with widening of roads and redefining the existing community areas.



**Reconstruction of houses at a relocation site in Bhuj**

They worked out draft proposals for widening roads, modification of land use, etc. They made two presentations to senior officers and ministers in the presence of the Chief Minister during April 2001. They made a number of suggestions including:

- (i) Improving layout of settlements and urban infrastructure.
- (ii) Setting up of a local authority at Bhuj to offer technical assistance for appropriate construction and monitoring of reconstruction.
- (iii) Finalizing an approach to preparation of a development plan.
- (iv) Adoption of a Town Planning Scheme for re-development of the inner city.
- (v) Widening of roads to facilitate movement of vehicles at the time of crisis and development of a hierarchy of streets.
- (vi) Some reorganization of plots of land in order to widen the roads; acquisition of plots that are cut more than 75 per cent.

The outcome of the above study provided valuable inputs for planning reconstruction of the four towns of Kutch district. It also enabled policy makers to crystallize their ideas and to formulate an approach envisaging a mix of *in-situ* reconstruction and relocation with regard to the four towns of Kutch district.

Area Development Authorities (ADA) for the four towns of Kutch were set up under the provisions of the Gujarat Town Planning and Urban Development Act of 1976. The ADAs engaged reputed consulting firms for the preparation of various plans.

The government sponsored 19 studies to collect basic information and identify the safety aspects for *in-situ* reconstruction. Development plans were prepared so as to ensure the planned use of land.

The ADAs as well as the consultants undertook many of the functions which were required to be done by the municipalities. Senior officers were appointed as CEOs of the ADAs. The ADAs were entrusted with the task of issuing building permissions and development of relocation sites. The new development plans incorporated a new set of general development control regulations.



**A reconstructed house at a relocation site at Bhuj**



**Reconstructed municipality office building at Anjar**

Town plans were prepared for three towns of Kutch. It was necessary to survey and measure plots or individual holdings keeping in view the importance envisaged in respect of wider streets, access of each plot to the street and so on. Thousands of plots had to be surveyed and maps prepared. Numerous disputes and grievances also had to be settled.

Public consultation was an important part of the planning process for the development of the four towns of Kutch. The idea was to ensure people's participation in the process of planning.

For the purpose of public consultation, three categories of people were addressed: local communities, people from local governments and NGOs working at the local level. In addition, eminent local people were also included. Some details of public consultation in the context of Anjar town will illustrate the approach. Public consultation was organized in two stages. In the first stage various communities, people's representatives and eminent persons were consulted with regard to the formulation of a vision document and related aspects of development of the town. After analysing the views and opinions of people, a vision statement and a conceptual development plan were prepared. In the second stage, public consultation focused on the vision statement and the conceptual development plan. The idea was to explain the conceptual plan to the public and get their views and suggestions.

After the preparation of the development plan, written comments were invited from the stakeholders as per sections 14 and 16 of the Gujarat Town Planning and Urban Development Act of 1976. This was a statutory requirement.

The draft development plan of Anjar (Volume 3) describes the process, outcome and conclusions of public consultations. It indicates how the target groups were selected from among those living in temporary rehabilitation shelters and other areas, NGOs, members of the municipality and eminent persons. Consultation sessions were organized at various locations. The document indicates the dates of consultation, locations, community groups, number of households who participated and so on. The public consultations followed a format of semi-structured and open-minded discussion. There was adequate scope for people to raise issues and offer ideas and suggestions; the teams conducting the sessions acted as facilitators.



**An urban relocation site**

## **Role of NGOs**

As mentioned earlier, a number of NGOs played an important role during both the relief and reconstruction phases. An innovative aspect of the programme is that it provided a systematic framework for public-private partnership, especially for rehabilitation and reconstruction work.

The participation of NGOs was not limited to the housing sector. As Table 31 indicates, NGOs also participated in reconstruction of school buildings, health facilities and restoration of livelihood.

**Table 31: Progress of activities taken up by NGOs as of January 2004**

<b>Component</b>	<b>Number of NGOs</b>	<b>Target</b>	<b>Completed</b>
<b>Housing</b>			
Reconstruction of Houses in 286 Villages	80	42,528	41,902
Construction of Worksheds	14	945	638
<b>Education</b>			
Reconstruction of Additional Classrooms for Primary Schools	-	3,938	3,810
Reconstruction of Municipality Schools in Surendranagar and Radhanpur	9	8	6
<b>Health</b>			
Reconstruction of Health Facilities	-	246	246
Reconstruction of <i>Anganwadis</i>	45	246	246
<b>Livelihood (Beneficiaries Covered)</b>			
Women's Livelihood Restoration Project	13	16,127	10,663
Formation of Self-help Groups (SHGs)	36	1,885 SHGs with 35,618 members	
Day Care Centre	15	157 centres with 8,558 children.	

**Note:** For the last two items, i.e., formation of SHGs and Day Care Centre, there are no targets. The details provided are the achievements.





**Newly constructed village Sayan**

An important role was played by Abhiyan. In the aftermath of the 1998 cyclone, some NGOs joined to create Abhiyan, with a view to facilitating information sharing and better coordination among themselves. In the beginning, 11 NGOs joined; this number gradually increased to 29. This arrangement was further strengthened and played an important role in the earthquake relief and reconstruction.

An innovative concept known as *Setu* was introduced by Abhiyan. *Setu* is basically a resource centre for about 25 villages. Each centre is operated by a support group of seven to eight people. The idea is to facilitate and create an information linkage between the Government of Gujarat and local communities. At *Setu*, information is collected from the villages and transmitted to Abhiyan once every week, or once a fortnight. Abhiyan gives the necessary guidance to the *Setu*. The information, if necessary, is passed on to the government so that relevant issues are addressed. The *Setus* are managed by young men and women. At the peak of the reconstruction work, 33 *Setus* covered 400 villages. Even though the project is similar to that of an extension organization in the government, the *Setus* functioned more effectively because of the commitment of the personnel and their rapport with the village communities.

The Sustainable Environment and Ecological Developmental Society (SEEDS), an NGO, undertook a comprehensive reconstruction programme in the Patanka village of Patan district. The programme involved reconstruction as well as capacity building of the villagers and community preparedness. Other agencies such as the United Nations Centre for Regional Development (UNCRD), the Earthquake Disaster Mitigation Research Centre, Japan, and the National Society for Earthquake Technology, Nepal, participated in the capacity-building activities in Patanka.

In Bhuj, the Bhuj Development Council, an NGO, played an important role in the process of town planning. It set up small offices at eight locations in the walled city, with personnel and computers and displayed their plans. The affected people could file objections and offer suggestions. This NGO interacted regularly with the planning consultants and government agencies. Similar efforts were made in Bhachau and Anjar.

Abhiyan, the GSDMA and UNDP brought out a report entitled *Coming Together*, a few months after the earthquake. It contains details of the work done by NGOs in areas such as shelter, water, irrigation systems, health and livelihood. Five such editions have been published from time to time. These volumes contain a wealth of information on the contribution of NGOs in the reconstruction and rehabilitation work in Gujarat.

It may, however, be noted, that NGOs played a limited role in the urban reconstruction as compared to the rural reconstruction. Government agencies such as the GUDC and ADAs played a leading role. NGOs, however, facilitated the interaction between the citizens and the government agencies in some of the urban areas.

### **Multi-hazard Resistant Construction and Retrofitting**

Many measures were taken to promote multi-hazard resistant construction with a view to reducing the vulnerability of buildings on a sustainable basis. Guidelines prepared by A.S. Arya, Seismic Adviser to the GSDMA were widely circulated in the earthquake-affected areas. The guidelines relate to various aspects of repair and reconstruction of houses. The guidelines have taken into account local resources and local technology. Some innovative construction technologies have also been adopted. The following guidelines are prepared by the GSDMA:

- Guidelines for cyclone-resistant construction of buildings in Gujarat.
- Guidelines for construction of compressed stabilized earthen wall buildings.
- Guidelines for repair, restoration and retrofitting of masonry buildings in the Kutch earthquake-affected areas of Gujarat.
- Guidelines for reconstruction and new construction in the Kutch earthquake-affected areas of Gujarat.
- Guidelines for control on quality of construction in earthquake-affected areas of Gujarat.

These guidelines were circulated amongst various agencies and individuals associated with reconstruction programme such as NGOs, engineers and even masons.



**Earthquake-resistant construction at Bhuj**

## **Meeting the Demand for Skilled Masons**

There was huge demand for masons because of the widespread damage and destruction. They came from neighbouring regions and states. Yet, there was a problem of the availability of skilled masons. Most of the masons were not familiar with hazard-resistant construction and retrofitting. In view of this, efforts were made to undertake the training of masons on an emergency basis. Masons who participated in the training were provided with the cost of travel and food. Organizations such as District Rural Development Agencies, the Directorate of Employment and Training, the NCCBM and various NGOs, were involved in this process.

While designing the course for training of masons, emphasis was given on practical aspects. It was not feasible for masons to undergo training for a long period. Hence, a one-week training programme was designed and given to the agencies providing the training. This was with a view to ensuring the quality of training, as it was being carried out at a number of locations. Besides imparting skills through classroom lectures, masons were given hands-on training at construction sites. The training covered aspects such as earthquake zones, availability of building materials, preference of the people for different building materials, cost effectiveness and safety. Booklets covering the relevant aspects were prepared and circulated among the trainees. Training programmes were arranged not only at district headquarters but also at *taluka* and village centres.

About 20,000 masons were trained by the Directorate of Employment and Training; another 700 by the NCCBM. About 500 masons were trained by an NGO as a part of community-based disaster preparedness. Masons were also trained by other NGOs and District Rural Development Agencies. Overall, more than 29,000 masons were trained. Further, the masons who were trained were given a kit worth Rs 1,200 which could be utilized for construction work.

## **Training of Engineers**

As already mentioned, about 1,900 engineers were recruited to supervise the housing reconstruction work and provide technical guidance to the people. Disbursement of assistance for construction of houses was based on the certificates given by the engineers. It was necessary to train



**Training of masons**

these and other engineers on hazard-resistant design and construction. The GSDMA involved expert institutions such as the IITs and the NCCBM in this task. In some cases, foreign experts were invited to impart training. Training programmes addressed not only government engineers but also private engineers and architects.

For government engineers, six-week training courses were provided by IIT, Powai and IIT, Kanpur, at Rajkot, Gandhinagar and Bhuj on the following subjects:

- Seismic retrofitting;
- Seismic design of concrete and masonry structures;
- Seismic design of bridges; and
- Special course on earthquake engineering for architects.

Some of the other training programmes/workshops conducted were as follows:

- (i) Engineers were trained on 'Repairs and Rehabilitation of RCC Structures' by experts from IIT, Powai, at Gandhinagar, Rajkot, Bhuj and Gandhidham.
- (ii) Engineers, architects and technical experts were trained on 'Architectural Concern in Seismic Design of Buildings' by experts from IIT, Kanpur.
- (iii) Government and private engineers were trained on 'Seismic Design of RCC Buildings' by experts from IIT, Kanpur.
- (iv) Engineers were trained on 'Earthquake Resistant Design and Reinforced Concrete Buildings' by experts from IIT, Kanpur.
- (v) Government and private engineers were trained on 'Seismic Design of Bridges' by experts from IIT, Kanpur.
- (vi) A seminar was organized for engineers and architects on 'Repairs and Strengthening Guide for Earthquake Damage in Low-rise Domestic Buildings' by Dinesh Patel (an expert from the UK).
- (vii) A two-day workshop on new seismic code IS 1893-2002 was conducted in March 2003 for more than a 100 participants.

## **Revision of Syllabus and Training of Teachers of Technical Institutions**

It was realized that training practising engineers alone would not be adequate for capacity building on a sustainable basis. The syllabi of degree and diploma courses in engineering do not focus adequately on seismic engineering and as a result, diploma holders and graduate engineers do not acquire the necessary skill on the subject. Training practising engineers in seismic engineering may supplement their existing skill but it cannot substitute knowledge and training imparted in course of formal academic teaching. Hence, the GSDMA initiated steps during the later part of 2001, for revising the syllabi of engineering colleges and polytechnics. A.S. Arya, Seismic Adviser to GSDMA and Sudhir Jain Professor at IIT, Kanpur, prepared the seismic engineering components to be incorporated in the syllabi of diploma, degree and master's level programmes. The Government of Gujarat also issued the necessary administrative instructions. All the engineering colleges and polytechnics of Gujarat have subsequently incorporated seismic engineering in their curriculum. Based on the Gujarat experience, the Government of India has begun a similar programme at the national level.

Mere revision of the syllabus would not be effective unless the teachers of the technical institutions are familiar with the subject and are in a position to teach and guide the students. The GSDMA organized training programmes for teachers of technical institutions. Short-term and medium-term courses were designed for the purpose. There were 13 modules of one-week duration each that were designed for engineering teachers. All the modules together are equivalent to a full semester programme in earthquake engineering. The training programme commenced in July 2003. More than 500 teachers were expected to be trained in different modules under this programme. However, till the end of 2003, only 120 teachers were trained in selected topics; the shortfall was because of the lack of enthusiasm on the part of the department concerned. In addition, teachers were sponsored for an intensive 19-week programme at IIT, Kanpur.



## **Strengthening of the Regulatory System for Safe Construction**

The GSDMA has sponsored a study by reputed consultants on the existing procedures for building permissions and enforcement of building codes. One aspect of the study is to examine the General Development Control Regulation (GDCR) and to prepare a model GDCR that can be used by urban local bodies. This is because the existing GDCR has inconsistencies and several parts of it are difficult to comprehend. Unless the GDCR has clarity and consistency, it will be difficult to enforce the building codes.

Another study which has already commenced relates to the building codes. The objective is to analyse the existing codes and to suggest revisions, if necessary, to meet the specific requirement of the state keeping in view its hazard and vulnerability profile. The study will also prepare a handbook of commentaries on building codes, which will provide guidance to professionals for implementing these building codes in design and construction. The study is being undertaken by experts from IIT, Kanpur.

A manual containing systems and procedures to assist municipal and area development authorities in reviewing building plans and structural designs is being prepared. It will provide guidelines for the submission of drawings and structural designs. It will also have a checklist for ascertaining whether a particular drawing or design conforms to seismic standards. A workshop was organized to sensitize engineers of municipal and area development authorities on seismic standards and design.

## **Licensing of Engineers and Certification of Masons**

It is well known that many buildings collapsed during the earthquake because of faulty structural design and poor quality of construction. Building codes and bye-laws can be enforced only if those involved in design and construction of buildings follow them. The training of engineers and masons can facilitate such enforcement. It is also necessary to ascertain and verify whether engineers and masons are familiar with various aspects of seismic safety and hazard resistance. At present, there is no mechanism for ensuring that those with the necessary competence are selected for actual construction work. Though some local authorities prepare a register

of qualified engineers there is no process of screening them based on their skill and capability. An individual who wants to build a house has no way of knowing if an engineer or a mason has the necessary skill to ensure appropriate design and construction.

In most parts of India, compliance with seismic codes in construction was not mandatory prior to the Kutch earthquake. In most cases, it depended on the discretion of the owner or builder concerned, though many of the government departments tried to follow the codes. For example, in the AMC, there was no insistence on the explicit compliance of seismic codes, though there was some requirement relating to certain features of the code. In India, there are legislations in respect of professions such as medicine, law, chartered accountancy and architecture. In addition to legal provisions, there is regulation by professional bodies. There is no such legal provision for civil engineers. There is no licensing system for structural engineers. A person with a degree in civil engineering can go ahead and practice. The general custom in construction is that an architect takes the overall charge and a structural engineer plays a role only through the architect. A citizen who wants to construct a building cannot easily identify a competent structural engineer.<sup>7</sup>

The GSDMA has sponsored a study to work out a system of the licensing of engineers based on written and practical tests. For this purpose, an autonomous agency comprising representatives of the government, practising engineers, architects and other professionals will be set up. A draft legislation for this purpose has been prepared.

