



# **EARTHQUAKE ENGINEERING RESEARCH INSTITUTE**

## **Learning From Earthquakes Program**

**October 2003**

### **EERI LFE Team on Bhuj Recovery Issues**

Recognizing that the recovery phase holds many important observations and lessons for the global earthquake engineering community, EERI's Learning from Earthquakes Committee has initiated what will hopefully be the first in a series of reconnaissance missions focusing on observations of the post-earthquake recovery process. A multidisciplinary team was asked to investigate rebuilding following the Bhuj, India, earthquake of January 2001. Taking advantage of a small invitational workshop organized by the government of Gujarat on earthquake reconstruction practices in several countries, a team was put together under the leadership of C. V. R. Murty, professor of structural engineering at the Indian Institute of Technology, Kanpur. Team members included Marjorie Greene, EERI (urban planner); Sudhir K. Jain, IIT Kanpur (structural engineer); Vipul V. Mehta, Bhuj (consulting structural engineer); Jelena Pantelic, World Bank (urban planner and architect); and N. Purendra Prasad, University of Hyderabad (social anthropologist). Team members included those familiar with earthquake engineering in India as well as the government of Maharashtra's rebuilding experience.

The reconstruction program for this earthquake holds many important lessons for the U.S., as well as other countries, particularly with regard to the management of large rebuilding effort spread over a vast geographic area. An emphasis on mitigation and future disaster preparedness, advances in the use of information technology, innovative planning techniques for rebuilding in urban areas and creative strategies for involving citizens in their rebuilding are among the relevant lessons emerging from this earthquake.

The 2001 Bhuj, India, earthquake was a devastating event, causing over 13,800 deaths and 167,000 injuries, the loss or damage to 1.2 million housing units and over \$4 billion in property losses. The scope and breadth of the reconstruction program is staggering. The government of the state of Gujarat quickly set up the Gujarat State Disaster Management Authority (GSDMA), with direct control over the entire rebuilding program and an explicit mandate to promote long-term disaster mitigation during the recovery phase and into the future. The GSDMA has supported the rebuilding of over 200,000 housing units and the repair of another 900,000. In most cases owners have participated actively in the rebuilding, assisting in the design and construction of their homes. In 20 percent of the cases, a public/private partnership between NGOs and the government has rebuilt the housing. Little construction work has been done by government agencies themselves. Over 1,000 materials banks were established, to supply cement and steel at subsidized prices. The GSDMA has brought in technical assistance to help in the rebuilding process, particularly with the focus on promoting earthquake-resistant technology, by providing training to almost 30,000 masons and 6,200 engineers. The GSDMA has employed a quality control organization — a consortium of two government agencies and a university. The GSDMA has developed assistance packages for those who lost their livelihoods. Social innovations have been advanced, such as setting up bank accounts and depositing housing payments directly in the banks, and including women's names on both the bank accounts and the property deed for the house. Much of this information can be tracked on the GSDMA web site, where many of the statistics for the project are available, as well as other background documents ([www.gsdma.org](http://www.gsdma.org)).

Four towns with substantial damage in the earthquake are developing new town and development plans that will include adjusting property lines and developing a more accessible road system. Even while facing pressures to rebuild quickly, the government is taking the additional time needed to develop these town plans in a thoughtful manner. A pilot project has been developed in Bhuj to allow citizens access to information on the earthquake rehabilitation process through interactive computers at several kiosks around the city. The nongovernmental organizations have developed innovative techniques for sharing information with individual owners and tenants. A major change in India is taking place in giving greater priority to seismic safety on the national agenda. The central government, the government of Gujarat, and the academic and practicing engineering communities are beginning discussions that will result in higher standards of seismic safety and changes in codes and practice. Social science academics are stimulating discussion on models of disaster recovery and the relationship between earthquake recovery and ongoing development.

A full report from the reconnaissance team documenting their observations on this major reconstruction program will be available in a few months and sent to all EERI members.