Development of Hypothetical Mw = 8.0 Sunder Nagar Earthquake Disaster Scenario for Disaster Risk Management – An NDMA led Multi-State Earthquake Preparedness Campaign.

Minutes of the Meeting held on 06.06.2012 at HP Secretariat, Shimla.

A meeting on Multi-State Earthquake Scenario was held on 6th June, 2012 at 1215 hours at HP Secretariat, Shimla. The meeting included a presentation and discussion on multi-state earthquake scenario with its epicentre at Sunder Nagar, Himachal Pradesh. Background note on the proposed exercise is at Annexure – A.

2. The meeting was chaired by:

- Prof. Prem Kumar Dhumal, Hon'ble Chief Minister, Himachal Pradesh.

3. The other Dignitaries who attended the meeting were:-

- Sh. M. Shashidhar Reddy, Hon'ble Vice Chairman, NDMA, New Delhi.
- Sh. T Nanda Kumar, Hon'ble Member, NDMA, New Delhi.
- Sh. Sudripta Roy, Worthy Chief Secretary, Himachal Pradesh.

4. The list of participants is at Annexure – B.

5. At the outset, the Chief Secretary, HP welcomed team of NDMA led by Hon'ble Vice Chairman. He thanked Hon'ble Chief Minster to spare his valuable time for the meeting. He also welcomed all the participants of the meeting.

6. The Chief Secretary said that Himachal Pradesh is prone and vulnerable to many natural and man-made hazards and the State keep facing various disasters every year. And there is need to prepare ourselves to face them. Keeping in view the disaster risk of the State, there is need to proactive disaster risk reduction and preparedness at all level.

7. Hon'ble Vice Chairman, NDMA expressed his gratitude for providing opportunity for holding this meeting. Recalling the 1905 Kangra earthquake he said that 20,000 people died when the population of the area was very less but now the population of the area has increased multi-fold and built-up environment has also increased many times. Therefore, the earthquake risk has increased several time. He also drew the attention towards the projections made by Prof. A S Arya of the repeat of 1905 Kangra earthquake. Citing example of March, 2011 Japan earthquake which resulted in Tsunami and then nuclear disaster, he said we need to prepare ourselves to face disasters proactively. Earthquakes don't come with warning and there is greater need to prepare ourselves to face them so that loss of life and property can be minimised. He also emphasized the need to look into the aspects which need to be looked into so that earthquake risk can be reduced and minimised. He said that for the first time in the country, the earthquake preparedness campaign was organized in NCT of Delhi during October 2011 and February 2012. There were two main objectives of this Mega Drill. Firstly to generate greater public awareness about the vulnerability of Delhi

to disasters with specific emphasis on earthquakes and steps to be taken by people to save themselves, their family and the community in the event of an earthquake. There were also Information, Education and Communication (IEC) interventions with the campaigns in print media, FM Radio, outdoor media, rallies, nukkad natak, workshops, etc. over 3 crore SMSs were also sent to people in the NCT of Delhi. Mr. Kapil Dev was the goodwill ambassador. All these initiatives culminated in the Mega Mock Exercise on 15th February 2012. Delhi Disaster Management Authority (DDMA) in close collaboration and guidance of National Disaster Management Authority conducted this exercise in all the 9 Districts of the NCT at over 400 places simultaneously, with the participation of more than 15,000 Officials. About 400 Army observers were also deployed to cover the exercise. There was large scale involvement of volunteers, Civil Defence Volunteers and Resident Welfare Associations (RWAs). He hoped that the proposed mutli-state earthquake scenario preparedness exercise would receive full support from the State Government and its departments so that it results into increased awareness and preparedness to deal with earthquake risk of the region.

8. Thereafter, Maj. Gen. (Retd.) R K Kaushal, Senior Specialist (Policy and Plans), NDMA gave a detailed presentation on the proposed scenario with its aims, objectives, magnitude, intensity, area likely to be affected, stakeholders to be involved etc. Summary of the key points of the presentation is as under:-

A. **Role of NDMA:-**

- Scenario Building led by IIT Bombay and IIT Madras.
- Assist training of the trainers in various disciplines.
- Conceptualise and conduct Mass Awareness Programmes in partnership with the states.
- Guide the Multistate Table Top Exercise and Mega Mock Drill.