The GSDMA has initiated measures to introduce a system of certification of masons. In order to ascertain the competence of masons, three levels of skills could be considered:

- Core skills
- Basic skills
- Advance skills

The certification may be done based on tests consisting of written and practical components. The Gujarat Council of Vocational Training (GCVT), an autonomous society under the Department of Labour and

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<sup>7</sup>Further details are given in chapter 17 of Earthquake Engineering Research Institute (2002).

Employment, will implement the programme. Such competency-based certification will provide an opportunity to a mason to improve his skill. He can be trained in respect of skills which he does not have. There are a large number of masons in the state. At the initial stage, it is envisaged to cover about 10 per cent of these workers. Certification will be voluntary. It is expected that masons who are certified will have better opportunity for employment and higher wages.

## **Measures for Long-term Disaster Management**

An important aspect of the GERP is the emphasis on medium and long-term disaster management. Even when the task of reconstruction appeared enormous and challenging, these aspects of disaster management were kept in view right from the beginning. The GSDMA undertook wide-ranging activities relating to capacity building, disaster management plans and preparedness for emergency response (Tables 33, 34, 35). Above all, it took effective steps for introducing a legal framework. Indeed, Gujarat became a pioneer in India in introducing such measures.

## **Disaster Management Policy and Act**

The Government of Gujarat announced the Gujarat State Disaster Management Policy in September 2002. The policy envisages a number of objectives, some of which are enumerated below:

- To assess risks and vulnerabilities associated with various disasters.
- To develop appropriate disaster prevention and mitigation strategies.
- To provide clarity on roles and responsibilities for all stakeholders.
- To ensure coordination among agencies related to disaster management.
- To create awareness and preparedness, and to provide advice and training to agencies involved in disaster management.
- To strengthen the capacities of the community.
- To establish and maintain pro-active programmes of risk reduction.
- To develop and implement programmes for risk sharing and risk transfer.

- To address general issues in disaster management.
- To develop disaster management as a distinct management discipline.

In order to provide a legal framework, the Gujarat State Disaster Management Act, 2003, was passed by the State Assembly in March 2003. Gujarat is the first state in India to introduce such an Act. It is a very comprehensive legislation, which derives from similar legislations in other countries. The draft was prepared after an elaborate study of similar legislations in different countries and related legislations in India. There was wide consultation with stakeholders. The Act gives statutory status to the GSDMA and envisages a multi-hazard approach to disaster management. It is based on the premise that disaster management is the responsibility of all the state departments and agencies. It enumerates the powers, functions and duties of various departments and functionaries at state, district and sub-district levels. It also indicates duties of community groups, youth organizations, industries, private and public sector entities, voluntary agencies and citizens. It provides for the declaration of an area as a disaster-affected area. The Act also prescribes offences and penalties.

### **Establishment of earthquake observatories and accelerographs**

At the national level, the IMD uses seismological instruments for observing seismic phenomena. Keeping in view the recent earthquakes, the Government of India has planned to augment the instrumentation system. The GSDMA felt that though augmentation of the national network would help improve the status of earthquake monitoring in Gujarat, it may not be optimal for the state, even if it is adequate for the country as a whole. Consequently, a group was constituted under the chairmanship of A.S. Arya to analyse the need of seismological instrumentation for Gujarat. The group comprised experts from the IMD, IIT, Roorkee, and the Gujarat Engineering Research Institute (GERI). Based on their recommendations, the GSDMA has planned to set up/upgrade observatories at 16 locations and accelerographs at 40 locations. Instrument specifications have been prepared by the GERI in consultation with the IMD and IIT, Roorkee. The process of procurement of these instruments has been initiated.

An additional seismological monitoring unit has been set up with the help of the GEON Institute, Russia. Equipment has been provided by the GEON Institute through Asianet Communication, Thiruvananthapuram. This is a mobile unit that can be shifted from place to place depending on the requirement. Such a unit would be useful in the context of seismic activities in areas such as Rajkot, Junagadh and Jamnagar.

### **Establishment of a Seismological Research Institute**

It is envisaged to set up a seismological research institute. The idea is to undertake study, research and training in seismology. A variety of data on seismic aspects is being generated. It is necessary to study such data in order to identify mitigation measures. At present, there is no specialized institute dedicated to seismology in India, even though institutes such as the National Geophysical Research Institute (NGRI) have been doing excellent work in the field. The Government of Gujarat has signed a memorandum of understanding with the Earth Institute of Columbia University, USA, for studies in some specific areas. One of the studies relates to setting up of the Seismological Research Institute in India. The Columbia University has already submitted an inception report. The study will identify the core issues that will be addressed by the proposed Seismological Research Institute, its design and other related aspects. Simultaneously, a Director General for the institute has been appointed. A fund to meet the institute's capital expenditure has also been earmarked.

### **Establishment of the Gujarat Institute of Disaster Management (GIDM)**

It is proposed to set up an institute of disaster management with a view to catering to training needs of all the stakeholders in this area. The institute will undertake study, research and documentation, in addition to training. The activities of the institute will cover the mitigation and management of all types of disasters including fire and chemical accidents. An international consultant will be assigned the task of designing the institute. This will take some time. In the meantime, the institute will begin its operation at the Sardar Patel Institute of Public Administration (SPIPA), Ahmedabad.

## **Review of disaster management plans**

District-level disaster management plans of all the 25 districts were reviewed by the GSDMA and suggestions and guidelines were issued for further improvement. The existing cyclone contingency plan at the state level was also reviewed by the GSDMA. Recommendations were made for modification keeping in view the provisions of the Disaster Management Act. Guidelines for preparations of local-level cyclone contingency plans were prepared and circulated among different districts. A pocket-sized booklet on cyclone preparedness has been prepared and circulated in all the cyclone-prone areas. The GSDMA has prepared a state-level response plan for chemicals and industrial disasters.

The draft of a handbook on preparedness for fire, chemical and nuclear emergencies has been compiled. The preparation of a set of general guidelines for droughts is also in progress.

## **Upgrading the emergency response system and search and rescue capability**

An important lesson learnt during the earthquake is that we need to upgrade our search and rescue capability and improve upon the existing system of emergency response. Foreign search and rescue teams arrived with state-of-the-art equipment that were more effective than the existing equipment available in India. The GSDMA has taken a number of initiatives to upgrade systems in recent times.

### *Improvement of control rooms*

The GSDMA, with the help of international experts in disaster management, reviewed the status of control rooms at the state and district levels. Interim guidelines for control room design and operations were circulated to the districts. They contain details of equipment, location of the control room information centre, its function, staff, etc. A model layout plan for a control room was also circulated.

### *State Disaster Resource Network (SDRN)*

As mentioned earlier, during the Kutch earthquake, a large number of

equipment had to be deployed. This is inevitable at the time of major disasters. It is thus necessary to have an inventory of equipment and other resources for immediate response. Keeping this in view, the SDRN was created. The objective is to have village-level data for the thousands of villages in the state. The database includes the village profile, hazard scenario, demographic features, available resources, details of village disaster management teams and lists of contact persons. The SDRN provides for creation and updating of village, *taluka*, district and state-level disaster resource inventory. The Government of Gujarat has a state-wide fiber optic wide area network, the Gujarat State Wide Area Network (GSWAN), which connects all the government offices up to the *taluka* level. The SDRN is hosted on the GSWAN and is available in both English and Gujarati.

The Government of India also introduced the India Disaster Resource Network (IDRN) which is an inventory of equipment, both in the public and private sector, for deployment during disaster. The focus is on equipment, whereas the SDRN includes a more comprehensive database.

### *Regional Emergency Response Centres*

It is proposed to establish regional emergency response centres at five locations in Gujarat: Ahmedabad, Rajkot, Surat, Baroda and Bhuj. It is also proposed to engage international consultants to suggest the design, equipment, staffing and other details for such centres. In the interim, the fire service units of Ahmedabad, Surat and Rajkot will operate as regional emergency response units. For this purpose, the GSDMA has already provided state-of-the-art equipment sets to the three municipal corporations.

### *ERUs*

An ERU has been established at the Ahmedabad Fire Brigade. CORDAID, a Netherlands-based NGO, provided equipment that is meant for advanced search and rescue capability in disaster situations. The important categories of equipment are:

- Trauma Care Unit (ambulance with a life-support system);
- Emergency medical and rescue unit;



**Training of incident command officers organized by ICET, Netherlands**



- Hook-Arm Chassis and containers;
- HAZMAT Van; and
- Command Unit (useful for immediate setting up of a command/communication post).

*Multi-disciplinary training in search and rescue operations*

The GSDMA, with the help of ICET, Netherlands, and the AMC, organized training in search and rescue and emergency medical services for 49 fire, police and medical services personnel. The training was for one month and held in the Netherlands and Germany. The training was carried out in three groups. They will, in turn, train 500 other personnel. The process of training has already commenced. In addition, it is proposed to train 11 teams of 30 each from the State Reserve Police Force in search and rescue operations.

At Nauka Talim Kendra, Vadodara, two batches of 30 firemen and fire officers each were trained in flood rescue.

*Emergency equipment for municipalities*

Most of the municipalities do not have adequate equipment and trained personnel to meet fire emergencies. Measures have been initiated to provide emergency equipment, which are meant not only for fire emergency but also for search and rescue in disaster situations, to about a 100 municipalities in the state. The municipalities have already been identified by the Department of Urban Development. The procurement process has been initiated by the GUDC.

*Provincial fire service*

In Gujarat, the fire services are with municipal corporations and municipalities. There is no integrated fire service in the state. In view of the fact that fire services have the potential to undertake effective search and rescue operations, a committee was set up by the Government of Gujarat to review the recommendations of the Standing Committee



**Search and Rescue training of Gujarat officials in The Netherlands**

constituted by the Government of India and to look into the best practices in other states. The committee has done considerable work on the subject. Some members of the committee visited the Tamil Nadu Fire and Rescue Services to study their arrangement and suitability to Gujarat. The committee examined other alternatives, which include corporate organizations and public-private partnership, in search and rescue.

### *Emergency communication*

At the time of a disaster, normal communication systems are adversely affected and quite often, they break down. This affects preliminary damage and loss assessment, and even search and rescue work. Hence, emergency communication is extremely important. Furthermore, a system of early warning is crucial not only to emergency communication but also to alert people in the context of a likely event. The GSDMA has initiated a study on early hazard warning and emergency communication system. It addresses the nature of the emergency communication system required and the modalities of disseminating early warning. Gujarat already has a wide area network known as GSWAN, which connects, through optical fiber, districts and *talukas*. There are satellite phones at district headquarters. Yet, it is necessary to have an effective system of emergency communication which is integrated to the existing systems and has the desired level of redundancy. It is also necessary to integrate HAM radios to a system of emergency communication for disaster management.

### **Community-based disaster preparedness programme**

The GSDMA, in collaboration with the UNDP, has initiated a community-based disaster preparedness programme known as the Disaster Risk Management (DRM) Programme. This is part of a national programme initiated by the Government of India. The programme initially envisaged covering 3,598 villages in 44 *talukas* of 11 districts. The villages were identified on the basis of their vulnerability to different types of disasters. Subsequently, the programme was expanded to cover about 4,174 villages in 14 districts. The programme also envisages covering some municipal and corporation areas.

The programme focuses on capacity building of communities through awareness, training and institutional arrangement. The programme will involve village youth in a big way. It envisages identifying young volunteers in the villages to form teams for various activities and prepare them for disaster response. Such teams will be organized for tasks such as early warning, rescue, first-aid and medical services, evacuation and shelter management. Members of each team will be imparted training to perform the tasks assigned to them. They will also be provided with necessary materials and equipment. The objective of the programme is to ensure long-term capacity building of the community and reduce their dependence on external sources.

Prior to the above programme, the GSDMA had initiated a programme called 'Affat Sajjata Sena' (Disaster Preparedness Brigade) in 484 earthquake-affected villages. This also envisages involvement of village youth, their capacity building and training in earthquake resistant construction. The programme is implemented through NGOs.

Another approach to community awareness and preparedness is through *gram sabhas* or village councils. In 2002, the Government of Gujarat initiated steps to activate these councils. Senior officers and ministers have been attending these village councils, which meet regularly in all the 18,000 villages of the state, at which various developmental issues are discussed. Disaster preparedness is included as a permanent item on the agenda of the *gram sabhas*. From time to time, details on specific types of hazards are provided by the GSDMA to District Panchayats for discussion in the *gram sabhas*.

### **Information, Education and Communication (IEC) activities**

The GSDMA has undertaken numerous activities related to IEC. Some of these are:

- Over one million pamphlets on earthquake-resistant construction were circulated in the earthquake-affected areas of Gujarat.
- Four Shake Table demonstrations and many video shows have been conducted for awareness generation and confidence building.

- Audio cassettes by folk singers such as Bhikhudan Gadhavi and Shabudin Rathod, were prepared in order to create awareness through music and humour.
- A video cassette in the form of folk dances called Bhavai was prepared on the construction and retrofitting of houses.
- Full-page advertisements in local dailies were released, indicating appropriate methodologies to be adopted for the reconstruction of houses.
- The display of messages on multi-hazard resistant construction and retrofitting on 600 state transport buses in five worst-affected districts.
- Hoardings of seven kinds at strategic locations in the entire state of Gujarat for awareness creation.
- Brochures were prepared in Gujarati.

**Table 32: IEC activities**

<b>Description</b>	<b>Number</b>
Pamphlets	100,000
<i>Nirdeshika</i> for Seismic Resistant Construction	71,000
Posters on Various Aspects	44,000
Pamphlets and Posters on Insurance of Houses	50,500
Guidelines for Construction	12,000
Training Literature for Engineers	860
Training Literature for Masons	10,100
Information on Status of GERP	51,863
CDs on Current Status of the Project	1,225
Audio and Video Cassettes	5

### **Studies on important aspects of disaster management**

The GSDMA has sponsored several studies on important aspects of disaster management. These studies focus on long-term aspects such as hazard assessment, mitigation, preparedness and response. Consultants

were selected through international competitive bidding. The idea is to have state-of-the art and world-class knowledge and expertise for the studies. The following studies have been undertaken:

- Emergency Communication and Early Warning System
- Seismic Microzonation
- Hazard, Risk and Vulnerability Analysis
- Damage and Loss Assessment Methodology
- Review of Building Codes
- Establishment of Regional Disaster Response Centres
- Establishment of Gujarat Institute of Disaster Management.
- Establishment of the Institute of Seismological Research

Tables 33, 34 and 35 below contain more details on the kind of training that was undertaken:

**Table 33: Disaster management capacity building**

<b>Training</b>	<b>Target Group</b>	<b>Number</b>	<b>Remarks</b>
Engineers	Govt and private engineers and architects	>6000	Trained by experts from IITs, NCCBM, etc.
Masons	Masons working in the state including masons from outside the state	>29000	Trained by Directorate of Employment and Training, NGOs, etc.
S & R	Fire officers, firemen, policemen and doctors	49	Trained at ICET, Netherlands
Fire Fighting and S&R	Fire personnel and police personnel	88	At Ahmedabad by ICET trained persons
Flood Rescue	Firemen/fire officers	60	At Vadodara
Incident Command System	Officers from different govt. depts at state and district levels	72	Two training programmes held at Gandhinagar and Jamnagar with the help of international disaster management experts.

