

# NEED FOR IMPROVEMENT IN CONSTRUCTION OF INFRASTRUCTURE TO REDUCE IMPACT OF DISASTER IN INDIA

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**Abstract**— In this paper effort is made to study about existing disaster management structure in India; existing rules regulations for construction of buildings and actual ground reality in execution/implementation on ground in India. In last number of years, India is experiencing heavy floods, cyclones, landslides and earthquakes almost every year. The number of death, destruction and loss because of natural and man-made disasters are becoming more rather than less frequent. Disaster Risk reduction is increasingly becoming more important because climate change is expected to result in more frequent & severe hazards. It is expected to increase people's vulnerability, resulting in even more disasters. It has also been experienced that the country is not adequately prepared to deal with consequences of these disasters. The experience suggests that there is an urgent need for a proper disaster management planning/strategy that is focused, well co-coordinated & prepared for all obvious eventualities so that its impact is reduced. The paper mainly focused on requirement of proper planning & implementation on ground while constructing any infrastructure projects, considering various aspects of disaster management & has finally recommended various comprehensive measures to be taken. The author was actively associated with surveying/assessment of large number of earth quake affected buildings in various places in India. The major reasons leading to failures of large number of structures have been analyzed, their remedial measures discussed, & deliberated by special emphasize on planning/designing & actual implementation on ground, for reduction of its impact in future.

## I. INTRODUCTION

A hazard leading to an event of any kind of destruction, loss of life, damage or drastic change to the environment can be called as "disaster". There is a requirement of analysing and mitigating the disasters, in order to minimize the loss of life as well as the property. Floods are the most common natural disaster in India. The heavy southwest monsoon rains cause the Brahmaputra and other rivers to distend their banks, often flooding surrounding areas. The floods can kill thousands and displace millions. Excess, erratic, or untimely monsoon rainfall may also wash away or otherwise ruin crops. Most parts of India are flood-prone, and extreme precipitation events, such as flash floods and torrential rains, have become increasingly common in central India over the past several decades, coinciding with rising temperatures. The floods in Uttarakhand

caused one of the biggest disasters in the history of India in 2013. It caused huge loss of life & property. Again in 2014, the floods in J & K caused similar type of loss. Disaster of all types e.g., earthquakes, floods, cyclones, drought, cloudbursts accidents, etc. have been occurring since time immemorial. However, their frequency, magnitude & area have increased many times in all parts of world, in recent times. They may be broadly classified as natural disasters such as earthquakes, floods, droughts & cyclones and manmade disasters such as riots, conflicts, terrorist events and environmental disasters, like fire, epidemics, industrial accidents & environmental fallouts. Often difference between them is marginal. Natural disasters can be perceived as an "extreme natural event", which, may affect different places singly or in combination (Coast line, hillsides earthquakes prone areas, etc.) at different time's & different duration, etc. The hazard has varying degrees of intensity & severity. Any Natural hazards become disasters, when they come in contact with vulnerable social setting of human population. Human Settlements, structure & centres of economic activity increase the damages caused by disasters. Globally, natural disasters

account for nearly 80% of all disaster affected people. In this paper focus will be on Natural Disaster.

Over the last century, about 75% of fatalities attributed to earthquakes have been caused by the collapse of buildings. India's substantial percentage ones (59%) continue to live in the non-engineered weak buildings, due to absence of knowledge, poverty & awareness about compliance of appropriate buildings regulations and legislation. In the construction industry, there are various types of professionals required. These include those are at Senior Management, Managerial, Supervisory level as well as Trades man & worker. Till recently Indian Construction Industry (barring few major contractors) was in the hands of small contractors. The project being constructed were mainly labour oriented and therefore not exposed to specialized equipment's & mechanized construction. Unskilled worker mostly remained unskilled throughout their lives. These have affected our quality construction very badly & thereby impact of disaster is so heavy in developing country like India. Further our implementation machinery is weak & lack firm commitment. Though defence infrastructure is normally less vulnerable to

disaster so far, but if we do not take adequate precaution, this may create lot of problem in future.

## II. EXISTING POLICY FOR DISASTER MANAGEMENT

National Policy on Disaster Management-2009 was approved by GOI on 22nd Oct 2009, based on Disaster Management Act, 2005. The National Disaster management Authority (NDMA) is the apex body for disaster management, headed by the Prime minister. It has the responsibility of laying down policies, plans & guide lines for Disaster Management (DM) in the country. The guidelines assist the central Ministries, Departments & States to formulate their respective DM plans. It approves the National Disaster Management plans & DM plans of the Central Ministries/Departments. NDMA take such other measures, as it may consider necessary, for the prevention of disasters or mitigation or preparedness & capacity building, for dealing with a threatening disaster situation or disaster. Central Ministries/Dept. & State extends necessary cooperation & assistance to NDMA for carrying out its mandate. NDMA oversee the provision & application of funds for mitigation & preparedness measures. NDMA has the power to authorize the Dept.'s or Authorities concerned, to make emergency procurement of

provisions or materials for rescue & relief in disaster.