B. **Major Initiatives to be taken during the Exercise:** Training of Trainers for :

- Incident Response System
- Engineers for Rapid Visual Assessment
- State Response Force

C. **Scenario Based Response Plan to be prepared by the Department of the State which will mainly contain:-**

- Gap Analysis
- Damage Assessment
- Resource Mapping
- Intra State Coordination Mechanism
- Inter State Coordination Mechanism
- Updating Existing Plans
- State and District Level

D. **Awareness Campaign to be launched during the Exercise:** Joint Campaign by States in Partnership with NDMA

- Print- Stress on vernacular media.
- Electronic- Local channels to be preferred.
- Publicity departments in the States to have full ownership to make innovative contribution.
- Extensive use of SMS

(Programme to be finalized by August and launched from September onwards)

E. <u>Expectations from the State Government/State Government Departments:-</u>

- Nomination of Nodal Officer for each State and by each Departments of the State Government.
- Identification of various sites and Departments which shall provide the data for the actual exercise.
- Setting up of EOCs for actual running of the exercise and data for damage assessment.
- Review and up- dating of plans and SOPs.
- Training of key personnel from various departments.
- Conduct of Tabletop exercise and mock drills at departmental and district levels.
- Involve officials for coordination with IIT B & IIT M, Geo-Hazards Society and NDMA.
- Make available training facilities as per project requirement.
- Ensure participation of key officials in training programs
- Effective Coordination Mechanisms:-
  - IRS framework to be institutionalised
  - Coordination amongst various agencies (Central and State) and NDMA.
- Preparation of the Standard Operating Procedures for Response, Capacity Building and Preparedness.
- Vulnerability assessment:-
  - Assess the impact of earthquake scenario on legal, functional & administrative responsibilities and financial resources.
  - Identification and Structure safety audit of Life Line Buildings i.e., Type & age of the Structure and Land Use.
- Mitigation Measures:-
  - Strengthening (Retrofitting) of Lifeline structures and resources.
  - Effective Non Structural Measures
  - Robust Disaster Management Plans.
  -

9. For ready reference and more information the copy of the Presentation is attached at Annexure – C. The list of the key departments which have been identified for this exercise has been annexed as Annexure – D. Besides, all departments of the State Government would be involved in this exercise.

10. Sh. Nanda Kumar, Hon'ble Member, NDMA said that while preparing for earthquake risk reduction, the State must learn from the 16th September, 2011 Sikkim earthquake. This

earthquake resulted in more than 250 landslides and all access blocked the roads after the earthquake. Inclement weather conditions hindered relief operations through air.

11. He also emphasised that there is urgent to construct earthquake resistant schools and hospitals and for this purpose the State should project demand for additional funds under the 12th Five Year Plan to take care of extra cost involved in incorporating earthquake features in new construction. While constructing roads it is required that the design takes care of slops so that it should not lead to landslides. Further, while doing the resource mapping exercise the tie-up with neighbouring states is also required so that their help can be taken in case earthquake hits the State.

12. Dr. Srikant Baldi, Principal Secretary (Finance) emphasised that earthquakes don't give warning and hence no time for response. Hence there is urgent need for retrofitting life-lines buildings to begin with and also to ensure that earthquake resistant features are incorporated in new constructions. He expects NDMA to provide know-how on retrofitting. Vice Chairman, NDMA informed the meeting that a Core Committee of experts has been constituted at the national level which will come up with guidelines on retrofitting. Besides, a National Earthquake Risk Mitigation Project is likely to be implemented in near future in which there is a major component on training and capacity building in earthquake resistant construction, etc.

13. Sh. SK Das, Additional Chief Secretary (SJE and TE) stressed upon the need of advance planning, resource mapping and alternate means of communication as communication is the first causality during disasters. Dr. Nagin Nanda, Secretary cum Director, Environment, Science and Technology said that the State has set-up Centre for Climate Change and AGISAC and these institutions would play important role in disaster management.

14. Dr. PC Kapoor, Principal Secretary (Industries, Labour and Employment) emphasised the need of putting in place techno-legal regime in the entire State for effective disaster mitigation. Earthquakes won't distinguish between rural and urban areas and would cause the same loss if earthquake resistant features are not incorporated in constructions be it any area, he said.