*Contd*

Contd

Instructors Course and Commander Training	Fire, police and Medical Personnel	24	Facilitated by trainers from CORDAID/ICET
Training on Revised Syllabus	Faculty of engineering and technical institutes	180	Total targeted 500. Trainers from IIT &LD College of Engineering
Training Under DRM Programme	District and <i>taluka</i> -level officers	831	

**Table 34: Emergency equipment**

Emergency Equipment	Target	Number	Remarks
For Municipal Corporations	AMC, Surat Municipal Corporation (SMC), Rajkot Municipal Corporation (RMC)	3 sets	
ERU	Ahmedabad Fire brigade	1 set	Established in association with CORDAID, Netherlands based NGO.
Emergency equipment	100 municipalities		

**Table 35: Plans and workshops**

Disaster Management	Number
District Disaster Management Plans	25
Village Disaster Management Plans	478
National and International Workshops	30

## **Social Impact Assessment**

Social impact assessment studies were undertaken through independent organizations such as the M.S. University, Vadodara, and the Gujarat Institute of Development Research, Ahmedabad, on a continuing basis, in order to monitor the social dimensions of the earthquake reconstruction programme. The focus is on identification of needs and to ascertain the impact of the programme in addition to restoring the social welfare of the affected persons. The idea is to have an independent mechanism to implement the social safeguards framework.

The methodology involves a combination of surveys such as household surveys, direct observations and participatory techniques. Numerous interviews were held with the primary stakeholders.

The studies have been carried out in the worst affected districts of Kutch, Patan, Surendranagar, Rajkot and Jamnagar. Based on the findings of the studies, a number of remedial measures are being taken from time to time to rectify deficiencies, if any, in the implementation of the programme.

## **A Reconnaissance Survey on Disposal of Debris**

In order to ascertain the nature of the use and disposal of debris, the GSDMA undertook a study that covered 79 villages across 12 *talukas* of Rajkot, Surendranagar and Jamnagar districts. The methodology involved discussions with villagers and field-level officials, and reconnaissance surveys. It was found that materials such as wood and iron rods were reused, whereas other types of debris such as broken bricks and stones were used for widening of roads, erecting or augmenting field boundaries to check soil erosion and filling of low-lying areas. Water bodies like water ponds and tanks were not affected by the disposal of debris. Pieces of wood were used as fuel in some cases. The general finding is that the debris disposal practices in the villages did not have adverse effects on the environment.



## **Benefit Monitoring**

A process of benefit monitoring was introduced. An international consultancy firm, KPMG, was assigned the task to evaluate how and to what extent the intended benefits of the project components have accrued to the target groups. It is an attempt to go beyond the routine review of progress in terms of numbers and to look at quantitative aspects and ascertain if the earthquake-affected persons have actually received the benefits. Some aspects of the benefit monitoring study and some of its preliminary results are indicated below.

### Objectives:

- Develop a benefit monitoring framework to record changes and developments taking place as a result of GERP interventions;
- Develop a benefit monitoring system that will enable a two-way communication for each project entity for effective knowledge sharing and mutual learning;
- Monitor and verify the derived benefits from the project interventions on an ongoing basis over a period of two years; and
- Provide feedback on the project design, implementation and derived benefits to enable all stakeholders to review projects and affect mid-course corrections where possible.

### Scope:

- To cover all the 16 sectors under GERP.
- During implementation and after completion of project period.

### Methodology:

#### *Quantitative Surveys:*

- First Survey: covering 8,000 beneficiaries (June-July 2003).
- Second Survey: covering 4,000 beneficiaries (March-April 2004).
- Third Survey: covering 8,000 beneficiaries (November-December 2004).

*Qualitative studies:*

- On focus areas which cannot be covered through a quantitative approach.
- On some issues that would be identified from the quantitative surveys.

Key Findings of the First Sample Survey:

- Social and Community Infrastructure
  - Social and community infrastructure in most cases, has not only been restored to pre-earthquake levels but in some places even exceeded those levels.
- Housing
  - Nearly 50 per cent of the beneficiaries say that they received final payments within 18 months of the earthquake.
  - 93 per cent of the beneficiaries have started living in their new houses; high occupancy reflects the confidence of the dwellers in the new houses.
  - There has been an increase of 85 per cent in the number of families below the poverty line living in pucca houses, as compared to a 41 per cent increase for those families above the poverty line. Of the beneficiaries, 90 per cent are now living in a similar or larger house as compared to the pre-earthquake situation.
  - Newly-constructed houses have more amenities than before the earthquake.
  - Overall, there has been 61 per cent increase in beneficiaries living in homes with separate toilets, with each of the sample districts showing a statistically significant increase.
  - The beneficiaries have responded well to GERP's efforts to encourage the usage of local and recycled material.
  - Beneficiaries seem to be unaware that husband and wife jointly own new houses.

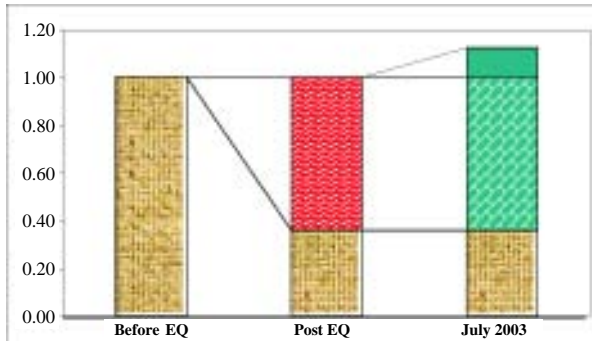
- Disaster Preparedness
  - Beneficiaries' awareness of risk-transfer mechanisms has increased substantially. Not only has insurance awareness increased but there is a significant increase in voluntary insurance.
  - Almost all reconstructed houses have used multi-hazard resistant technology and awareness of disaster management groups is increasing.
  - At least one trained mason is available in three out of four villages.
- Education
  - Not only have the damaged schools been restored but the number of classrooms has increased as well.
  - Nearly nine out of 10 students who dropped out of school because of the earthquake have rejoined.
- Water Supply
  - More people have access to water through pipes/public stand posts.
  - Overall, the proportion of beneficiaries receiving adequate water through a piped source has remained the same.
  - Beneficiaries are willing to pay for water.
- Agriculture
  - About 95 per cent of the beneficiaries have found the assistance given by the government useful.
  - Despite an earthquake and two successive drought years, the income of 86 per cent of the farmers has been restored.
- Cottage and Village Industry
  - Incomes of more than 80 per cent of the respondents have been restored to their pre-earthquake levels.
- Women's Livelihood Restoration Programme
  - The earning capacity of more than 90 per cent of the women surveyed has been restored.

**Benefit quantification:**

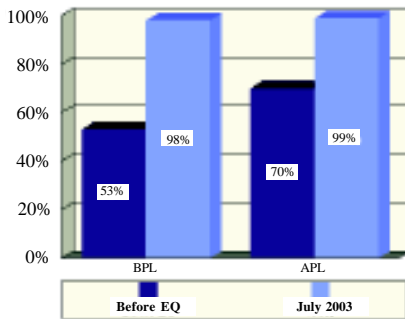
The GERP has not only restored the quality of life index (indicated in Chart 7 below) to the pre-earthquake levels but has also exceeded it.

**Chart 7: Some findings of the benefit monitoring survey**

**Quality of life index**

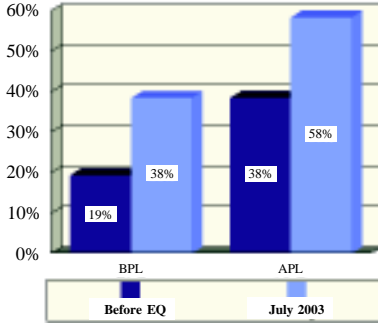


**Housing**



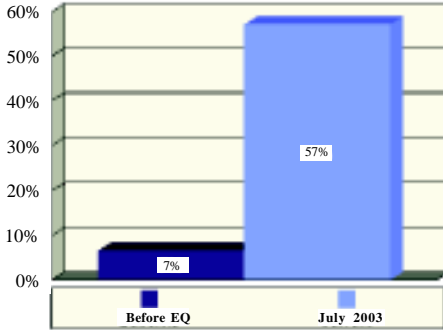
**Pucca houses**

*The Kutch Earthquake 2001*



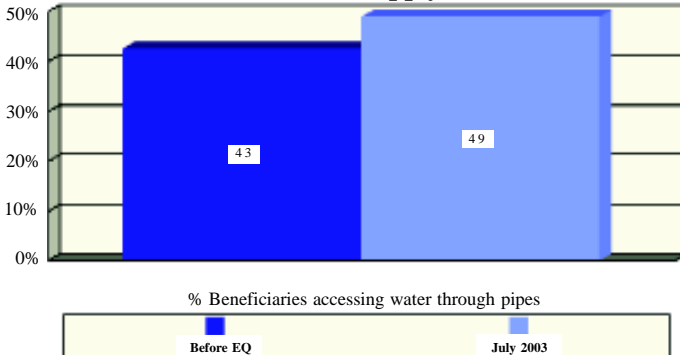
**Separate toilets**

**Disaster Preparedness**



**Awareness of housing insurance**

**Water Supply**



**% Beneficiaries accessing water through pipes**

The first sample survey had covered 8,000 beneficiaries in 188 villages and 12 urban locations. The second sample survey (March-April 2004) covered 4,391 beneficiaries in 65 villages and 14 urban locations. Infrastructure-related changes were assessed in respect of 20 common villages from the first sample survey. It is envisaged that beneficiary-level changes—socio-economic aspects—will be monitored with reference to the second survey and the final survey.

The findings of the second survey were similar to that of the first survey. There was further progress in the restoration of social and community infrastructure. There was greater improvement in the overall 'quality of life index'.

The second survey had more focus, as compared to the first, on urban housing. The percentage of beneficiaries with *pucca* houses has increased significantly. This is so even for those below the poverty line and those belonging to socially vulnerable categories. Newly-constructed houses have more amenities such as toilets and separate kitchens. Most of the houses conform to the approved plans. However, there is inadequate awareness of the house being jointly owned by husband and wife. There is substantial increase in the awareness of housing insurance, especially those, whose houses had to be reconstructed. Almost all the houses are built to earthquake-resistant standards.

The second survey recommends:

- (i) Efforts to improve awareness on joint ownership of the newly-constructed houses and a review of the process of property registration;
- (ii) improving awareness of insurance among those whose houses were of categories G1 to G4 and those in rural areas, bridging the gap between awareness and knowledge to claim insurance and access to insurance for those who want to insure their houses; and
- (iii) more effective communication on the future benefits of the town planning schemes to the beneficiaries in the towns of Bhuj, Bhachau and Anjar.

## IX | An Appraisal

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The Kutch earthquake of 26 January 2001 was one of the worst natural disasters to strike Gujarat. The earthquake was most devastating in terms of its magnitude and intensity. It posed enormous challenges because of its magnitude and geographical spread for rescue, relief and rehabilitation. Indeed, it appeared, at least during the first few hours, to be overwhelming to the government and the society. Yet, they faced the challenge with courage and conviction. Rescue and relief activities were organized within the shortest possible time. What is remarkable is that a comprehensive rehabilitation and reconstruction programme was put in place at the earliest. An adversity was transformed into an opportunity.

### **The Devastation: A Glimpse**

Overall, 7,633 villages in 21 (out of 25) districts of Gujarat were affected to varying degrees. The districts most affected were Kutch, Surendranagar, Jamnagar, Rajkot, Patan and Ahmedabad. About 40 per cent of the state's population was affected. The number of human lives lost was 13,805. About 1,67,000 persons were injured. Over a million houses were damaged or destroyed. About 10,000 small and medium industrial units went out of production, affecting income and employment. Thousands of artisans lost their livelihood. It was a calamity of rare severity.

The impact on infrastructure was devastating. The power system, water supply and telecommunication were severely disrupted. About 442 villages were flattened, four towns of Kutch were in ruins and a number of high-rise and low-rise buildings collapsed in Ahmedabad and other towns. About 53,000 schoolrooms and 5,000 structures providing health and child/women welfare facilities were damaged or destroyed. The civil

hospital at Bhuj—the most important government hospital in the district—collapsed, resulting in the death of patients, their relatives and medical personnel. The district administration of Kutch was traumatized because many of their employees lost their lives, homes and relatives. Personnel of the armed forces, especially the Air Force, had a similar predicament.

The task of damage assessment was equally complex. Thousands of people were affected. Hundreds of villages and towns were involved. Different types of houses and other premises had to be surveyed.

Gujarat is one of the India's richer states. However, the area affected by the earthquake included a significant proportion of population that is poor. The district of Kutch and the affected areas of Jamnagar, Rajkot, Surendranagar and Patan are resource-poor and arid regions. These areas are vulnerable to several hazards such as earthquake, cyclone and drought. The earthquake was followed by two consecutive years of drought in 1999 and 2000. Indeed, Gujarat suffered five major disasters in four years: cyclones of 1998 and 1999, droughts in 1999 and 2000 and the earthquake of 2001.

The complexity and enormity of the task before the administration during the few days and weeks after the earthquake were unimaginable. It may be easy to comment, with the wisdom of hindsight, that certain things should have been done and that there was delay in certain measures. Much depends on the ground realities. It may not always be feasible when the impact is so severe, widespread and complicated, to have a system which triggers automatic action at all places. The fact, however, remains that there is a need to improve upon the existing arrangements, systems and procedures.

The severity and spread of damage and destruction could overwhelm any system. As mentioned earlier, the area affected was larger than the area of many states and even countries. Many government employees and officials were traumatized because of the death and injury of near and dear ones. The communication system broke down. Even the telephone lines between Gandhinagar, the state capital and Ahmedabad stopped functioning for the first few days. Therefore, it took some time for the state machinery to mobilize all the available resources. Similar situations arose in the past in Kobe, Turkey and many other places.



A few months earlier there had been tremors in Bhavnagar. Consequently, there was some awareness of the implications of earthquake. Some do's and don'ts were available with the Revenue Department and some of the districts including Bhavnagar. Yet, the severity of the disaster was beyond anybody's imagination. Detailed contingency plans particularly focusing on earthquakes were not available, especially in the affected districts.

Narrow streets caused enormous problems for rescue operations because vehicles could not move in the affected areas. No doubt local people, police and armed forces tried their best and rescued many people who had been trapped. But the fact remains that modern rescue equipment and manpower trained specially for earthquake-related rescue were not available. In the absence of a systematic inventory of equipment and resources, it took some time to mobilize them.

The above aspects provide important lessons for the future. Many steps have already been taken based on this experience.

### **Some Important Lessons and Initiatives**

Many lessons were learnt in the context of the earthquake relief and reconstruction efforts. Gujarat has prior experience in handling disasters. Structures and systems, evolved over the years, have facilitated quick response and effective recovery. Similarly, at the national level there are mechanisms to support states at the time of major disasters. However, with the recent experiences, it was realized that there was a need to further improve the existing systems and procedures. Some of the lessons learnt are enumerated below:

- The field-level administration has varied experiences of carrying out search and rescue operations, especially in the event of disasters such as a flood. However, there is a lack of capability for specialized search and rescue as was seen during the Gujarat earthquake. It is necessary to upgrade search and rescue capability immediately. This means procuring modern equipment, identifying full-time and part-time personnel and providing training to search and rescue teams.