At state level, the SDMA, headed by the Chief Minister, lay down policies & plans of DM in the state. It approves the state plan in accordance with the guidelines laid down by the NDMA. SDMA Coordinate the implementation of the state plan, recommend provision of funds for mitigation & preparedness measures and review the development plans of the different

Departments of the state to ensure the integration of prevention; preparedness & mitigation measures. The State Govt. constitutes State Executive Committee (SEC) to assist SDMA. DDMA (District Disaster Management Authority) headed by District Collector act as planning, coordinating & implementing body at District level. DDMA ensures that the guide lines for prevention, mitigation, preparedness & response measures laid down by the NDMA & the SDMA are followed by all the Dept.'s. Of State Govt. There are other institutional arrangements for disaster management in India. Armed Forces – Called to assist Civil Administration, when situation is beyond their coping capability. Central Para-military Forces (CPMFs) - which are also the

Armed Forces of the Union, play a key role at the time of immediate response to disasters. State Police Forces & Fire Services- are crucial immediate responders to disasters.

- Civil Defence & Home Guards
- State Disaster Response Force (SDRF)
- Role of NCC; NSS (National service Scheme); & NYKS (Nehru Yuva Kendra Sangathan) & other NGO's.
- International cooperation & coordination in all spheres of DM.

## III. IMPROVEMENT NEEDED

The functioning of all these Institutes' need to be evaluated & possible improvement need to be carried out, for reducing impact of disaster. India has advanced considerably in developing earthquake resistant codes of practice and guidelines for constructing RCC and steel framed buildings, brick or stone masonry buildings and combination of clay, wood, bamboo and thatched houses. Yet high level of earthquake risk in our country's context is mostly attributed to the unplanned and ill planned urban infrastructures developments. In order to reduce vulnerability, it is important to create proper awareness about earthquake induced damages and their mitigation measures. India Govt. is looking forward to establish the necessary techno-legal and techno-financial mechanisms in order to ensure that all stakeholders like owners, builders, architects, engineers and government departments, responsible for regulation and enforcement adopt earthquake-safe construction measures in all design and construction activities. The main focus shall be:

- Earthquake resistant design and rehabilitation of structures
- Indian standards and guidelines on earthquake technology
- Seismic evaluations and retrofitting of selected lifeline buildings
- Disaster safe construction practices and issues
- Techno-legal and techno-financial framework for earthquake protection compliance
- Training and Capacity building of masons, architects and engineers

## IV. BUILDING CONSTRUCTION

The Expert Committee was constituted by Ministry of Home Affairs to Develop Model Building Bye-laws and the review of City, Town and Country Planning Act & Zoning Regulations. The Committee based on lesson learnt about the damages in buildings during various earthquakes etc. has observed that the main reasons of wide spread damage was due to faulty planning/designing and bad construction practices. The earthquake resistant features specified in Indian Standards and Building Codes were not followed. The Committee in its final Report has made detailed recommendations for modification in existing Town & Country Planning Act, putting Land use Zoning Regulation in place and addition to Development Control Rules and Bye-laws. The Ministry of Home Affairs, Govt. of India had recommended the same to the State Govt. & UT Administration for early adoption. The National Building Code prepared by BIS are advisory in nature and not been made mandatory so far. The seismic Strengthening of Existing Building has been also recommended. As per recommendation, prior to seismic strengthening/retrofitting of any existing structure, evaluation of existing as regards structural vulnerability in the specified wind/seismic hazard Zone shall be carried out by a registered structural Engineer. Further, Review of structural Design by the Senior Structural Designer has also been recommended. For the implementation of the recommendations a series of workshop in all states & UT have been planned to disseminate

the recommendations of the Model Techno-legal Regime so as to help them to actually modify the Acts/Development Control Rules/Bye-laws as applicable. However lot of works need to be done to give Building a New Techno-legal Regime for a safer India against the natural hazards. The Building Bye-laws and

BIS Codes need to be critically studied/examined & possible modifications/improvement need to be evolved for reducing impact of Disasters. All codes needs to be periodically updated/revised based on experience gained during various disasters.

