Training Program on

Earthquake Risk Mitigation and Building Codes

(March 05-09, 2018)

Organized by:

Towards a disaster free India

National Institute of Disaster Management South Campus

(Ministry of Home Affairs, Govt. of India)

Andhra Pradesh Human Resource Development Institute

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Introduction

Earthquakes are one of the most destructive natural hazards. They may occur at any time with sudden impact and no warning. They can destroy buildings in seconds, killing or injuring the inhabitants. Earthquakes not only destroy entire cities but may destabilize the government, economy and social structure of a country.

India on account of geo-physical setting is highly prone to earthquakes of varying intensities. The country has faced several devastating earthquakes in the past resulting in a large number of deaths and severe property damage. During the last century, five earthquakes measuring M8 or more had struck different parts of the country; Great Assam earthquake (1897), Kangra earthquake (1905), Bihar-Nepal earthquake (1934), Andaman-Nicobar earthquake (1941) and Assam earthquake (1950) had caused untold misery to the affected community and enormous damage to infrastructure and public and private property.

In recent past, damaging earthquakes had been experienced in different parts of the country e.g. Assam (1988) M 7.2, Bihar- Nepal (1988) M 6.5, Uttarkashi (1991) M 6.6, Latur (1993) M 6.4, Jabalpur (1997) M 6.0, Chamoli (1999) M 6.8 and Bhuj (2001) M 6.9. Most recent earthquakes affecting the country include Sikkim (2011) 6.9 and Manipur (2016) 7.7. Few of the earthquake events, which did occur outside Indian Territory, had a very severe bearing on the nation as well e.g. Muzaffarabad earthquake (POK), (2005) M7.6 had its bearing on Jammu and Kashmir; similarly, Great Sumatra earthquake, (2004) M9.1 created a severe tsunami affecting Indian coastline with severe impact.

As per the current seismic hazard map of the country (IS 1893: 2016), about 60% of India's land area is under threat of moderate to severe seismic hazard, i.e., prone to shaking of MSK Intensity VII and above (BMTPC, 2006).

The frequently occurrence of damaging earthquakes clearly demonstrates the high seismic hazard of the country and highlights the need for a comprehensive earthquake risk mitigation programme. To carry the earthquake risk mitigation programme forward, there is a need for trained manpower. To develop a cadre of trained professionals in the area of earthquake risk mitigation, National Institute of Disaster Management (NIDM) is organizing this training programme.

CAPACITY BUILDING OF BUILDING OFFICIALS

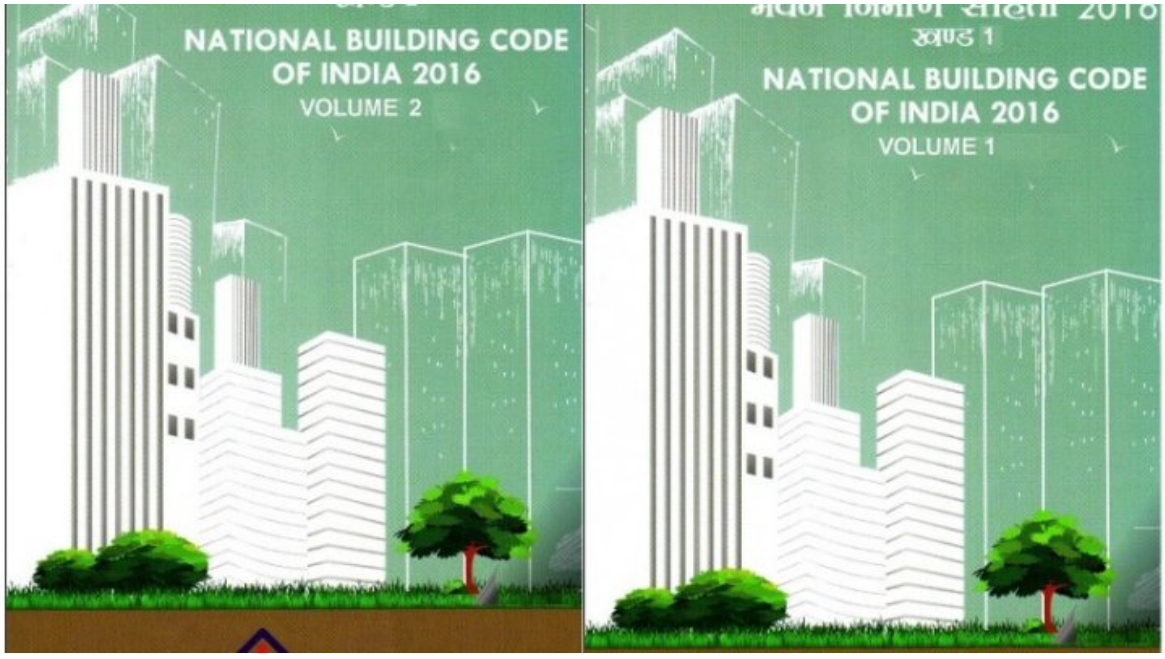
Questions	Explanations
What determines the expected damage and loss due to earthquake?	• Structural (system, height and building practices etc) and • Non-structural elements (occupational and functional components or OFCs) and its occupancy (residential, commercial, industrial, lifeline etc)
What is seismic vulnerability assessment?	The assessment of seismic risk involves the estimation of consequences of an earthquake in the chosen area in terms of the expected damage and loss from a given hazard to given elements at risk. Risk = Hazard × Vulnerability × Exposure – Capacity Different buildings vary in their degree of vulnerability to