- For areas which are prone to earthquakes, the installation of seismic instruments needs to be reviewed. A system of continuous monitoring should be put in place. A similar approach is needed to improve the flood and cyclone forecasts and early warning systems.
- It is necessary to review the disaster management plans already prepared with a view to updating and improving upon the existing documents. There are disaster management plans at district and *taluka* levels. In some cases, there are such plans for even village panchayats. Most of these were earlier meant for flood and monsoon seasons. In recent times there is a focus on cyclones in respect of vulnerable districts. District-level plans need to be reviewed keeping in view the recent experiences.
- It is necessary to prepare plans that will work at the time of an emergency. Disaster management plans for *talukas*, cities and districts should have clarity in terms of a command and control system. It may be useful to have separate parts of an overall plan addressing risk assessment and vulnerability analysis, response systems and inventory of resources.
- There are district level plans prepared in the context of environmental protection laws for chemical and industrial disasters. The subject is handled by the Labour Department in Gujarat. It is necessary to have a fresh look at such plans and ensure their compatibility with district disaster management systems.
- Each district located in areas prone to disasters should maintain an on-line inventory of resources available with the government, public sector and private sector. This will enable easy and quick mobilization of resources. A statewide on-line resource inventory would enable the mobilization of resources from neighbouring districts in the event of a disaster.
- The role of police, paramilitary and armed forces may be defined and clearly outlined in the disaster management plans. Organizations such as the State Reserve Police, the RAF, Central Industrial Security Force, Civil Defence, Gram Rakshak Dal and Home Guards should be integrated with the disaster management system, particularly with response plans.

- In the event of natural disasters, particularly in the Saurashtra and Kutch areas, it becomes necessary to mobilize equipment, tents, and boats etc., within a short time. It is worthwhile to stock such items for crisis situations. One may consider having warehouses at three or four locations such as Rajkot, Ahmedabad and Surat.
- Control rooms need to be upgraded particularly at the district and *taluka* levels. Personnel handling disaster management activities should have continuity and a high level of motivation. They should feel that they are performing important tasks.
- Training is extremely important. It is necessary to arrange training in a systematic way so that most of the employees and other stakeholders are exposed to the latest ideas and technologies in disaster management. At present, the SPIPA organizes training programmes but the participation is not satisfactory. Different government departments, public sector organizations and NGOs should ensure effective participation of their personnel in training programmes. Specialized training facilities for emergency medical management and search and rescue capability should be developed.
- In Gujarat, the subject of disaster management is handled by the Revenue Department at the state level, Collectors/DDOs at the district level and *Mamlatdars/Taluka* Development Officers at the *taluka* level. Other departments such as Roads and Buildings, Health, Agriculture, Water Supply and Urban Development, participate in disaster management activities. However, except for a few officers such as the Commissioner of Relief and Director of Relief, there are no officers dedicated to the subject of disaster management. Further, there is no special focus on disaster management. It is necessary to clearly define the arrangements for disaster mitigation and management in different departments. It may not be feasible to have personnel exclusively for this purpose; officers dealing with other subjects may be identified and given orientation for the purpose.
- Utilizing the services of retired personnel of armed forces and even retired police personnel in disaster management efforts may be considered. For this purpose, there should be a systematic approach of having a database, providing orientation from time to time and

deploying them quickly at the time of disaster.

- Youth organizations such as the National Service Scheme, National Cadet Corps and the Nehru Yuvak Kendra can play useful roles at the time of a disaster. They have valuable human resources and skill.
- Special focus should be on fire services with various agencies such as municipal corporations, the GEB and the private sector. The Government of India has suggested to the state governments that fire services need to be trained and equipped to function as all-hazard response units as in many other countries. This will necessitate some additional equipment and training to the fire units for carrying out search and rescue at the time of disasters. The Government of India has initiated measures to prepare a separate project for this purpose.
- Media management is extremely important. Developed countries have systematic arrangements for this purpose. This aspect should be considered while designing an operations centre and preparing disaster management plans.
- In Gujarat, effective steps have been taken to include seismic engineering in the syllabus of graduate courses and also that of polytechnics. For this purpose, training programmes for teachers of engineering colleges have been prepared and organized. It is, however, necessary to continue this on a more sustainable basis. Very often the institutions concerned and the related departments do not take adequate interest in continuing such activities. It is absolutely essential that they should be given proper and adequate attention.
- It is also necessary to continue the training of engineers and even masons through regular programmes on a sustainable basis. Unless this is done, it will be difficult to ensure the availability of skilled personnel for construction that conforms to disaster-resistant standards.
- Insurance schemes and other measures for disaster mitigation should be expanded and operated more comprehensively.
- In the past, not much attention was given to developing community awareness, capability and preparedness. Efforts will have to be directed to augment community preparedness and capability.

- It has been realized, that at the national and state levels it is essential to have a legal framework for disaster management. Gujarat is the first state in India to have enacted such a legislation. It is necessary to ensure that various provisions of the act are implemented by all the stakeholders.
- Disaster mitigation aspects should be incorporated in development plans and schemes for the areas vulnerable to disasters. In other words, every project should indicate how to address mitigation aspects. Plans or projects especially for mitigation/prevention of disasters may be given priority.
- Funds available under the ongoing schemes may be used for mitigation and preparedness activities. For example, funds under the rural development schemes can be used for construction of cyclone shelters in areas which are prone to cyclones. Similarly, sites and designs of primary school buildings in flood-prone areas may be selected in such a manner that they can serve as shelters at the time of flood. The design requirement for primary school buildings and hospitals and other important buildings in seismic zones IV and V should conform to the relevant building codes.

In the context of The Great Hanshin-Awaji earthquake, a document prepared in 2003 by the Hyogo Prefectural Government enumerates a number of important lessons learnt:

- Many senior functionaries themselves were affected by the earthquake. Consequently, only five out of 21 members could attend the first emergency meeting immediately after the earthquake.
- Due to the breakdown of communication, there was difficulty in comprehending, for quite some time, the extent of damage.
- Due to the lack of communication, it took a longer time to organize administrative officers, fire stations, police stations and medical organizations.
- Many people who were trapped in damaged structures were rescued by their families and neighbours, which highlighted the role of community preparedness.

- It was realized that modern cities are disaster prone and there is a need to make them disaster resistant.
- There is a need to establish a disaster management centre and control rooms.
- It was also found necessary to upgrade the immediate response system.

As mentioned earlier, many initiatives were taken by the Government of Gujarat. The Government of India also took a number of initiatives as follows:

Even prior to the Kutch earthquake, it considered the transfer of the subject of disaster management from the Ministry of Agriculture to the Ministry of Home Affairs. This was debated for quite some time. The Kutch earthquake possibly provided a new sense of urgency. The subject of disaster management was transferred to the Ministry of Home Affairs which was at that time headed by the Deputy Prime Minister of India. The Ministry of Home Affairs took a number of initiatives relating to prevention and mitigation in addition to upgrading of the emergency response system.

A DRM programme was introduced by the Government of India in collaboration with the UNDP. It was envisaged to cover 17 states in India. In each state, vulnerable *talukas* and villages have been identified. The objective is to put in place a comprehensive multi-disaster-based programme of community preparedness and capacity building. It also aims at the preparation of disaster management plans at the district, sub-district and village levels. Some details of this programme in respect of Gujarat were described earlier.

Another initiative by the Government of India focuses on vulnerable cities. A programme known as the Urban Earthquake Vulnerability Reduction Programme was introduced as a part of the DRM programme. The idea is to strengthen the earthquake preparedness of 38 earthquake-prone cities in India with a population of more than 500,000 and located in seismic zones III, IV and V. These 38 cities are located in 20 states. A conference of representatives of those cities was organized in Gujarat in July 2002 for the purpose of launching the programme. The lessons learnt

from the Gujarat experience were discussed in detail and the delegates exchanged ideas.

The Government of India has also taken initiatives for revising the syllabi of engineering colleges in various parts of India, including disaster management in the syllabi of schools, and training of teachers of engineering colleges through the IITs. There have been important initiatives in upgrading the search and rescue capability. A.S. Arya, who functioned as Seismic Adviser to the GSDMA, has recently joined as an adviser to the Ministry of Home Affairs, Government of India. The Government of India has made commendable efforts to replicate in other states some of the measures introduced in Gujarat.

### **A Remarkable Reconstruction Programme and its Performance**

In terms of number and magnitude, the performance in respect of activities such as housing, repair/reconstruction of classrooms, restoration of physical and social infrastructure and livelihood regeneration, is impressive. The progress of rehabilitation work has been remarkable even though the programme has a vast scope and is very comprehensive. It is not limited to the reconstruction of physical assets. There is a focus on enabling the earthquake victims to earn their livelihood. There are important initiatives to enhance capability for disaster management. Considering the complexity of the task, the progress made in three years has perhaps no parallel elsewhere. In fact, the progress has been rapid right from the first year and has continued to be so, as one can see from the achievements during each of the first three years.

The spectacular achievement in respect of reconstruction and repair of houses has been widely acclaimed. Reconstruction efforts, through an owner-driven approach and supplemented by the efforts of NGOs, of about 187,000 houses in three years, has no parallel anywhere. The repair of 925,344 houses was completed quickly. However, the quality of repair could pose both financial and technical problems. Prior to the earthquake there was hardly any awareness about earthquake-resistant construction and retrofitting. There was, and still is, a dearth of skilled human resources. Hence, it is unrealistic to expect that all these buildings would be retrofitted.



**Pramod K. Mishra receiving the Sasakawa Award Certificate of Merit, on behalf of GSDMA, in Bonn, Germany**



What was, however, ensured was that they were repaired and strengthened to the extent feasible.

The Government of Gujarat and the GSDMA initiated right from the beginning, many activities relating to capacity building, information dissemination, community awareness and community preparedness. This alone has distinguished it from similar programmes elsewhere. In most other cases, such activities were initiated at a later stage. Another significant aspect is the induction of reputed institutions and individuals who have expertise and specialized knowledge.

No doubt, the GSDMA had the benefit of drawing upon the experiences of the Maharashtra reconstruction programme and that of the UN experts and multilateral agencies. The fact, however, remains that the GSDMA had the commitment, willingness and ability to quickly internalize ideas derived from others, adapt them to the Gujarat situation and commence a variety of activities with an innovative approach.

There have been effective and decisive steps in institutionalizing disaster management through a legal framework, regulatory reforms, training and a knowledge network. A Disaster Management Policy and a Disaster Management Act were finalized at an early stage. Studies on aspects such as microzonation, hazard and vulnerability analysis, damage and loss assessment methodology, early warning and emergency communication, were initiated. Efforts were made to address issues relating to building codes, development control regulation and hazard resistant construction. Engineers and masons were trained in large numbers. Revision of syllabi and training of teachers of technical institutions were undertaken to ensure the availability of skill and quality on a sustainable basis. A mechanism for screening of competent engineers and masons is envisaged through certification and licensing.

People's participation, community preparedness and partnership with NGOs are important aspects of this unique reconstruction programme. People have been associated right from the beginning and at all stages. There have been concerted, comprehensive and intensive efforts towards community awareness and preparedness.

## **Some International Experiences and Comparisons**

It is worthwhile to have a comparative review of some of the recent earthquake reconstruction programmes in a few countries.

### **Sharing post-earthquake reconstruction experiences<sup>8</sup>**

On 30 September 2003, the GSDMA, in association with the UNCRD organized an international workshop on 'Post Earthquake Reconstruction Experiences' at Gandhidham in the district of Kutch. The idea was to share experiences on post-earthquake reconstruction in different countries. Experts from Algeria, Japan, Taiwan, Turkey, USA and India shared their experiences in the workshop. Multilateral agencies such as the WB and the ADB also participated. It is worthwhile to mention some important aspects brought out during the workshop.

#### *Algeria*

Djillai Benouar, Faculty of Civil Engineering, University of Bab Ezzouar (USTHB), Algeria described the experiences of the Algiers-Boumerdes earthquake (Mw 6.8) of 21 May 2003. This earthquake caused the death of 2,278 persons, injury to 11,450 others and rendered 200,000 people homeless; in addition, 128,000 houses were destroyed or damaged.

Algeria has a damage assessment methodology of five levels from Green 1 (no damage) to Red 5 (total collapse or to be demolished) based on the extent of damage. This is similar to the approach based on G-1 to G-5 categories followed in the case of Latur and Bhuj earthquakes.

In earlier earthquakes, Algeria had faced problems of false claims. A few individuals damaged their houses after the earthquake in order to be eligible to receive compensation; some people from outside came to the campsites and asked for compensation. To prevent such misuse in the context of the 2003 earthquake, the engineers in charge of damage assessment were required to report directly to the provincial authorities instead of the local ones. The managers of camps were under direct control of the Ministry of Interior. Assistance for buildings of the Red 5 category was up to US \$ 12,000, along with a low-interest bank loan and up to US

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<sup>8</sup>The following description of country experiences has derived significantly from Seth (2003) and EERI (1999).



**International workshop on earthquake reconstruction experience at Gandhidham**

\$ 2,200 for the Green 2 category. This was in line of those in the context of the Bhuj earthquake, in view of the cost of building at US \$ 180 per sq. mt in Algeria.

It was stipulated after the earthquake that retrofitting should be carried out as per the new seismic code. However, it was not feasible to implement the new code for buildings that were to be repaired for minor and moderate damages. In case of houses with major damage and those which were reconstructed, efforts were made to enforce the codes through government-appointed contractors with supervision by the Ministry of Housing and Urban Planning.

The rehabilitation programme tried to focus on livelihood, medical rehabilitation and social rehabilitation. Measures were also taken in respect of capacity building such as training of engineers and introduction of seismic engineering in graduate courses and also introducing insurance as a form of mitigation.

### *Turkey*

Polat Gulkan, Director for Disaster Management Implementation and Research Centre, Middle East Technical University, Turkey, described Turkey's experience. Turkey has a high seismic risk. It suffered devastating earthquakes on 17 August 1999, in Kocaeli, and on 12 November 1999, in Bolu with magnitudes respectively of M7.4 and M7.2. Over 17,000 people lost their lives and 600,000 people became homeless.

Initially, 45,000 temporary houses were constructed for the affected people. Those who did not opt for temporary housing were given US \$ 175 for a year so that they could rent houses on their own.

The earthquake brought into focus the usual deficiencies: faulty construction practices, faulty designs, lack of land use plan supervision and so on.

The Government of Turkey introduced, with funding from the WB and other sources, the Marmara Earthquake Emergency Reconstruction project which included components relating to disaster response and mitigation. It incorporated aspects such as an emergency response system, disaster insurance scheme, enforcement of construction codes, and land

use planning. Houses in rural areas were to be constructed by owners based on the approved plans and under the supervision of independent consultants, whereas urban houses were to be constructed under the supervision of municipal engineers.

There was substantial use of the tunnel form system of construction to build high-rise buildings quickly. Such buildings had performed very well in earlier earthquakes. The level of satisfaction of the affected people in respect of the houses built by the government was high. Efforts were made to introduce a system of licensing of engineers and architects, which did not materialize.

The Turkish Catastrophe Insurance Pool was established in order to provide insurance coverage for houses.

### *Taiwan*

Yuh-Chyurn Ding, Deputy Executive Director of the 921 Earthquake Post-Disaster Recovery Commission, discussed the 1999 earthquake, known as the Chi-Chi earthquake (M7.3), that had resulted in the collapse of 38,935 houses and damage to 45,320 houses, in which 2,455 people lost their lives and 11,305 were injured. The earthquake affected both urban and rural areas.