## V. LESSONS LEARNT FROM DISASTERS CAUSED IN GUJARAT & OTHER PLACES

India had experienced five great earthquakes, each with richer magnitude exceeding 8; 1819 Gujarat, 1897 Assam, 1905 Himachal Pradesh, 1934 Bihar & 1950 Assam. Apart from these, there have been other devastating earthquakes in the Indian sub-continent, which have created public awareness about this problem. In 1967, earthquake in Koyna (6.3R), in 1993 earthquake in Latur (6.2) area of Maharashtra surprised everybody, as no such shock struck until then. In 1991, a damaging earthquake occurred in Uttar-kashi (6.5R), in 1997 we had earthquake at Jabalpur (6R) & in 1999 Garhwal region of Western Himalaya (6.8R). After Bhuj earthquake (7.6) on 26 January 2001, we had earthquake (7.6) in Kashmir, Himachal Pradesh on 08 Oct 2005; Andaman Islands (7.5R) on 11Aug 2009 and on 18 Sept 2011 earthquakes (6.9R) in Sikkim. In all these earthquakes, the majority of the structural damages that were observed in the affected areas were due to non-compliance of earthquake resistance features, and poor construction practices using locally available building materials. In Gujarat, also we observed similar pattern of destruction at much bigger scale.

The havoc created in Uttarakhand due to heavy rainfall, which caused landslides and flood in the whole state on June 13. According to official figures, more than ten thousand were declared dead, but according to local media & certain assumptions, more than a lakh people are assumed to be dead. State Govt. estimated a loss of Rs. Sixty thousand crores. After one year similar situation arose in Jammu & Kashmir region, on Sept 14, due to devastating floods. Though death figure was low here in terms of few hundred only, but the loss of property and infrastructures were huge. Based upon the study of Gujarat Disasters and experiences of other disasters in India, the reasons for unsatisfactory state of affairs & major causes of failures are listed below:

- Lack of Effective coordination among various agencies,
- Lack or complete absence of inter-agency flow of information,
- Lack of transparency and accountability,
- Delays in release of relief materials & funds,
- Bureaucratic management approach that is top-down, non-integrated & piecemeal,

□□Past Experience in disaster management was not institutionalized and documented for future use,

□□Lack of comprehensive Disaster Mitigation Plan (DMP) at National, State, district & local levels,

□□Lack of public participation in reconstruction programmes,

□□Lack of effective rehabilitation policies & programmes,

□□People's attitude & behaviour is casual & directed to short-term personal gains,

□□Failures of Professionals (architects & engineers) in advising the people on magnitude of damage, if quality of building is compromised for cost considerations,

□□Engineers do not feel accountable for damage to the buildings due to their faulty design or supervision.

□□Builders are not accountable for quality of construction once building is handed over & mandatory six/ twelve-month's period is over. There are no laws to regulate builders & their performance properly,

□□Failures of Planners to evolve rural housing models acceptable to the local People & commensurate with their community living pattern.

## VI. PROPOSED STRATEGY & RECOMMENDATIONS

Based on the study carried out after analysing various aspects the following Measures are recommended: -

□□Comprehensive National Policy framed on disaster management after considering the various recommendations made by the HPC & suggestions made in this paper, is to be implemented on ground.

□□The culture of preparedness, quick response, strategic thinking & prevention, as brought out by the HPC, should be evolved and implemented on ground. The Centre's role in combating disasters needs to be enhanced.

□□Disaster Management aspects like preparedness response etc. should form part of curriculum in primary, high schools and colleges. Education and training in disaster prevention, preparedness and Mitigation is necessary for minimizing effect of disaster.

□□Identification & net-working of existing Centres of Excellence is to be done so as to enhance disaster prevention, reduction and mitigation activities. National Institute for Disaster Management (NIDM) needs to be strengthened as a centre of excellence.

□□Involvement and active participation of the community in combating disaster needs to be increased. The local bodies must be given additional role in this Regard. The local level plans need to be prepared in detail and rehearsed in the Disaster prone areas. All state Govt. should reorganize their disaster management mechanisms taking into account the Maharashtra model. Panchayat and village disaster Management communities should be established.

□□A formal mechanisms to co-ordinate activities of NGOs to be evolved, to avoid duplication of work and formalized, as has been done by US model for Disaster relief operations.

□□Alternative means of communications/stand-by communication System should be given high priority.

□□ There is an urgent need for careful study of all existing structures in Earthquake/disaster prone areas specially, based on various Indian Codal requirements and identifies the structures, which do not confirm to the Engineering Requirements. The requirement of strengthening existing old structures, which were not designed as per present Codal requirement need to be identified immediately & suitable alteration/ retrofitting work is to be carried out to avoid huge loss of life and property.