15. Vice Chairman NDMA also emphasised the need of raising State Disaster Response Force so that specialised response is available with the State and it can be deployed without loss of time. He also reiterated NDMA's assistance to the State in training and equipping the same. Dr. PC Dhiman, Principal Secretary (Home) urged NDMA to place one NDRF battalion in the State at the earliest as the land for the same has been earmarked for the purpose near Nurpur, District Kangra. The acquisition of land for the purpose is in the final stages.

16. The Chief Secretary highlighted the need of purchasing standard equipment for disaster response. The Vice Chairman NDMA said that the NDMA has put a list of equipment required for disaster response in the NDMA Website and 5% funds available with States under the State Disaster Response Fund should be fully utilised to purchase equipment required for the State. The training and capacity building funds under the FC-XIII are also available with the States to improve capacity in disaster response.

Address of Hon'ble Chief Minister

17. Hon'ble Chief Minister welcomed Vice Chairman NDMA and his entire team to the State and assured that the State would take active part in the proposed exercise and do everything possible to reduce disaster and particularly earthquake risk in the State. He acknowledged that disaster management is an important issued now and a lot needs to be done to reduce disaster losses and damages. Earthquake hazard is a serious cause of concern for Himachal and there is need to ensure inclusion of earthquake resistant features in all new constructions. According to him, main problem pertains to rural areas where Town and Country Planning Act doesn't apply. He emphasised the need of educating people about disasters and need to prepare for them. He desired that the Gram Sabha Meetings held four times a year should be utilised to educate people about various hazards and management of disasters. IEC material also needs to be distributed in these meetings on various aspects of disaster management. Disaster management should become peoples' rather than only a Government's programme, he said.

18. At the end, he assured the NDMA that the suggestions given by it have been noted by State and its officers and the State Government would take steps necessary as required to reduce earthquake risk and make the proposed exercise a success.

19. The meeting ended with the vote of thanks.

Sd/-
Principal Secretary (Revenue) to the
Government of Himachal Pradesh.

Edst No. Rev(DMC)(F)11-25/2011-I Dated: Shimla -2, 19th June, 2012.

Copy forwarded to:-

1. All the Additional Chief Secretaries to the Govt. of HP.
2. All the Principal Secretaries/Secretaries to the Govt. of Himachal Pradesh.
3. Director General of Police.
4. All the Heads of Department, Himachal Pradesh.
5. All the Deputy Commissioners in Himachal Pradesh.
6. PS to Vice Chairman, NDMA, NDMA Bhawan, A-1 Safadarjang Enclave, New Dehli.

Additional Secretary (Revenue) to the
Government of Himachal Pradesh,
HP Secretariat, Shimla – 171002.

Annexure – A

Background Note

M=8.0 Mandi, Earthquake Disaster Scenario for Conduct of Multi-State Exercise

1. Background

The NDMA for the first time in history of our country has initiated a project to develop a multi-state earthquake disaster scenario for the hypothetical earthquake of Magnitude 8 with its epicenter at Sundernagar Town in Mandi District of Himachal Pradesh replicating Mw = 8.0 Kangra earthquake of 1905, which had generated an Intensity of X on MM scale in Kangra. The epicenter of the Hypothetical earthquake is located in a "seismic gap" in western Himalaya and several scientists expect this region to experience a large earthquake in the future.

2. The main objectives of the project are:

a) To generate awareness amongst the stakeholders of an earthquake of such a high magnitude covering a large number of states.
b) To evaluate the response mechanism and functioning of various stakeholders to identify gaps.
c) To facilitate preparation of response plans at various levels.
d) To facilitate coordination between DDMAs, SDMAs and NDMA.
e) To understand the direct and indirect consequences of the earthquake in the affected area.
f) To provide a template for development of earthquake scenario elsewhere in the country.