The government enacted the 'Temporary Statute for 921 Earthquake Reconstruction' for providing a legal framework for the reconstruction work. A new organization, the 921 Earthquake Post-Recovery Commission, was set up. A comprehensive reconstruction programme incorporating roads and bridges, public buildings, educational and health infrastructure, industrial reconstruction and environmental protection measures was introduced. Unlike in Turkey, the Government of Taiwan does not undertake reconstruction of new houses for the affected people; it provides some temporary houses and financial assistance towards house rent after an earthquake. In the Chi-Chi earthquake, assistance (called a consolation allowance) was given in 32,604 cases. For reconstruction of houses by the affected persons, the government facilitates the availability of loans from financial institutions. However, for a few special categories such as indigenous tribes and disadvantaged people, some low-cost housing projects were undertaken through government and community efforts.

As of August 2003, about 70 per cent of the collapsed houses had been reconstructed. The reasons for delay were: problems of joint ownership of property, lack of finance to rebuild, inability to get loans, local issues relating to land, inadequacy of technical personnel, etc. Reconstruction of condominium houses involved complex issues and problems.

Taiwan officials feel that their reconstruction programme compares favourably with that of the Kobe earthquake.

### *Japan*

Masahiko Murata, Project Manager of the Disaster Reduction and Human Renovation Institute, Kobe, narrated the experience of the Kobe earthquake of 17 January 1995. The earthquake caused the death of 6,401 people and enormous damage and destruction to houses and infrastructure. About 248,000 houses were completely or partially destroyed. The immediate aftermath of the earthquake was chaotic and it took three days for the country to fully grasp the enormity of the devastation.

About 48,300 temporary houses were constructed immediately after the earthquake. Gas and water supply was restored in three months. However, it took five years after the earthquake to reconstruct permanent houses for all the affected families.

Disaster management cells and information collection centres at national and local levels were established to ensure better post-disaster management in the future. The earthquake brought into focus the need for a well-planned and coordinated system, comprising local authorities and national agencies in view of the fact that such disasters are often too difficult for local governments to cope with independently. It also highlighted the important role of local communities and volunteers, who were the main providers of relief in the initial days and prior to the arrival of rescue teams from outside. Training of such communities is very crucial to a system of disaster management. The earthquake also revealed the vulnerability of senior citizens.

The Government of Japan introduced the 'Seismic Building Retrofitting Act' to encourage the retrofitting of existing vulnerable buildings with the

provision of two-thirds of the diagnosis cost and up to 15 per cent of the retrofitting cost to be borne by the local government. However, this programme was not very popular as a major part of the cost of retrofitting was to be borne by the owners.

The Disaster Reduction and Human Renovation Museum, Kobe, was built as a memorial of the great earthquake and displays very interesting materials relating to it.

### *California, USA*

Marjorie Greene, from the Earthquake Engineering Research Institute, California, discussed the approach to reconstruction in the USA, particularly in California. Earthquakes are frequent in this state.

In the USA, the emphasis is more on earthquake mitigation and less on post-earthquake reconstruction. Unlike in India, Turkey and Algeria, the US government does not provide financial assistance for reconstruction though some assistance for rent and mortgage is given. Government assistance is targeted more at replacing government services and facilities. Homeowners are expected to buy insurance for their homes. However, over the years, it has been observed that people are unwilling to opt for such insurance because of the perception that buying an earthquake insurance policy does not seem to be worth the cost; thus only one in eight insured homes is covered by such insurance.

Most disaster management programmes are operated under the guidelines issued by the Federal Emergency Management Agency (FEMA). The general policy of FEMA is to assist in the immediate aftermath, rather than in rebuilding. There is also an emphasis on disaster mitigation.

The recent policy of post-earthquake management and reconstruction has not been put to a major test, as the recent earthquakes in California have not resulted in a significant number of people being homeless. It is yet to be seen if this policy would be adequate in the event of a major earthquake causing widespread damage and destruction.

Large programmes of retrofitting are undertaken for public buildings, monuments and infrastructure facilities such as bridges, lifeline structures, hospitals and court buildings.

## India

S.S. Momin, Secretary, Department of Roads and Buildings, Government of Maharashtra, discussed the Latur rehabilitation and reconstruction experience. Incidentally, the workshop coincided with the tenth anniversary of the Latur earthquake.

The Latur earthquake of 30 September 1993, caused the death of 7,601 persons; about 16,000 persons were injured and over a million became homeless. Sixty-seven villages were completely destroyed and there was extensive damage in another 1,300 villages in Latur and Osmanabad districts. There were 11 other districts in Maharashtra that suffered considerable damage to private and public property. The Government of Maharashtra, with the assistance of the WB, introduced the Maharashtra Emergency Earthquake Rehabilitation Project. It involved the relocation of 52 completely devastated villages and complete reconstruction of another 22 severely damaged villages. In addition, there was *in-situ* reconstruction and repair/strengthening of dwellings in over 2,400 affected villages. The project components included housing, infrastructure, economic rehabilitation, social rehabilitation, training and development of disaster management plans.

A study (EERI, 1999) by the Earthquake Engineering Research Institute, California draws, *inter alia*, the following lessons from the Latur experience:

- There were issues relating to damage assessment. In spite of three rounds of damage assessment, there was dissatisfaction among the affected people. One reason was that a large number of technical and other staff had to be deployed. It was not feasible to provide uniform damage assessment forms, training and orientation. Similar problems, though to a lesser extent, arose in the context of the Bhuj earthquake.
- A number of villages were relocated. The Government of Maharashtra took responsibility to undertake the construction work and accomplish it within a very limited time frame; it was felt that it would be easier for the government to manage the construction process with a small number of contractors than by a large number of individual homeowners. Some NGOs also participated in this work. Experience, however,



showed that the affected people did not feel involved in rebuilding their homes, particularly in the relocation villages because the government initiated and managed the programme. In villages with *in-situ* reconstruction that was a part of the repair and strengthening programme, the work was owner driven and beneficiaries played a more active role.

- At the relocation villages, there was some problem of drinking water. There were also issues relating to quality of construction and suitability of design to people's life and practices. Inadequate participation resulted in inadequate transfer of earthquake resistant construction technology to the villages.

There are similarities in the reconstruction programmes in the context of the Latur and Kutch earthquakes. In fact, the Kutch reconstruction programme derived considerably from the experience of the Latur programme and expanded and intensified efforts in respect of capacity building and long-term disaster management aspects.

To summarize, the above experiences bring out interesting aspects. In developed countries, there is limited assistance from the government to individuals for rebuilding their houses and other assets; more responsibility devolves on the people themselves. In countries such as Japan, Taiwan and the USA, there is greater reliance on individual efforts and resource commitment for reconstruction. Government resources are directed at restoring and rebuilding public services and infrastructure. In developing countries such as Algeria, Turkey and India, the state plays a more comprehensive role and allocates more resources for rehabilitation of the affected people.

Developed countries focus more on mitigation and long-term aspects such as retrofitting of public buildings, essential facilities and capacity building. In developing countries, more resources are deployed in the relief and rehabilitation phase and much less on mitigation.

In most countries, there is tremendous emphasis on capacity building, disaster management plans, etc., immediately after a disaster. However, such focus and interest diminish as time passes.

### Some international comparisons

Tables 36 and 37 indicate important features of some recent earthquakes.<sup>9</sup>

**Table 36: Magnitude, death toll and economic loss in the context of some recent earthquakes in different countries**

Earthquake	Date	Magnitude	Death toll	Economic loss (US \$)
Kutch, Gujarat, India	26 January 2001	7.7 Mw	13,805	6 billion
Chi-Chi, Taiwan	21 September 1999	7.3 Mw	2,455	12 billion
Marmara, Turkey	17 August 1999	7.4 Mw	17,000	6 billion
El Quindio, Colombia	25 January 1999	6.2 M	1,185	1.6 billion
Hanshin-Awaji, Kobe, Japan	17 January 1995	7.3 Mw	6,401	84.4 billion
Latur, Maharashtra, India.	30 September 1993	6.3 Mw	7,601	300 million
Mexico City, Mexico	19 September 1985	8.1 M	4,000	4 to 5 billion (for housing)

**Table 37: Reconstruction strategy in the context of recent earthquakes in some countries**

Earthquake	No. of houses/household units collapsed/damaged and to be reconstructed/ repaired	Approach to reconstruction of houses	Organization
Kutch, Gujarat, India	1,143,624	Owner driven and <i>in-situ</i> ; minimum relocation; NGOs in some cases	GSDMA
Chi-chi, Taiwan	74,255	Temporary houses and for some special categories permanent houses (through government and private contractors)	921Earthquake Post-Disaster Recovery Commission
Marmara, Turkey	43,850	<i>In-situ</i> and relocation (through private sector contractors)	Project Implementation Unit (Prime Minister's Off.)

Contd

<sup>9</sup>Some of the details are from a paper entitled 'Reconstruction Programmes: International Case Studies' by Krishna S. Vatsa, a Ph.D candidate at the George Washington University, USA.

Contd

Hanshin-Awaji, Kobe, Japan.	448,929	Large-scale temporary housing through contractors.	Kobe City and local government
El Quindio, Colombia	80,000	Relocation and <i>in-situ</i> repairs (NGOs and private sector contractors)	Fondo Resdesl Eje Cafetero
Latur, Maharashtra, India	220,000	Relocation and <i>in-situ</i> repair (contractors for relocation and owner-driven for <i>in-situ</i> repair)	Project Management Unit
Mexico City, Mexico	72,000	<i>In-situ</i> reconstruction through 260 local engineering firms	Low-income housing reconstruction Programme

The earthquakes of Marmara, Mexico City, Colombia and Kobe affected mostly urban areas. The Chi-Chi earthquake affected both urban and rural areas. The Latur earthquake affected rural areas. The Kutch earthquake affected both urban and rural areas.

The death toll depends on the nature of settlement—urban or rural—and the time of the earthquake. The number of people who died because of the Kutch earthquake could have been much higher had it occurred at night or early in the morning, for example, at the time when the Hanshin-Awaji earthquake occurred.

In case of the Kutch earthquake, the number of houses being reconstructed and repaired is large because the impact was widespread. One may argue that the houses in rural areas are smaller and easy to construct compared to urban areas. However, because of the geographical spread there can be complex problems of implementation. As already explained in detail earlier, the strategy of reconstruction of houses has been an owner-driven approach, supplemented by NGOs for about 20 per cent of the houses reconstructed. The Kutch earthquake reconstruction programme is possibly the first such programme in a developing country, to follow an owner-driven approach to reconstruction, which has been very successfully implemented both in terms of number and quality.

The following comparison is significant:

- 48,300 houses in Kobe, Japan, took six years.
- 72,000 houses in Mexico took five years.
- 43,000 houses in Turkey took four years.
- 80,000 houses in Colombia took three years.
- 38,935 houses in Taiwan took more than four years.
- Repair and reconstruction of 180,000 and 37,000 houses respectively in Latur, Maharashtra took six years.
- In Gujarat 143,000 houses were reconstructed and 892,000 houses repaired in two years.

There has been WB funding in a number of earthquake reconstruction programmes in recent times. In most cases, it took about a year for the borrower to prepare the project, negotiate and get the loan sanctioned. Only in the cases of Turkey and Gujarat was it possible to finalize the WB loan (as well as the ADB loan for Gujarat) in less than three months. In most cases, the reconstruction programme has taken four to five years, or even longer.

For most of the reconstruction programmes, a new organizational structure was set up to implement the project. This was with a view to having a special focus on the programme and providing autonomy and flexibility to the organization.

In most other programmes, reconstruction has mostly been through private sector contractors, and in some cases through the public sector, though repair has been owner-driven in many cases. Even in cases where NGOs have undertaken reconstruction of houses, they have engaged private contractors. In the case of Latur, where reconstruction mostly involved relocation, it was done through contractors even though repair and strengthening work was done by the owners themselves. A distinguishing feature of the Kutch earthquake reconstruction programme is that it is mostly owner-driven with some participation of NGOs. This is a milestone in the context of large-scale reconstruction and rehabilitation programmes in the world. Another aspect of the programme is that there was negligible relocation. Furthermore, there were extensive consultations with the people and the approach was participatory at all stages of the programme.

## **Role of the GSDMA**

The GSDMA was created in the immediate aftermath of the earthquake. Right from the beginning it focused not only on the rehabilitation and reconstruction work but also on medium-term and long-term measures for disaster mitigation and preparedness. The creation of the GSDMA was the beginning of a new era. A new institutional structure emerged. Measures were initiated to create a disaster management framework for the state by devising appropriate policies, programmes, methodologies and legislation. The GSDMA has successfully undertaken multifarious activities in the following broad areas:

- Earthquake reconstruction work
- Formulation of policies and legislation
- Preparation of disaster management plans
- Preparedness initiatives
- Capacity building
- Mitigation measures, and
- Awareness and community preparedness.

As the nodal agency, the GSDMA strives to establish links with the Government of India, state government departments, local authorities, NGOs, research agencies, public and private sectors, and other stakeholders. This is in order to share knowledge, establish coordination mechanism and to create capacity. Strategy planning is done by the GSDMA and implemented in collaboration with other departments and agencies. With the Gujarat State Disaster Management Act, 2003, coming into force, the GSDMA has statutory status. Its functions have been enumerated in the Act.

In the context of the earthquake, an elaborate administrative structure was put in place. It may, however, be noted that the GSDMA is at the core of the new organizational structure. It functions with a lean core staff consisting of seven senior officers, 10 middle-level officers, five MBAs and some support staff. It functions with tremendous dedication, commitment and professionalism.

The issue of transferring the activities of the Revenue Department in the context of disaster management to the GSDMA was extensively discussed. In order not to create a parallel organization and with a view to ensuring effectiveness, it was decided that the Revenue Department should continue to remain in-charge of emergency response and relief as one of the line departments. The GSDMA would function as the coordinating and monitoring organization. In fact, all the district collectors are designated as *ex-officio* Joint Chief Executive Officers of the GSDMA. This is with a view to ensuring organizational inter-linkages essential for the complex disaster response system to function. In fact, for the first three years, the Commissioner of Relief in the Revenue Department also functioned as an Additional CEO of the GSDMA.

The GSDMA continues to remain a lean and efficient organization and to have an officer-oriented approach. It was able to resist pressures to create a larger organization. The personnel were carefully selected and have a high level of commitment and dedication. It has a flexible and task-oriented system. To accomplish the reconstruction work, it successfully utilized the existing departments, organization and personnel. The Government of Gujarat gave the GSDMA the flexibility to operate in a professional way. At the same time, there were linkages with the state government.

Since the Chief Minister of Gujarat is the chairman of the governing body, which consists of a few senior ministers and senior officers, this ensured commitment of the state government at the highest level.

A question is often asked as to how the GSDMA could achieve so much in such a short time. Three factors—political commitment, structural and operational flexibility, and extremely committed and dedicated personnel—possibly contributed to this spectacular success. Though there were many changes of officers at *taluka*, district and regional levels—and of a few officers at the GSDMA—five or six senior officers of the GSDMA had continuity of tenure. Interestingly, most of them including the Chief Executive Officer had additional duties or assignments in addition to that at the GSDMA. This can be looked at in two ways. One can argue that such an arrangement leads to inadequate focus on the programme, less attention and problems of sustainability. In fact, some multilateral

organizations questioned this arrangement. Some even questioned why it could not have one full-time officer instead of two part-time officers. On the other hand, it can be argued that because of such flexibility it was possible to deploy competent and dedicated officers for a relatively long duration, simultaneously making use of their valuable services in other key assignments. Another aspect, though not consistent with conventional wisdom, is important. Senior officers of the GSDMA holding other key positions in the government could operate more effectively and achieve the tasks relating to the GSDMA through better coordination—both personal and functional—because of organizational inter-linkages. This phenomenon emerges from our administrative culture and ethos, which probably can be an interesting subject of study in organizational behaviour.