	earthquake ground motions as a function of geometrical or qualitative characteristics (height, plan dimensions and elevation configurations, age etc.) and structural characteristics (such as material of construction, mass, stiffness, quality of construction, strength, intrinsic ductility, state of stress, seismic displacements, nonlinear behaviour parameters, and other structural information)
Who are the stake holders for capacity building?	Engineers, architect, town planners and municipal authorities dealing with building permit, registration, construction safety monitoring, dangerous building identification and demolitions
Why capacity building is so important?	• Architectural plans are sanctioned without sound methodology of site specific tests/verification/professional judgements • Residents not fully aware of the potential danger, loss of life and livelihood, economic loss to cope up with each disaster. • Several buildings collapse without any warning • Most of the buildings are not engineered, beyond any repair strengthening measures • Building in many places are constructed without any breathing space in between, building byelaws are not followed emergency rescue operation in the narrow lanes/bye lanes possess difficulty • No authentic method of inventory/SOP of building functions are maintained, no regular health check-up buildings done in systematic manner
What are vulnerable components?	• In seismic zone III, IV, V no brick buildings without proper reinforcement can be made earthquake safe. • Buildings mostly have irregular plans, elevations and cantilever projections – potential danger in wait • Buildings are constructed along property boundaries with eccentric footings – pounding effect during earthquake possible • Buildings are poorly constructed, added, altered, dismantled without following safety guidelines • Ductile detailing of reinforcement as per IS code are not followed in many buildings. There is quality check on such constructions • Load bearing columns and beams are placed at random spacing, variable dimensions and geometry
How capacity of engineers can be enhanced?	• Training on vulnerability assessment of buildings, site inspection random checking of building materials available in open market, testing of buildings materials by testing agencies and quality monitoring • Onsite evaluation of building performed by NDT, DT and the other tests as per IS code • Vulnerability mapping by RVS • Performance of engineered and non-engineered building by shock table test • Earthquake simulation by Shake table test, liquefaction evaluation and mitigation measures • Quality checking of building foundation by borehole with

	SPT, DCPT, PMT etc. (as per IS code)
What methodology is to be followed?	Training of engineers, architect, town planners – classroom and field oriented, expert lectured cum demonstration, mockdrill, simulation, along with wide scale Media coverage and documentation.

National Building Code of India 2016

The National Building Code of India (NBC) provides guidelines for regulating the building construction activities across the country. It serves as a Model Code for adoption by all agencies involved in building construction works. The Code mainly contains administrative regulations, development control rules and general building requirements; fire safety requirements; stipulations regarding materials, structural design and construction (including safety); building and plumbing services; approach to sustainability; and asset and facility management. The Code was first published in 1970 at the instance of Planning Commission and then first revised in 1983. Thereafter three major amendments were issued to the 1983 version, two in 1987 and the third in 1997. The second revision of the Code was in 2005, to which two amendments were issued in 2015. The revised Code has been brought out in 2016 as National Building Code of India 2016 reflecting the state-of-the-art and contemporary applicable international practices.



