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A Review on Pre-Disaster Planning and Preparedness for Earthquakes in India

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"Earthquakes don't kill people; it is the structures built by man that kill people". Frequent reminders of moderate earthquakes makes our country India amidst of crossroads of earthquake preparedness. The one and only option is to prepare now because we do not want to repent and pay later. India being a country with relatively challenging economic conditions and with a very dense demographic distribution there is no other way out apart from a very strong and strategically planned earthquake preparedness. Late nineteenth and early twentieth century's earthquakes initiated a number of researches in science and engineering related to earthquakes which include the making of early codes and earthquake-proof housing and advancement of techniques enforced after the earthquake in Andaman Islands in 1941. Inspite of these early advances towards seismic safety, earthquakes result in a number of deaths in India. The Bhuj earthquake of Gujarat in 2001 marked a striking negligence for structural design principles and construction quality. This earthquake of Bhuj resulted in collapse of modern multi-storey structures in India, and initiated awareness amongst academics, professionals, scholars and the public which was seen never before. The earthquake was followed by the making of the National Information Centre of Earthquake Engineering and the development of a comprehensive 4-year National Programme on Earthquake Engineering Education which was initiated by the seven IITs and the IISc. Earthquake engineering is a highly context-specific stream of engineering and there are many engineering problems which require adequate solutions locally. "Confined Masonry Construction" is one such building typology. Construction of the students' hostels and faculty housing on the new 400-acre campus of the IIT Gandhinagar has given an opportunity to follow this construction typology on a large scale. The danger of the disaster in India is also evident from the occasional news of collapses of buildings under construction or during rains (without any earthquake shaking). Addressing the safety of built environment in our country is the need of the hour.

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Introduction

The Disaster Management Act, 2005 defined disaster as a "catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or manmade causes, or by accident or negligence which results in loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the recovering capacity of the community of the area affected".

In simple words it is an event or a series of events, which give rise to life threatening circumstances and acute damage or loss of property, environment and most importantly means of livelihood on a scale which is beyond comprehension and far beyond the recovering capacity of the community affected. These unfortunate events disturb the balance and progress of infrastructure development activities pushing nations back by several years in terms of GDP. Therefore, efficient disaster management has received great attention.

Disaster Management can be described briefly by the integration the following:

- Planning and implementation of disaster specific measures which are mandatory
- Mitigation of consequences
- Capacity building
- Pre-planned and prepared response
- Assessment of the severity
- Evacuation, Rescue and Relief
- Rehabilitation and Reconstruction

Largely due to its geo-climatic conditions combined with high population density and other socio economic factors, India is one of the most disaster prone countries in the world. The risk of damage of lives and property during and even after the occurrence of such an event is high due to the population spread and tendency of people to rehabilitate the areas prone to natural disasters such as earthquakes, Bhuj in Gujarat being a perfect example of such an occurrence. Increased vulnerability to the effects of disaster can be related to country specific problems such as population expansion, urbanization and industrialization, infrastructure development within high-risk zones and global problems such as environmental degradation and climatic changes. The current scenario of preparedness of our country in case of an earthquake has been discussed very categorically further.

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Literature Review

Ministry of Earth Sciences (MoES) (India Meteorological Department (IMD)) is the nodal Ministry for the management and mitigation of earthquakes in the country. In terms of National Disaster Management Guidelines on Management of Earthquakes issued in April 2007, MoES was to prepare the Earthquake Management Plan covering all aspects including earthquake preparedness, mitigation, public awareness, capacity building, training, education, research and development, documentation, earthquake response, rehabilitation and recovery. MoES did not prepare any disaster management plan for earthquakes. However, in reply to a query of the Committee regarding status of disaster management and mitigation plan for earthquake, the MHA informed as under:

"ESSO-IMD is only responsible for monitoring seismic activity in and around the country and disseminates the information to all the user agencies including the concerned State and Central Government agencies responsible for carrying out emergency response, relief and rehabilitation measures. It is to mention that the institutions of MoES/ESSO only deal with monitoring, detection and warning of cyclones and tsunamis and only carry out aspects of monitoring and detection in respect of earthquakes and hence have no experience of developing and monitoring the associated components of disaster management cycle viz., preparedness, mitigation, risk reduction, response and relief, etc., that are all along being dealt with by different Central and State Government authorities. Moreover, the implementation of disaster mitigation plans also has a significant component of techno-legal, and regulatory components that are operated by various competent authorities at different levels of governance in the country".

A project on “Optimum Seismological Network Program” was sanctioned in May 2009 by the IMD at an estimated cost of ₹ 48 crore, which was reduced to ₹ 25.17 crore. The project implementation was proposed to be carried out in two phases spread over a period of three years from 2009-10 to 2011-12. The objective of the project was to strengthen and modernize the National Seismological Network for improving the detection and location capability for earthquakes of magnitude greater than or equal to 3.0, occurring anywhere in the mainland of the country. The project was found by audit as still in the preliminary stages of implementation even after expiry of three years. The MHA in their submission about the

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status of OSNP stated as under:

"Earlier plan of "Optimum Seismological Network Program" was reviewed in the light of recent networks established in the country by various R & D groups. Under this approach, already 65-stations (40-seismic stations and 25-GPS stations) are operational and very soon the network would have 90-stations (50-seismic stations and 40-GPS stations) by which already medium and low seismic intensity is successfully getting monitored and analysed in real-time. Accordingly a new scheme was taken up for deploying a total of 78 additional state- of art broadband systems to the national seismological network in October, 2012. Global tenders have been floated and technical evaluation of bids received has been completed. Further action is in process for placement of order is under progress".