### **Relevance of the GSDMA to other states**

As mentioned earlier, the GSDMA received national and international acclaim for its outstanding work. In many seminars and workshops, experts recommend the GSDMA model to different states of India and even to other countries. Indeed, the Government of India has advised states to set up organizations like the GSDMA for disaster management.

The organizational structure of the GSDMA evolved almost organically since its inception. In a sense, the process of evolution was a response to various requirements and demand from different stakeholders and was conditioned by the emergent situation at that time.

An international consultant carried out a study to suggest an organizational structure and to prepare a business implementation plan. In order to design an organizational structure, it kept in view some evaluation criteria: mitigation focus, continuity and permanence, involvement and participation, autonomy and independence, single-point accountability, flexibility and adaptability and multi-disciplinary approach and implementability.

Prior to suggesting an organizational structure for the GSDMA, the consultant considered the following organizational models:

*Model 1: A Think-tank*

In this model, the disaster management authority (DMA) is basically a committee or a think-tank that helps in the formulation of a comprehensive disaster management plan. It reviews existing procedures and recommends guidelines, policies and laws. However, it does not get involved in any work of implementation and even of supervision. The prevailing system of disaster management at the centre was similar to this model. There were committees such as the NCMC and the High Power Committee.

*Model 2: Disaster Management Department*

A nodal authority is set up for the purpose of disaster management within the state administration, either through an existing or a new department. The department takes responsibility of mitigation, relief and reconstruction. The department reviews existing procedures, formulates new policies, recommends guidelines and is also responsible for programme management and monitoring. An example is the arrangement in Maharashtra. There are similar systems in countries such as South Africa and Bangladesh.

*Model 3: Disaster Management Task Force*

It envisages the creation of a nodal organization that is independent and autonomous in its operations. Even though it has the support of the government, it is independent in its day-to-day functioning. The model can be illustrated by organizations such as the National Human Rights Commission, the Election Commission of India and the Central Bureau of Investigation.

*Model 4: Disaster Management Agency*

This is an autonomous and independent nodal agency that is fully accountable and has significant responsibility for disaster management. The difference from the earlier model is in the extent of its involvement in all phases of disaster management. It is also autonomous. There is a large



permanent staff associated with mitigation, emergency response and reconstruction activities. It has field-level units. An example is the FEMA in the USA.

The consultant examined the strengths and weaknesses of various models. A hybrid model was recommended that incorporates certain features of some or all of the above models. In particular, a model largely built on model 3, but incorporating key features of models 2 and 4 was recommended.

The basic approach is stated as follows:

While there is a need for an independent and autonomous organization, resource capabilities and manpower already exist within the State and local Administration to deal with the implementation of many aspects of disaster management. The need is for a nodal organization that provides the necessary guidance and direction. Therefore, the organization model depicted above takes care to ensure that a parallel structure is not created for disaster management. However, in respect of disaster management, this entity is clearly a single point of accountability for all stakeholders.

The consultant suggests that in view of the need for flexibility and adaptability, the involvement and participation of the nodal agency in disaster management may be limited to mitigation with other components being outsourced to implementing agencies within and outside the administrative framework of the state.

The above aspects are relevant to most states and countries. Yet, the specific structure will have to be designed keeping in view the hazard profile, availability of resources and prevailing organizational structure. In fact, the organizational structure of the GSDMA itself, appropriate for the post-reconstruction scenario, needs to be addressed at the earliest. This is necessary for both long-term aspects of disaster management and sustainability of the organization.

## **Consolidation and Sustainability of Initiatives**

Numerous initiatives have been taken by the Government of Gujarat and the Government of India. NGOs have also taken many initiatives. Some of them are in the process of implementation and need to be completed and consolidated. There is a sense of urgency because the memories of the earthquake and the devastation still linger. When the memories fade, will the interest and enthusiasm remain? Do we have systems and procedures in place that ensure continuity of the new initiatives. For example, thousands of masons and even engineers have been trained in earthquake-resistant construction. What about those who have not been trained? Those who have been trained during the aftermath may need more intensive training. Training of teachers of engineering colleges still remains a challenge. It is necessary to ensure that the GSDMA continues to receive the same attention and high quality of human resources that are available to it at present.

In the aftermath of the earthquake there has been awareness generated about earthquake-resistant construction. But we have to go a long way for enforcing building codes. There has been some improvement in the construction practices. Engineers and builders today are more conscious and careful. Municipal by-laws have been modified. Yet, it is felt that an effective system is yet to be in place. There is still dearth of qualified technical personnel. It is necessary to undertake programmes of capacity building of municipal engineers. Though it is essential to focus on municipal corporations, it is also necessary to address the problems relating to municipalities and other urban areas.

There is also a need of exploring the potential of financial mitigation—mitigation measures in the form of financial instruments such as insurance and contingency credit.

## X | Concluding Remarks

The Kutch Earthquake of 26 January 2001 was a devastating event and posed a massive challenge to the people, the community and the government due to its magnitude, spread and complexity. Thousands of villages were devastated. Cities were in ruins. Millions of people were affected: 13,805 persons lost their lives, 167,000 persons were injured and over a million homes were damaged or destroyed. There was enormous damage to economic and social infrastructure. Even those holding key positions in the local administration were affected and traumatized. Needless to say, the initial moments, hours and even days were full of uncertainty, shock and confusion.

Yet, the people, the government and the society rose to the occasion. The state government launched massive rescue and relief operations with the help of armed forces, NGOs, the central government, other state governments and the international community. There was unprecedented mobilization of human and material resources. Essential services such as communication, electricity, water supply and transport, were restored quickly. Millions of affected people were provided with relief materials, medical services and temporary shelters.

Efforts were made to ensure that the transition from the relief phase to recovery was smooth and short. Even when the relief activities were being undertaken, the need for sustainable recovery was addressed. In a few months time, the government conceptualized and formulated schemes for reconstruction and rehabilitation. A comprehensive reconstruction programme was introduced with a view to restructuring the physical infrastructure and rebuilding the economic and social fabric.

Many departments and other agencies had to be associated with this gigantic task. The GSDMA helped to formulate and monitor the implementation of a comprehensive and complex reconstruction programme. It accomplished this task with remarkable success. The salient aspects of the reconstruction efforts are :

- A comprehensive reconstruction and rehabilitation programme
- Medium and long-term perspectives
- Excellent public-private partnership
- Awareness, capacity building and information dissemination
- Involvement of expertise and specialized knowledge of institutions and individuals
- Effective community participation
- Progress during each of the first three years has no parallel elsewhere.

It is worthwhile to briefly recapitulate some innovative aspects of the GERP.

As already discussed earlier in detail, the approach to reconstruction of houses was unique and probably one of the best efforts of the programme. There was hardly any relocation; in spite of initial dilemma and suggestions from some quarters, large-scale relocation was avoided. The entire process was owner driven. Even though thousands of houses were to be reconstructed within a short time, a temptation to undertake the massive construction work through state agencies and contractors was avoided. This does not mean that the state government did not play any role; it provided financial assistance, facilitated availability of building materials and most importantly arranged for technical assistance so as to ensure hazard-resistant construction. People themselves were fully involved in the design and construction of their own houses.

NGOs were associated right from the beginning. In order to facilitate public-private partnership, a framework was conceptualized and a formal procedure was prescribed at a very early stage of the reconstruction

programme. Consequently, there was an extremely smooth, healthy and effective exchange and cooperation among a large number of public agencies and NGOs. Even the private sector and industries were involved in this endeavour.

Reconstruction of the four towns of Kutch district: Anjar, Bhachau, Bhuj and Rapar was another example of a systematic approach with a vision, administrative acumen and political courage. There was tremendous pressure from the media and other quarters, on the government, to take up reconstruction of the towns immediately. There was also severe criticism of delay in reconstruction of towns as compared to villages. Yet, a scientific approach was adopted. A number of technical studies were undertaken. Area development authorities were created. Professional agencies were engaged for the purpose of preparing development plans and town-planning schemes. A variety of data was collected. Thousands of plots were surveyed. Detailed infrastructure plans were prepared. Measures were taken to widen roads in the old cities of Bhuj and Anjar. Elaborate public consultations were organized. All these efforts were appreciated only at a later stage.

The Kutch Earthquake Reconstruction Programme had the benefit of the experiences of those who worked earlier in the context of the Latur and other recent earthquakes. International organizations and other agencies also brought with them the experience and learning from across the world. The fact, however, remains that even when the task of reconstruction appeared massive and challenging, the state administration did not hesitate to keep in view medium-term and long-term aspects, particularly mitigation measures that are more difficult to undertake during an emergency situation. The newly created GSDMA with a small band of dedicated functionaries, undertook innovative measures and a range of activities relating to information dissemination, building codes, insurance, capacity building, policy and legal framework and community awareness. A significant aspect was the involvement of reputed institutions and individuals with expertise and specialized knowledge.

There are deficiencies and limitations that arise due to the enormity of the devastation and vastness of the affected area. In retrospect, one can point to areas where there was scope for improvement. For example, it is

pointed out that there was lack of clarity in respect of transit or interim shelter for some time. It took considerable time to provide interim shelters. However, with varied situations and perceptions of the affected people, it was difficult to have a uniform approach towards it. As indicated earlier, people were given a choice of alternatives such as building materials and cash assistance. Maybe the government should have a policy or at least a scheme of interim shelter for major disasters.

Another aspect relates to grievance redressal. For the first time, officers of the judiciary were associated with a reconstruction programme and it was an innovative approach to grievance redressal. Some people feel that more could have been done in this respect. There are also suggestions relating to damage and loss assessment, capacity building of engineers supervising reconstruction in rural areas, better management of information etc., however, no system is perfect. There is always a scope to improve upon the existing systems and procedures. It would be worthwhile to address these and other aspects as a part of preparedness for disasters.

Overall, the Gujarat earthquake reconstruction efforts have been widely acclaimed by international experts and multilateral agencies. When compared with similar programmes elsewhere in the country and abroad, the performance of Gujarat has been considered spectacular. Not surprisingly, the recognition has come in the form of international awards.

There is a need to build new institutions, as in the case of the Kobe and Chi-Chi earthquakes, and to preserve the experiences and lessons learnt for future generations. It will be a great loss to the country and to mankind if these unique experiences and insights are not available in the future.

In the past there have been major disasters in India and in other countries. Every earthquake or a similar disaster leads to a flurry of activities that lose momentum and focus as time passes. The Kutch earthquake resulted in one of the most comprehensive endeavours in history, with numerous initiatives. It is necessary to ensure that all such initiatives and innovative measures are further strengthened and consolidated so that they become sustainable.

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# Index

- Abhiyan, 163–64  
adaptability, 216, 218  
Adhoi, Bhuj: police role in relief and rescue, 29  
administration response, 4, 22, 33, 194  
administrative machinery, disrupted by earthquake, 12  
Advani, L.K., 43  
Affat Sajjata Sena (Disaster Preparedness Brigade), 181  
aftermath of devastation, 4, 149  
aftershocks, 59  
agriculture and livestock, effected, 87, 89  
    assistance, 116  
    beneficiaries of relief, 188  
Ahmedabad, Gujarat, 196  
    communication system, disrupted, 5  
    devastation, 17, 20–1, 29, 34, 51, 70–1, 192  
    fire brigade, 176  
    magnitude, 59  
    Municipal Corporation (AMC), 22, 24, 71, 178  
    municipal infrastructure damaged, 79  
    Regional Emergency Response Centres, 176  
    relief and rescue operations, 22–26, 33, 43  
    Urban Development Authority (AUDA), 22, 24  
Alagh, Y.K., 122  
Alang, 22  
Algeria, Algiers-Boumerdes earthquake 2003, 203, 205  
    reconstruction, 210  
All India Institute of Medical Sciences (AIIMS), New Delhi, 15, 31  
ambulance phone system, 68  
Anand  
    effect of earthquake, 17  
    relief material to effected areas, 4  
*anganwadis*, 109, 134  
Anjar, Bhuj, 100  
    damage to industrial units, 89  
    devastation, 27, 58, 82  
    grievance redressal, 123  
    housing for victims, 95, 99, 128  
    interim accommodation to victims, 94  
    municipal infrastructure damaged, 79  
    power infrastructure damaged, 83  
    reconstruction, 191  
    relief and rescue operations, 33, 38  
    urban reconstruction, 159, 163  
Archeological Survey of India (ASI), 81  
archives and monuments, reconstruction, 143  
Area Development Authorities (ADAs), 156, 164  
army role in relief and rescue, 29, 100  
artisans, schemes for, 115  
Arvind Joshi, 103  
Arya, A.S., 24, 70, 109, 164, 169, 173, 200  
Asian Development Bank (ADB), 69, 82, 92, 105, 108, 112, 122, 203, 213  
Asianet Communication, 174  
asset building, 113  
asset losses and reconstruction cost, assessment, 92–93  
autonomy, 213, 216  
awareness generation, 153, 172, 181, 182, 194, 214  
  
Banaskantha, Gujarat  
    earthquake, 17  
    education effected, 76  
    power infrastructure damaged, 82  
    water supply system effected, 78  
Bangladesh, 217  
Baroda, Regional Emergency Response Centres, 176  
base isolation technology, 134  
benefit monitoring process, 186–88  
benefit monitoring survey, 189  
benefit quantification, 189–91  
benevolence, 2  
Bhachau, Bhuj, Kutch  
    devastation, 4, 27, 59  
    grievance redressal mechanism, 123  
    housing for victims, 94, 95, 99, 128  
    municipal infrastructure damaged, 79  
    reconstruction, 150, 163, 191  
    telecommunication systems, 87  
Bhanujan, K.V., 95  
Bhatt, Ashok, 15, 17  
Bhatt, Himanshu, 11  
Bhavai, 182  
Bhavnagar  
    damage to industrial units, 89