The comprehensive NBC 2016 contains 12 Parts some of which are further divided into Sections totaling 33 chapters. The salient features of the revised NBC include, apart from other changes made, the changes specially in regard to further enhancing our response to meet the challenges posed by natural calamities.

The NBC 2016 contains chapters on development control rules and general building requirements, fire and life safety, building materials, structural design, construction management, practices and safety and building services besides others.

Rapid Visual Screening

While the safe dwelling constructed in the world over has been the kingpin for advancement of human civilization, it also poses a potential hazard in the event of earthquakes and other related hazards. A lacuna in the construction quality brings loss in the life. Hence, there is a definite urgency to inspect the vulnerability of these built infrastructures so as to take timely corrective steps to prevent failure. Identifying potential danger arising out of many ill-conceived structures rampantly mushrooming in the major cities of India has to be taken up with utmost national priority. Rapid Visual Screening (RVS) of building is one such simple tool to classify vulnerability class based on professional judgement. Therefore, a training programme has been mooted for the building professionals of India.

The paradigm of sustainable development as a prime necessity in the realm of India's soaring economy, even though it was in existence in different form to developed nations, has been a latecomer to the Indian context. The upsurge of real estate developments across the country necessitates quality monitoring and regulation. While the safe dwellings constructed in the world over have been the kingpin for the advancement of human civilization, it also poses a potential hazard in the event of earthquakes and other related natural hazards. A lacuna in the construction quality brings in loss of life and disastrous economic consequences. Hence, there is a definite urgency to inspect the vulnerability of these built-infrastructures so as to take timely corrective steps to prevent failure. Identifying potential dangers arising out of many ill-conceived structures rampantly mushrooming in the urban/ city of India is to be taken up with utmost national priority. Rapid Visual Screening (RVS) of building is one such simple tool to classify vulnerability class based on professional judgment. Therefore, a training programme under the broad framework of NIDM was mooted for the building professionals of the seismic prone establishment of the country.

Rapid Visual Screening (RVS) is a cheap and fast procedure in assessing the safety of buildings and classifying them according to the risk that they pose in times of strong earthquakes. As per Indian Standard Code the Rapid Visual Screening method is designed to be implemented without performing any structural calculations. The procedure utilizes a damageability grading system that requires the evaluator to

a. identify the primary structural lateral load-resisting system, and
b. Identify building attributes that modify the seismic performance expected for this lateral load-resisting system along with non-structural components.

A building must go for detailed evaluation if the following conditions are met:

(a) The building fails to comply with the requirements of the preliminary evaluation.
(b) A building has six storeys and higher in RC and steel; and three storeys and higher in unreinforced masonry.
(c) Buildings located on incompetent or liquefiable soils and/or located near (less than 12 km) active faults and/or with inadequate foundation details.
(d) Buildings with inadequate connections between primary structural members, such as poorly designed and/or constructed joints of pre-cast elements.

Visually assessable variables, namely, storey number, cantilever extension, soft storey, weak storey, building quality, pounding effect, hill-slope effect, and peak ground velocity etc. are noted as earthquake hazard category. The inspection, data collection and decision-making process typically occurs at the building site, and is expected to take couple of hours for a building,

depending on its size, accessibility and societal response. The screening is based on Code based Seismic Intensity, Building Type and Damageability Grade as observed in past earthquake and covered in MSK/European macro-intensity. The RVS procedure can be integrated with GIS-based city planning database and can also be used with advanced risk analysis software. The methodology also permits easy and rapid reassessment of risk of buildings already surveyed based on availability of new knowledge that may become available in future.

The main uses of this procedure in relation to seismic upgrading of existing buildings are:

- To identify if a particular building requires further evaluation for assessment of its seismic vulnerability.
- To assess the seismic damageability (structural vulnerability) of the building and seismic rehabilitation needs.
- To identify simplified retrofitting requirements for the building (to collapse prevention level) where further evaluations are not considered necessary or not found feasible.