MOES/IMD had set up the Earthquake Risk Evaluation Centre at Delhi, in February 2004 [4]. During 2007-12, IMD proposed to carry out three projects:

(a) Seismic micro-zonation of Mumbai, Guwahati, Ahmedabad and Dehradun on 1:10000 scale;

(b) Creation of national database for seismic hazard and regional risk appraisal; and

(c) Impact assessment of utilization of database in planning and mitigation

An allocation of ₹ 298.38 crores was made for these projects. MoES stated (September 2012) that the micro-zonation of Guwahati, Bangalore, Ahmedabad, Dehradun and Delhi was completed. IMD initiated a project titled "Archival digitization of seismic analogue chart" in May 2008 at an estimated cost of ₹ 13.50 crores for two years. The duration of the project was extended from time to time and finally till June 2012. In their submission, the MHA furnished as under:

"Seismic data base comprises scanning and digitization of analog seismic charts for the period 1927-1996, on-line archival of digital wave form seismic data since 1996 in real time. The scanning of about 89,000 analog charts and out of which digitization of about 5000 earthquake events are taken up since 2008. As things stand today, the scanning of all the charts is completed and digitization of events is in its final stage. Archival-digitization of seismic analogue charts is pursued till December 2013 to complete the activity. The National NDMA had undertaken the task of preparing the upgraded hazard maps and atlas of Indian land Mass. In this connection the MHA informed that as per the recommendations of the

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Working Committee of Experts (Geophysical-Hazards), NDMA has undertaken a project through Building Materials Technology Promotion Council (BMTPC) for upgradation of Earthquake Hazards Maps for the country at a cost of ₹ 76.83 lakh. Project which started in June, 2011 is yet to be completed. It is getting delayed due to non-availability of district boundaries data from the Census of India. NDMA has also taken up National Earthquake Risk Mitigation project. This Project was still in preparatory phase after a lapse of five years. The Ministry while furnishing the status of project stated as under:

"The Centrally Sponsored Scheme for National Earthquake Risk Mitigation (Preparatory Phase) has been approved in April, 2013 at an outlay of ₹ 24.87 crore, to be implemented within a period of two years *viz.* 2013-2015. The aim of the project is to demonstrate the effectiveness of strategies proposed for implementation of activities under four components namely,

(i) Techno-legal Regime,

(ii) Institutional Strengthening,

(iii) Capacity Building and

(iv) Public Awareness. The scheme will be implemented in 21 States/UTs that lie in seismic Zones V & IV in the country.

Present Status

1. NDMA has initiated preliminary steps for implementing the scheme

2. A Project Steering Committee has been constituted under chairmanship of Member(Earthquake), NDMA and Secretary, NDMA, JS(DM), Financial Advisor, Town & Country Planner, Technical experts, representatives from BMTPC, CPWD, NIDM etc. as members."

The Committee has noted that considering the vulnerability of the country's landmass to the risks of earthquake, various efforts are underway to prepare for such eventualities. It includes archival-digitisation of seismic /analogue charts since 1996, preparation of hazards map and atlas of India etc. Also following the Optimum Seismological Network Programme sanctioned in 2009 by the IMD, 65 stations are now operational and the capacity is being further enhanced. However the Project for up gradation of Earthquake Hazards Maps for the Country costing ₹ 76.83 lakh, which started in June 2011, is yet to be completed due to

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non-availability of district boundaries data from the Census of India. Another project 'National Earthquake Risk Mitigation', approved in April, 2013 is under implementation during 2013-15. Considering the increased seismic activity in the Himalayan region, which has been witnessed recently, the Committee emphasise upon an early completion of the earthquake preparedness activities at all levels. They desire that the MHA must take up the matter urgently with the Census Commissioner for supply of requisite boundaries data so that the hazard atlas/map could be completed early. The Committee hope that the preparatory phase of the Earthquake Mitigation project would be completed this year as stipulated and final phase would start on time. Meanwhile the MHA must strive to create maximum public awareness on earthquakes in the Country as an essential part of disaster preparedness.

Conclusion

India, one of the fastest growing GDPs of the world estimates unprecedented growth over the next decade, a situation both exciting and challenging. The growth prospects for all those in the construction industry are huge, yet with the possibility of repeating many of the potentially fatal mistakes discussed above. The most important among the unfinished agenda to improve this construction process are:

(a) Competence-based licensing for engineers in general and structural engineers in particular

(b) Enforcement of building codes by the municipal authorities, and

(c) Development and propagation of building typologies that are inherently earthquake-resistant.

The emphasis, with particular urgency, should be on new construction of all kinds, from the millions of housing for the masses that the central government has identified as a priority, to the expensive apartment buildings for the affluent. Clearly, India has come a long way on the road to earthquake safety and yet, much remains to be done before this journey is completed. Creating a system and culture for building safe houses in 21st century India is something not only possible but an absolute necessity. This is the least that the general masses of our country expect from technically qualified engineers and management professionals and others associated with the construction industry. Provisions for such safe housing are both our challenge and obligation.