- devastation, 17  
 reconstruction, 194
- Bhuj, Kutch, Gujarat**  
 devastation, 5, 6, 8–9, 13–14, 17,  
 26–27, 203, 205, 209  
 engineer's training, 168  
 grievance redressal mechanism, 123  
 housing for victims, 95, 99  
 interim accommodation to victims, 94  
 damage to industrial units, 89  
 medical aid to victims, 27  
 municipal infrastructure damaged, 79  
 power infrastructure damaged, 83  
 reconstruction, 143, 191  
 Regional Emergency Response  
 Centres, 176  
 relief and rescue operations, 33, 38,  
 40–51  
 telecommunication systems, 87  
 transport infrastructure damaged, 87  
 urban reconstruction, 154–56
- Bochasanwasi Akshar Purushottam Sanstha  
 (BAPS), 49**
- Bombay Municipal Corporation, 100**
- Border Security Force (BSF), 35, 45**
- building codes, 202, 219, 222
- Calamity Relief Fund (CRF), 104**  
**California, USA**  
 earthquake, 208  
 Earthquake Engineering Research In-  
 stitute (EERI), 209  
 Federal Emergency Management  
 Agency (FEMA), 208
- capacity-building initiatives, 3, 114, 147,  
 149, 163, 169, 199, 202, 205, 210, 214,  
 222
- Care, 51**
- Caritas India, 49**
- Central Building Research Institute (CBRI),  
 151**
- Central Bureau of Investigation (CBI), 217**
- Central Implementation Review Group  
 (CIRG), 122**
- Central Industrial Security Force (CISF), 195**
- Central Reserve Police Force (CRPF), 22,  
 35, 45**
- Centre for Environmental Planning and  
 Technology (CEPT), 24, 70–1**
- Chandana, M.L., 13**
- Chaubari, Bhuj: the epicentre of earthquake,  
 59; magnitude of earthquake, 59**
- Colombia, 212, 213**
- Coming Together, 164*
- commitment, 214–15
- Common Wealth Association for Public  
 Administration and Management  
 (CAPAM), 2**
- communication system, disrupted, 186, 191,  
 193, 198, 220
- See also telecommunication*
- community awareness, 222  
 community kitchen, 10  
 community participation mechanism, 3, 73,  
 109, 124, 148, 214, 221
- community preparedness, 147, 180–1, 198,  
 199, 202
- Confederation of Indian Industry (CII), 51,  
 150**
- confidence building, 181
- consolidation and sustainability of initia-  
 tives, 219
- contingency credit, 219
- contingency plans, 194
- continuity and permanence, 216, 219
- Contribution (Regulation) Act, 1976, 117**
- control room improvement, 175, 196
- cooperation, 222
- coordination and monitoring, 67, 118, 121,  
 163, 172
- CORDAID, 176**
- corruption, 73
- cost effectiveness, 166
- cost sharing mechanism, 152
- cottage and village industry  
   beneficiaries of relief, 188  
   schemes for, 114, 115
- criminal cases against builders, contractors  
 and engineers, 38, 40
- cyclone(s), 193, 198**  
   contingency plan, 175  
   forecasts, 195  
   preparedness, 175  
   resistant construction, 164
- dam safety and irrigation: assessment of  
 damage, 76–78, 102  
   reconstruction, 141
- Dam Safety Review Panel (DSRPs), 141**
- damage and destruction, magnitude,  
 51–65
- damage and loss assessment, 148,  
 192–194, 209  
   methodology, 183, 202–3, 222–23
- Dastoor, M.F., 14–15**
- Dave, Janak, 14**
- Dayani, Kamal, 6, 8–9**
- debris disposal, removal, 100–1, 114, 185  
   irregularities, 101
- demographic features, 176
- design and construction, 171
- devastation, *See* damage and loss assessment
- development control regulation, 202
- Dhrangadhra, Surendranagar, Gujarat: mun-  
 icipal infrastructure damaged, 79**
- disaster insurance scheme, 205
- disaster loss model, 152
- disaster management, 67, 95, 103, 112, 113,  
 147, 152, 172–73, 195–200, 214–18  
   agency, 217–18  
   plans, 175, 209–10  
   studies on important aspects, 182–84  
   task force, 217
- disaster mitigation, *See* mitigation
- disaster preparedness, *See* preparedness
- disaster prevention, 172
- disaster reduction, 114
- disaster resource inventory, 176
- disaster response system, 215
- Disaster Risk Management (DRM)**

- Programme, 180, 199  
 District Advisory Committee, 124  
 District Rural Development Agencies (DRDAs), 166  
 droughts, 175, 193
- early warning system, 183, 195, 202  
 earthquake engineering, 168–69  
 earthquake insurance, 152  
 earthquake monitoring, 173  
 earthquake observatories and accelerographs establishment, 173–74  
 earthquake resistance, 147, 149  
 earthquake resistant construction technology, 113, 210  
 economic infrastructure, 220  
 economic rehabilitation, 209  
 education, education infrastructure, assessment of damage, 76  
     reconstruction, 130–4, 188  
 education strategy, 113  
 emergency communication system, 180, 183, 202  
 emergency equipment for municipalities, 178  
 emergency medical management, 196  
 emergency preparedness, 112  
 emergency response capacity, 113  
 emergency response system, 175–80, 199, 205, 215, 218  
 Emergency Response Unit (ERU), 176, 178  
 Emeritus, Professor, 70, 109  
 employment opportunities for victims, 118, 192  
 Employment and Training, Directorate, 166  
 Empowered Group of Ministers (EGOM), 42  
 environmental protection, 195  
 equity procedure, 3  
 European Union, 109, 112, 136
- favouritism, 73  
 Federation of Indian Chambers of Commerce and Industry (FICCI), 51  
 financial mitigation, 219  
 fire service, 178, 180  
 first-aid and preliminary treatment, 14  
 flexibility, 213, 215–16, 218  
 Food and Agricultural Organization (FAO), 105
- Gadhavi, Bhikhudan, 182  
 Gandhidham, 8, 100  
     damage to industrial units, 89  
     engineer's training, 168  
     medical assistance, 31  
     municipal infrastructure damaged, 79  
     relief and rescue operations, 33  
     service sector, affected, 89
- Gandhinagar, 17  
     communication system disrupted, 5  
     engineer's training, 168  
     impact of earthquake, 10  
     relief material to effected areas, 4  
     reconstruction, 193
- Gems and Jewellery Merchants' Association, 49  
 gender empowerment, 113  
 General Development Control Regulation (GDCR), 170  
 Geological Survey of India (GSI), 58, 63  
 GEON Institute, Russia, 174  
 Gram Navrachna Samiti, 124  
 Gram Rakshak Dal, 195  
 Gram Sabha, 95  
 Great Hanshin–Awaji earthquake, *See* Japan  
 grievance redressal mechanism, 122, 123, 150, 223  
 group insurance, 153  
 Gujarat Council of Vocational Training (GCVT), 172  
 Gujarat Earthquake Insurance Pool, 152  
 Gujarat Earthquake Reconstruction Programme (GERP), 105, 112, 186, 187, 221  
 Gujarat Electricity Board (GEB), 37, 45, 197  
 Gujarat Emergency Earthquake Reconstruction Program (GEERP), 114, 147  
 Gujarat Engineering Research Institute (GERI), 173  
 Gujarat Industrial Development Corporation (GIDC), 89  
 Gujarat Industrial Investment Corporation (GIIC), 104  
 Gujarat Informatics Ltd (GIL), 103  
 Gujarat Institute of Civil Engineers and Architects (GICEA), 70–1  
 Gujarat Institute of Desert Ecology (GUIDE), Bhuj, 139  
 Gujarat Institute of Development Research, Ahmedabad, 185  
 Gujarat Mineral Development Corporation (GMDC), 100  
 Gujarat Narmada Valley Fertilizers Company Limited (GNFC), 49  
 Gujarat Ship Breaking Association, 100  
 Gujarat State Civil Supplies Corporation, 149  
 Gujarat State Disaster Management Act, 2003, 152  
 Gujarat State Disaster Management Authority (GSDMA)  
     organizational structure, 120–3, 218  
     role in relief reconstruction and rehabilitation, 2, 95, 103, 104, 105, 109, 118, 148, 152–4, 164, 168–73, 175, 178, 180–2, 185, 200, 202–3, 214–16, 221, 222  
     relevance to other states, 216–18  
 Gujarat State Disaster Management Policy, 2002, 172, 202  
 Gujarat State Financial Corporation (GSFC), 49  
 Gujarat State Insurance Fund (GIF), 152–53  
 Gujarat State Land Development Corporation (GSLDC), 34  
 Gujarat State Police Housing Corporation, 136, 139  
 Gujarat State Wide Area Network (GSWAN),

- 176, 180  
 Gujarat Town Planning and Urban Development Act, 1976, 156, 159  
 Gujarat Urban Development Company (GUDC), 123, 141, 164, 178  
 Gulkan, Polat, 205
- Halvad, Surendranagar: municipal infrastructure damaged, 79  
 hazard assessment, 182  
 hazard resistant technology, standards, 151, 166, 168, 188  
 health and health infrastructure  
   assessment of damage, 74–75  
   reconstruction, 123, 134–6, 164  
 heritage buildings, rehabilitation, 115  
 High Frequency (HF), 10  
 High Power Committee on Disaster Management, 43  
 Hinduja Foundation, 49  
 Home Affairs ministry, Government of India, 200  
 Home Guards, 35, 195  
 houses, housing infrastructure, 69, 187  
   assessment of damage, 69–74  
   beneficiaries, 189  
   insurance, 151  
   owner-driven reconstruction, 148–151  
   policy, 94, 112  
   repair, reconstruction and rehabilitation, 114, 126–29
- Housing and Urban Development Corporation (HUDCO), 110  
 Housing and Urban Planning Ministry, Government of India, 205  
 human resources, quality, 219  
 Hyogo Prefecture, *See* Japan  
 Hyogo-Gujarat Friendship Fund, 109
- ICET, Netherland, 178  
 IFFCO-TOKIO, 153  
 immediate response system, 199  
 implementation process, 122–25, 186, 212, 216, 217, 219  
 India Disaster Resource Network (IDRN), 176  
 India Meteorological Department (IMD), New Delhi, 1, 5, 43, 58, 59, 173  
 Indian Air Force (IAF), 43  
 Indian Airlines, 49  
 Indian Farmers and Fertilizers Cooperative Ltd. (IFFCO), 89  
 Indian Institutes of Technology (IITs): Kanpur, 168, 169, 170; Powai, 151; Roorkee, 173  
 Indian National Trust for Art and Culture (INTACH), 82  
 Indian Oil Corporation (IOC), 22  
 Indian Seismic Code, 63  
 Indira Awas Yojana, 99, 150  
 Indus Valley Civilization, 81  
 industrial units, schemes for restoration, 114, 117–18  
 industry, damage, 89  
 inefficiencies, 66
- inequity, 73  
 information, 67  
   dissemination, 202, 222  
   sharing, 163  
 Information, Education and Communication (IEC) activities, 181–82  
 infrastructure creation, 123  
 injustice, 73  
 Innovative measures, 223  
*in-situ* reconstruction, 96, 148, 156, 209  
 institutional framework, 122  
 instrumentation system, 173  
 insurance, 219, 222; awareness, 188  
 integrated nutrition, 113  
 intensity, 192  
 international assistance, 46–51, 105, 108–9  
 international community, 220  
 International Development Department (DFID), 49  
 international experiences and comparisons, 203–13  
 International Fund for Agricultural Development (IFAD), 109  
 International Labour Organization (ILO), 49  
 International Maritime Satellite Organization (INMARSAT), 45  
 International Migration Organization (IMO), 49  
 International Red Cross Society, 31  
   Emergency Response Units (ERUs), 47, 49  
 international relief measures, 37–38  
 involvement, 216, 218  
 irrigation structures, systems, 114, 164  
 Israel: medical assistance, 14, 31, 49
- Jain Hospital, Bhuj, 13  
 Jain, Sudhir, 169  
 Jamnagar, Gujarat  
   damage to industrial units, 89  
   debris disposal, 185  
   devastation, 17, 34, 51, 192, 193  
   historic monuments, damage, 81  
   power infrastructure damaged, 82, 83  
   seismic activities, 174  
   service sector, affected, 89  
   telecommunication systems, 87  
   water supply system effected, 78
- Japan  
   bureaucratic sectionalism, 68  
   Earthquake Disaster Mitigation Research Centre, 163  
   Great Hanshin-Awaji earthquake, 1995, 67–68, 198, 212  
   Hyogo Prefecture Disaster Relief Fund Raising Committee, 109  
   Hyogo Prefecture, 108, 198  
   Kobe earthquake, 1995, 108, 193, 207, 210, 213, 223  
   medical assistance from, 31  
   reconstruction, 210  
   Seismic Building Retrofitting Act, 207

- Joint Assessment Team, 69, 74–91, 92, 105  
 Joshi, Sanjay, 103  
 Jubilee Hospital, Bhuj, 82  
 Junagadh, Gujarat: reconstruction, 143; seismic activities, 174
- Kandla, 45  
   Free Trade Zone, 89  
   port damaged, 83  
   Port Trust, 100
- Kanthkot, historic monuments, damage, 81  
 Khavda, Bhuj, police role in relief and rescue, 29
- Kheda  
   relief material to effected areas, 4  
   telecommunication systems, 87
- Klynweld, Peat, Marwick, Geordler (KPMG), 186  
 knowledge sharing, 186
- Kobe earthquake, *See* Japan
- Koshy, C.K., 5–6
- Koyna earthquake, 1967, 63
- Kutch, Gujarat  
   dam safety and irrigation effected, 76  
   devastation, 5, 6, 11–16, 17, 20, 29, 34, 51, 192 education effected, 76  
   grievance redressal mechanism, 123  
   housing for victims, 99–101, 126, 128  
   damage to industrial units, 89  
   restoration, 111–18  
   magnitude, 59  
   municipal infrastructure damaged, 79  
   power infrastructure damaged, 82  
   public buildings and historic monuments, damage, 79, 81, 82  
   reconstruction, Earthquake Reconstruction Programme, 117, 141, 185, 210, 222  
   relief and rescue measures, 13, 14, 27, 31  
   service sector, affected, 89  
   urban reconstruction, 156, 159  
   water supply system effected, 78
- Kutch Jain Samaj, 49
- Kutch Navnirman Abhiyan, 49
- Kutchi Leuva Patel Samaj, 14
- L.D. Engineering College, Ahmedabad, 24
- Labour and Employment Department, Government of Gujarat, 171–72
- Lakhota, historic monuments, damage, 81
- land use modification, 156
- Larsen & Toubro (L&T), 49
- Latur, Maharashtra  
   earthquake 1993, 63, 70, 203, 213, 222  
   rehabilitation and reconstruction experience, 209, 210
- legal framework, 222
- lessons and initiative, 194–200
- Leuva Patel Hospital, Bhuj, 13
- liberalization, 152
- licensing of engineers and certification, of masons, 170–2, 202
- licensing system, 206
- Limdi, Surendranagar  
   municipal infrastructure damaged, 79  
   livelihood restoration and regeneration, 113, 115, 144–46, 161, 164, 188, 205  
   load-bearing structure, 97–98  
   Lodia village, Bhuj, the epicenter of earthquake, 59  
   logistics and coordination, 33–34, 49, 67
- M.S. University, Vadodara, Gujarat, 185
- Machhu II dam, 78
- Madhapur, Bhuj, medical assistance, 31  
 magnitude and complexity, 192, 220
- Maharao Lakhpatji Chhatri, Bhuj, 81
- Maharashtra Emergency Earthquake Rehabilitation Project, 209
- Maharashtra  
   reconstruction programme, 202, 217  
   relief and rescue assistance, 34, 40, 45, 100
- Mandvi, Kutch  
   municipal infrastructure damaged, 79
- Maninagar, Ahmedabad, 22
- Mansingh, L., 33
- marketing linkages, 144
- Marmara Earthquake Emergency Reconstruction, 205
- masons, competence, 170–2
- Mata Amritanandmayi Math, 49
- media management, 197
- media perceptions, 53, 66
- medicines and equipment, 15
- Mehsana, relief material to effected areas, 4
- Mehta, Sureshchandra, 6, 9, 26
- Member of Parliament Local Area Development (MPLAD), 110
- Mexico City, earthquake, 212, 213
- microzonation, 202
- Mid Day Meal kitchen sheds, 130
- mitigation, 113–14, 147, 172, 196–99, 182, 205–6, 208, 210, 214, 216–18
- mobilization of personnel and equipment, 34, 149
- Modi, Narendra, 124–25
- Momin, S.S., 209
- monitoring, 195
- Morbi, Rajkot  
   municipal infrastructure damaged, 79
- Mother Dairy, relief material to effected areas, 4
- motivation, 196
- Mukundan, L.N.S., 20
- multi-hazard resistant construction, 150, 164
- Mundra, 8
- municipal infrastructure, assessment of damage, 79, 82
- municipalities, 219
- Murata, Masahiko, 67, 207
- Nakhatrana  
   power infrastructure damaged, 83  
   telecommunication systems, 87
- Nani Kakhar  
   power infrastructure damaged, 83