To develop a cadre of trained professionals in the area of earthquake risk mitigation, National Institute of Disaster Management (NIDM) –South Campus is organizing this training programme with following details:

Objectives of the Programme

1. To enhance understanding concerning
   - the nature and extent of the threats due to earthquake
   - the concept and issues involved in earthquake risk mitigation and management
2. To describe different activities involved in earthquake risk mitigation/ preparedness including building codes
3. To develop capability to analyze plans for better earthquake risk preparedness and mitigation measures to minimize the impact of earthquake
4. To provide a forum for inter-changing of ideas and views pertaining to earthquake risk mitigation

Target Group

This programme is primarily designed for people across the humanitarian to development spectrum, who may in some capacity be involved in earthquake risk mitigation activities at different levels. The programme will be useful for architects, engineers, planners, administrators, and faculty involved in teaching and research in this area.

Venue and Duration

The programme will commence on Monday, March 05, 2018 and will conclude on Friday March 09, 2018 at NIDM South Campus, APHRDI Complex at Bapatla, Andhra Pradesh.

Registration

The participants of the programme will assemble at NIDM and register themselves on Monday, March 05, 2018, at 9.30 a.m. onwards. NIDM Team will assist them in Registration.

Programme Details

The training programme schedule, list of participants, faculty involved and the Programme Staff assisting this programme are included.

Faculty for the Programme

Besides NIDM, faculty from various leading organizations working in the area of earthquake risk reduction will be invited for interaction with the participants of the programme.

Evaluation of the Programme

The final session of the programme will be devoted to panel discussion, evaluation of the course content and valediction. The participants will be supplied with an evaluation proforma, which may be completed and handed over to the Programme staff.

Certificate

A Certificate of participation will be awarded to each participant on successful completion of the programme.

Detailed Programme Schedule (Tentative)

Hrs	Monday (March 5)	Tuesday (March 6)	Wednesday(March 7)	Thursday(March 8)	Friday(March 9)
9:30 10:00-10:15	Registration Inauguration	Recapitulation – 1st day	Recapitulation – 2nd day	Recapitulation – 3rd day	Recapitulation – 4th day
10:15-11:30	Expectations, Experience Sharing & Ground Rules **- CG, AAK**	Engineering Approaches for Seismic Risk Mitigation **- *CG***	Seismic Micro-zonation studies for earthquake risk mitigation - **Local Resource Person**	Discussion on RVS exercise **Participants / CG, AAK**	School and Hospital Preparedness for Earthquake Risk Mitigation **- *AAK***
11:30	**Tea Break**	**Tea Break**	**Tea Break**	**Tea Break**	**Tea Break**
11:45-13:00	Earthquake risk & hazard profile of South India - ***AAK***	***-Do-***	RVS of buildings around – a tool to mitigate the earthquake risk ***- CG***	Retrofitting Techniques for earthquake risk mitigation - **CG, AAK**	Administrative concerns for earthquake safety of buildings **– Local Resource Person**
13:00	**Lunch break**	**Lunch break**	**Lunch break**	**Lunch break**	**Lunch break**
13:45-15:15	***_Do_***	Non-structural mitigation of earthquake risk with a short field visit - ***AAK***	Field Visit for conducting Rapid Visual Screening of Buildings **- CG, AAK**	Architectural and Planning Approaches for Seismic Risk Mitigation **- Local Resource Person**	Training evaluation exercises ***Valedictory Function***
15:15	**Tea break**	**Tea break**	**Tea break**	**Tea break**	**Tea break**
15:30-17:00	Local Built Environment and Earthquake Risk Mitigation – a discussion **- CG&AAK**	National Building Code -2016 and its implications in Earthquake Risk Mitigation **Local Resource Person**	-Do-	Preparing earthquake risk mitigation plan **– *an exercise*** **- CG, AAK**	
17:00-17:15	Summary of 1st day's program	Summary of 2nd day's program	Summary of 3rd day's program	Summary of 4th day's program	

Faculty for the Programme

NIDM Faculty

Name	Address
Shri Sanjeev Kumar Jindal	JS,DM & Executive Director, NIDM
Dr. Chandan Ghosh , Professor & Head	Course Director, NIDM
Dr. Amir Ali Khan, Assistant Professor	Co-Course Director, NIDM

External Resource Persons

Name	Address
1. Dr Hanumanth A Rao	Professor & Dean, Rajiv Gandhi Knowledge Technology

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