□□ The use of Indian Standard codes of practices & building bye-laws in the Construction of Government & private buildings is to be made compulsory and enforced properly. The hazard Zonation map of the country need to be upgraded regularly.

□□ To establish a creditable R & D organizations, under the new Ministry to develop modern mechanisms, in the field of disaster management. Further, as Recommended by eleventh Finance Commission, National Centre for Calamity Management (NCCM) should be set up at the earliest.

□□ The Central Govt. should publish & circulate all the lessons learnt in the Post disaster, to the states that are prone to specific disasters. This can be done by NDMA.

□□ The existing warning systems, including infrastructure in disaster prone areas should be improved.

□□ The Armed Forces being a major player in Disaster Management in India need to look inwards and formulate their own response mechanism including procurement of State of Art equipment's and skill improvement, to maximise the utilisation of their resources and effort. Further, there should be synergy between Armed Forces and Civil Administration

(Including NGOs) towards providing efficient response. NDRF need to be strengthened more.

□□ Our Civil Engineering fraternity/ faculty members should possess adequate knowledge and experience in design & construction of earth-quake proof structures, so that they are capable of imparting knowledge to students at various level.

□□ Lastly, while creating any future infrastructure, we must strictly adhere to the various codal provisions while planning/designing and implementing on ground, to reduce impact of disaster in future.

## VII. CONCLUSION

All state governments and all local bodies (urban & rural), development authorities, special and new town development agencies, etc. need to modify, revise, revamp the existing building byelaws; development control rules; planning standards; town planning rules; special regulations for fire, structural health, construction, electric and life safety, in line with the NBC by suitably adopting fully or adapting it with local variation as may be needed. NBC-2005 (which is under revision in 2015) is to be adopted as the basis for all structural design, fire protection, building and plumbing services, building materials and construction practices (and construction safety) and for proper protection, upkeep & maintenance of water bodies by modifying the departmental construction

codes/ specifications/manuals of Govt. construction departments.

The strengthening of all building development and regulating agencies with the right level of professional human resources to deal with proactive responses needed with the building professionals and builders. Strategies to be made for pre and post event data collection and further instrumentation of the affected area for understanding unique tectonic features by reputed Indian organisations such as NGRI, GSI, IMD, NEIST, WIHG, IIG, IITs. There is an urgent requirement of providing a forum for interchanging of ideas and views pertaining to earthquake and other risk mitigation, capacity building of mason, architect, engineers, town planners, contractors and other stake holders. Workmanship, supervision, and construction methods must be revised in the form of strict regulation and implementation drives. Thus, strict adherence to prescribed standards, of construction materials and processes is essential in assuring a disaster resistant building.

The various measures recommended in this study are an absolute necessity, if we want to bring more professionalism & effectiveness in our system to combat disasters and to reduce impact of loss of human life & property due to disasters in India. There is an urgent need of nationwide mass awareness generation activities as a foundation layer of earthquake and other hazards preparedness in the country, so that the impact of disaster can be reduced substantially. The defence infrastructure projects developments also have to move on this direction.

## REFERENCES

- [1] Global Facility for Disaster Reconstruction and Recovery. (2009) "GFDRR: Natural Disaster Institutional Capacity Building and Emergency Response in the Republic of Yemen." Washington, D.C. <[http://gfdr.org/docs/Snapshots\\_Yemen\\_Jan09.pdf](http://gfdr.org/docs/Snapshots_Yemen_Jan09.pdf)>
- [2] GOI (2005). Scheme for Support to Public Private Partnerships in Infrastructure, Ministry of Finance, New Delhi
- [3] IPCC (2007) Climate Change 2007: Synthesis Report – Summary for Policymakers, Assessment of Working Groups I, II, and III to the Third Assessment Report of the International Panel on Climate Change IPCC, Cambridge University Press.
- [4] National Building Code (2005), Bureau of Indian Standards, India.
- [5] Prasad, N., Ranghieri, F., Shah, F., Trohanis, Z., Kessler, E., and Sinha R. (2009) Climate Resilient Cities: A Primer on Reducing Vulnerability to Disasters, World Bank, Washington, D.C.
- [6] Trohanis, Z., Shah, F. and Ranghieri, F. (2009) Building climate and disaster resilience into city planning and management processes, Fifth Urban Research Symposium,
- [7] Bhattacharjee J, ( 2014), "Need for Improvement in Disaster Management Strategies based on lessons learnt in floods in J & K and Uttarakhand" published in "International Journal of Management, Sociology & Humanities" (IRJMSH), in Vol-5, Issue-10 on Dec14.