- National Building Codes, 103  
 National Building Construction Corporation (NBCC), 110  
 National Cadet Corps (NCC), 197  
 National Calamity Contingency Fund (NCCF), 104–5, 108  
 national calamity, 42  
 National Committee on Disaster Management, 42  
 National Council For Cement And Building Materials (NCCBM), 151, 166, 168  
 National Crisis Management Committee (NCMC), New Delhi, 15, 40, 42, 217  
 National Human Rights Commission, 217  
 National Institute of Communicable Diseases (NICD), 35  
 National Service Scheme (NSS), 197  
 National Society for Earthquake Technology, Nepal, 163  
 National Thermal Power Corporation (NTPC), 45  
 Nauka Talim Kendra, Vadodara, 178  
 Navlakhi port damaged, 83  
 needs, identification, 185  
 Nehru Yuvak Kendra, 197  
 Netherlands  
   financial assistance for reconstruction, 109, 112  
   new organizational structure, 103–4, 213  
   non-governmental organizations (NGOs), role in relief, reconstruction and rehabilitation, 14, 24, 47, 71, 94, 103, 105, 118, 126–27, 130, 136, 196, 148, 150–1, 154, 159–64, 166, 181, 202, 209, 213, 219, 220, 222  
 Office of the Coordination of Human Affairs (OCHA), 46  
 Oil and Natural Gas Commission (ONGC), 22, 100  
 On-Site Operations and Coordination Center (OSSOCC), 46, 47  
 organization arrangements, 118–19  
 organizational inter-linkage, 216  
 Orissa  
   Cyclone, 1999, 103, 104  
   relief and rescue assistance, 45  
   State Disaster Management Authority, 103  
 Paldi, Ahmedabad, 22  
 Panchayat Department, Government of Gujarat, 136  
 Panchmahals, relief material to effected areas, 4  
*panchnama*, 10  
 Pandya, J. G., 103  
 Pant, J.C., 43  
 paradigm shift, 2  
 participation, 159, 185, 196, 202, 216, 218  
 partnerships, 150  
 Patan, 4, 5, 185  
   devastation, 17, 51, 192, 193  
   education effected, 76  
   service sector, affected, 89  
 Patel, B.R., 4–5  
 Patel, Keshubhai, 17  
 Pawar, Sharad, 42  
 physical infrastructure, 112, 220  
 planning process, 159  
 police role in relief and rescue, 29, 33, 38, 195  
 Porbandar: transport infrastructure damaged, 87  
 post-disaster mitigation and preparedness, 3  
 post-reconstruction scenario, 218  
 Power Finance Corporation, 45  
 Power Ministry, Government of India, 45, 109  
 power system, failed, power infrastructure damaged, 8–9, 69, 82–83, 113, 192, 220  
   reconstruction, 141  
 Powergrid Corporation, 45  
 preparedness, 103, 112, 113, 121, 166, 172, 180–2, 188, 190, 198, 199, 214, 223  
 Prime Minister's Relief Fund (PMNRF), 110, 134  
 professionalism, 214  
 provincial fire service, 178, 180  
 psychological counselling, 113  
 public buildings and historical monuments, damage, 79–82  
 public buildings, reconstruction, 136–39  
 public consultation, 159  
 public sector undertakings, role in relief and rehabilitation, 51, 149  
 public services and infrastructure, 210  
 public-private participation, 127, 180, 221  
 public-private partnership programme (PPPP), 150  
 Purneshwar, historic monuments, damage, 81  
 quality, 170, 212  
 quality control, 151, 164  
 quality of life index, 189, 191  
 Quetta earthquake, 1935, 63  
 Rajasthan  
   relief and rescue assistance, 34, 40, 45  
 Rajkot, Gujarat, 196  
   damage to industrial units, 89  
   debris disposal, 185  
   devastation, 17, 51, 192, 193  
   education effected, 76  
   engineer's training, 168  
   municipal infrastructure damaged, 79  
   power infrastructure damaged, 82, 83  
   reconstruction, 143  
   Regional Emergency Response Centers, 176  
   relief and rescue operations, 33  
   seismic activities, 174  
   service sector, affected, 89  
   telecommunication systems, 87  
   transport infrastructure damaged, 87  
   water supply system effected, 78  
 Ramkrishna Mission, 49

- Rao, Dr G, 14  
 Rao, G. Subba, 33  
 Rapar, Kutch, 27  
   grievance redressal mechanism, 123  
   housing for victims, 95, 100  
   municipal infrastructure damaged, 79  
   public buildings, damaged, 82  
   relief and rescue operations, 33  
   telecommunication systems, 87  
 Rapid Action Force (RAF), 20, 35, 45, 195  
 Rathod, Shabudin, 182  
   rebuilding, 208, 210  
   reconnaissance surveys, 185  
   reconstruction and rehabilitation, 2, 42, 94–95, 109–10, 114, 192, 205, 210, 213, 215, 217–18, 220–1, 223  
     its performance, 200–2  
   recovery, 194  
   rehabilitation, *see* reconstruction and rehabilitation  
 Reliance Industries, 49, 100  
   relief and rescue operations, 2, 8, 14, 15, 20, 22, 24, 27, 29, 33, 37–38, 42–51, 94, 103, 192, 194, 217  
     by domestic and International community, 46–51 financing, 104–11  
     Government of India and state governments, 40–5  
     coverage by media, 66  
   relief material supply and delivery, 67  
   relocation, 128, 148, 154, 156, 210, 213  
   rescue, relief and rehabilitation, *See* relief and rescue operations, reconstruction and rehabilitation  
 Reserve Bank of India (RBI), 115  
 resilience through diversification, 113  
 resource inventory, mobilization, 195  
 response capacity, 112  
 response system, 182, 195  
 retrofitting, 110, 138, 150, 164, 166, 182, 205, 207, 208  
 risk analysis, assessment, 172, 183, 195  
 risk awareness, 112, 153  
 risk sharing, 152, 172  
 risk transfer mechanism, 114, 152, 172, 188  
 Roa, G. Subba, 15, 17  
 roads and bridges, reconstruction, 141  
 Roads and Building Department, Government of Gujarat, 100, 136  
 Robinson Seismic Ltd, New Zealand, 134  
 Rural Development Ministry, 109  
 rural development programme, 150  
 Rural Electrification Corporation, 45  
 rural reconstruction, 164  
 rural water supply, effected, 78, 139–40  
  
 Sabarkantha, relief material to affected areas, 4, 5  
 Saffdarjung Hospital, New Delhi, 15, 31  
 safe construction, strengthening the regulatory system, 169  
 safety aspect, 166  
 Sahu, M., 103, 104  
  
 sanitation, 79  
 Sardar Patel Institute of Public Administration (SPIPA), 196  
 Sardar Sarovar Narmada Nigam Limited (SSNNL), 34, 71, 100  
 Sarpanch, 124  
 Saurashtra, Gujarat, 196  
   dam safety and irrigation effected, 76, 78  
   reconstruction, 141  
 School Earthquake Safety Project, 109  
 School of Architecture, CEPT, 154  
 search and rescue (SAR) capability, 46, 175–80, 194, 196, 200  
 seismic codes, 63, 171, 205  
 seismic engineering aspects, 70, 169, 197, 205  
 seismic instruments, 194  
 seismic safety, 170  
 seismic standards, 170  
 seismic zones, 96–97, 114, 139, 199  
 seismological monitoring, 174  
 Self-Employed Women's Association (SEWA), 109  
   service sector, affected, 89  
 Setu, 163  
 Sewa Bharti, 49  
 shelters, 94–98, 114, 164, 223  
 Sheth L.G. Municipal Hospital, Ahmedabad, 24  
 Sheth Vadilal Sarabhai General Hospital, Ahmedabad, 24  
 Shivilakha dam, 78  
 Sinha, Anil, 15–16, 43  
 Smt S.C.L. Municipal General Hospital, Ahmedabad, 24  
 social and community infrastructure, restoration, 187, 191  
 social deprivation, 113  
 social impact assessment, 73, 185  
 social infrastructure, 112, 113, 220  
   emergency measures, 102–3  
 Social Justice and Empowerment Ministry, Government of India, 45, 109  
 social rehabilitation, 144, 205, 209  
 Societies Registration Act, 103, 120  
 socio-economic aspects, 154, 191  
 soil erosion, 185  
 solid waste management, 79  
 South Africa, 217  
 Srivastav, Vivek, 9–10  
 Standing Committee, 178  
 State Advisory Committee, 124  
 State Disaster Resource Network (SDRN), 175–76  
 State Reserve Police, 195  
 storage system, 79  
 Surajbari Bridge, damaged, 9, 38, 83  
 Surat, Gujarat  
   earthquake, 196  
   damage and destruction, 51  
   Municipal Corporation, 100  
   Regional Emergency Response Centres, 176

- Surendranagar, Gujarat  
 debris disposal, 185  
 devastation, 17, 51, 192, 193  
 education effected, 76  
 damage to industrial units, 89  
 municipal infrastructure damaged, 79  
 power infrastructure damaged, 82, 83  
 relief and rescue operations, 29  
 service sector affected, 89  
 telecommunication systems, 87  
 water supply system affected, 78  
 surveillance system, 35  
 sustainability, 112, 215, 218, 219, 223  
 Sustainable Environment and Ecological  
 Developmental Society (SEEDS), 163  
 Swamy, Sadhu Brahmavihari, 14
- Tagore Hall, Ahmedabad, 22
- Taiwan  
 Chi-Chi, earthquake, 1999, 206, 212,  
 213, 223  
 Earthquake Post Recovery Commission,  
 206 reconstruction, 210
- Talati, 124  
 Taluka Development Officer (TDO), 153  
 talukas, 33
- Tamil Nadu: Fire and Rescue Services, 180;  
 relief and rescue assistance, 33, 45
- Tappar dam, 78
- Tariff Advisory Committee, 153
- Tata Group, 49
- Teachers' Training Institute (TTI), 130
- technical guidance, assistance, 149, 156,  
 166
- technical institution, teacher's training and  
 syllabus revision, 169, 202, 219; quality,  
 166
- Telecommunication Department (DOT), 43  
 Telecommunication Ministry, Government  
 of India, 45
- telecommunication systems, disrupted by  
 earthquake, 5, 8, 9, 67, 87, 192
- Thaltej, Ahmedabad, 22
- Thangadh, Surendranagar  
 municipal infrastructure damaged, 79
- therapy and counselling, 144
- think-tank model, 217
- Thiruppughaz, V., 103
- Topno, Rajiv, 11–13
- town planning, 123, 128, 156, 191, 222
- trade and commercial activities, 114
- traffic system, disruption and transport in-  
 frastructure, damaged, 34, 67, 83–87, 220
- transparency, 3, 73, 148
- transport network and utility, 113
- trauma, 24, 193, 220
- Turkey, Kocaeli, earthquake, 1999, 205–6,  
 213  
 reconstruction, 210  
 relief and rescue assistance, 46
- Turkish Catastrophe Insurance Pool, 206  
 typology, 154
- Ukraine, medical assistance, 31  
 uncertainty, 220
- UNESCO, 105
- United Kingdom: relief and rescue assistance,  
 46
- United Nations (UN), 47, 105
- United Nations Centre for Regional Devel-  
 opment (UNCRD), 163, 203
- United Nations Development Program  
 (UNDP), 49, 105, 164, 199
- United Nations Disaster Assessment and  
 Coordination (UNDAC), 46, 53
- United Nations Children's Fund (UNICEF),  
 37, 49, 102, 105
- United States Agency for International De-  
 velopment (USAID), 49
- United States Geological Survey, 58
- United States of America: World Trade Cen-  
 tre (WTC) attacked, 66
- Urban Development Department, Govern-  
 ment of Gujarat, 178
- urban earthquake vulnerability reduction  
 program, 199
- urban housing, 128
- urban infrastructure, reconstruction, 141,  
 154–60, 164
- Usmanpura, Ahmedabad, 22
- Vadodara, 22
- Vajpayee, Atal Bihari, 42
- Vasna, Ahmedabad, 22
- Vastrapur, Ahmedabad, 22
- Very High Frequency (VHF), 10
- Videocon Group, 51
- vulnerability, vulnerability analysis, 112,  
 113, 170, 172, 183, 193, 195, 199, 202
- Wadaj, Ahmedabad, 22
- Wadhwan, Surendranagar  
 municipal infrastructure damaged, 79
- Wankaner, Rajkot  
 municipal infrastructure damaged, 79
- Water and Sanitation Management Organi-  
 zation, 109
- water supply infrastructure, affected, 35, 37,  
 79, 113, 123, 164, 220  
 beneficiaries of relief, 188, 190
- Woman And Child Welfare Department,  
 Government of Gujarat, 146
- wood shortage for cremation, 27
- working capital assistance, 115
- World Bank (WB), 2, 69, 82, 92, 105, 108,  
 112, 122, 152, 213
- World Food Program (WFP), 49, 109
- World Health Organization (WHO), 37, 49
- Yoshimoto, Kazuhiro, 67
- Yuh-Chyurn Ding, 206
- Zydus Cadila, 49



## About NIDM

The National Institute of Disaster Management constituted under the Disaster Management Act 2005 has been entrusted with the nodal national responsibility for human resource development, capacity building, training, research, documentation and policy advocacy in the field of disaster management, NIDM is steadily marching forward to fulfill its mission to make a disaster resilient India by developing and promoting a culture of prevention and preparedness at all levels.

**Functions:** Under the Disaster Management Act 2005, the Institute inter alia, has been entrusted with the following functions.

- Formulate and implement a comprehensive human resource development plan covering all aspects of disaster management.
- Develop training modules, undertake research and documentation in disaster management and organize training programme.
- Formulate and implement a comprehensive human resource development plan covering all aspects of disaster management.
- Provide assistance in national level policy formulation.
- Provide required assistance to the training and research institutes for development of training and each programmes for various stakeholders.
- Provide assistance to the State Governments and State training institutes in the formulation of State level policies, strategies, disaster management framework etc.
- Develop educational materials for disaster management, including academic and professional courses.
- Promote awareness among stakeholders in multi-hazard mitigation, preparedness and response measures.
- Undertake, organize and facilitate study courses, conferences, lectures, seminars within and outside the country to promote disaster management.
- Undertake and provide support for publication of journals, research papers and books and establish and maintain libraries etc.

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The Kutch earthquake of 26 January 2001, was one of India's most severe natural disasters. This book attempts to revisit the first few hours, weeks and months after the tragedy. It describes how the system, i.e., the government, the affected people and the society, responded to one of the greatest challenges of our time.

The scale of the rescue and relief operation in Gujarat was unprecedented. The author describes the holistic reconstruction programme that was conceptualized, formulated and implemented. It was truly a unique attempt at disaster management in India. During the reconstruction and rehabilitation efforts, many lessons and insights were learnt for the future.

This interesting book also discusses the need to improve upon current practices, procedures and preparedness on a sustainable basis. It focuses on both the quantitative and qualitative aspects of the disaster, documenting important aspects and initiatives for future reference.

Written in a reader-friendly style, this fascinating and extremely practical book will be invaluable for researchers, practitioners and policy makers in the field of disaster management.



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