3. Scenario

This Scenario has been developed by a team lead by NDMA and consists of scientific experts in the field of earthquake engineering (from IIT Bombay and IIT Madras) including scientists from Wadia Institute of Himalayan Geology, Seismology Division IMD and Geological Survey of India. The simulation results with the epicenter near Sundernagar in the Mandi District of Himachal Pradesh which lies in the seismic zone V has predicted strong shaking in the states of Himachal Pradesh, Haryana, Punjab, Uttarakhand and Jammu & Kashmir state governments and Union Territory of Chandigarh. The earthquake has been considered to be on the Main Boundary Thrust at a depth 15 Km. The MSK Intensity map using the Boore and Atkinson (2008) GMPE is shown in figure 1. It is seen that the maximum intensity obtained due to this earthquake is IX which is observed at the rupture surface. It is also seen that the MBT fault is ruptured to a length of 200 Km over the districts starting from the middle of Kangra passing through Mandi, Bilaspur and Solan.

The salient points of the Scenario are:

Intensity IX and above is felt over most parts of Himachal Pradesh, Punjab and in some parts of Haryana, Uttarakhand and Uttar Pradesh.

- The extents of Intensity VI are observed in five states, Jammu and Kashmir, Himachal Pradesh, Haryana, Uttaranchal and Uttar Pradesh. It may be further noted that the Intensity VI region in the map is truncated, and only the area included in the map are considered for this project.
- The ground motion parameters have been amplified in the south west of the rupture, which is due to presence of Indo-Gangetic plan in the region.
- Such a Scenario will also impact the States of Jammu & Kashmir, Uttarakhand and Uttar Pradesh. However for administrative reasons the mock exercises are being planned for Himachal Pradesh, Haryana, Punjab and Union Territory of Chandigarh.

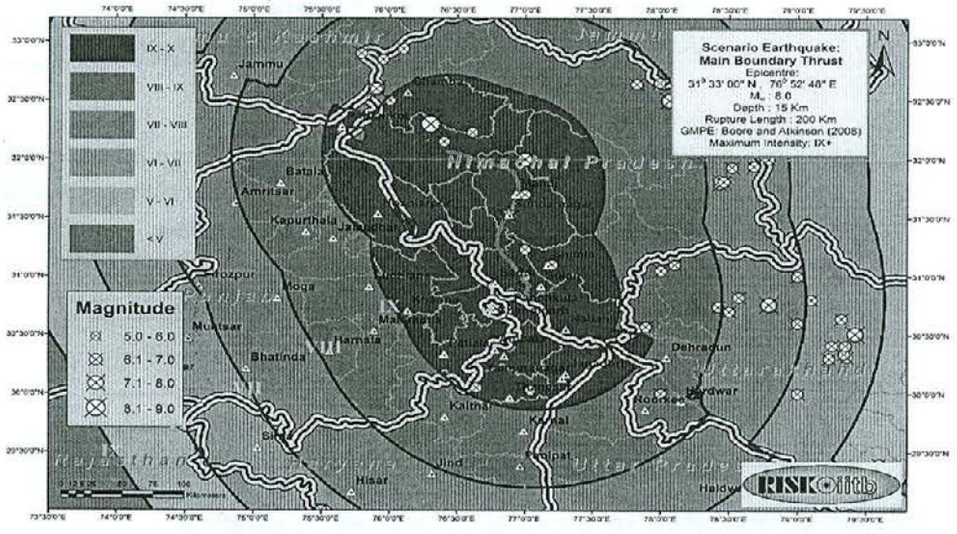

Figure 1

Details of important urban centres with damage intensities are shown below:

Intensity	State	Districts
IX-X	Chandigarh	Chandigarh
	Haryana	Ambala,Karnal,Kurukshetra Yamunanagar
	Himachal Pradesh	Bilaspur,Chamba, Hamirpur,Kangra, Kullu, Lahul and Spiti, Mandi, Shimla, Sirmaur, Solan, Una
	Jammu and Kashmir	Kathua
	Punjab	Fatehgarh Sahib, Gurudaspur, Hoshiarpur, Jalandhar, Ludhiana,

		Patiala, Rupnagar SAS Nagar, SBS Nagar
	Uttarakhand	Dehradun
IX-VIII	Haryana	Kaithal, Karnal, Jind, Panipat
	Himachal Pradesh	Kinnaur.
	Jammu & Kashmir	Doda Jammu, Kargil, Kishtware, Ladakh
	Punjab	Amritsar,Bhandinda,Faridkot
	Uttrakhand	Uttarkashi, Tehri Gariwal
VII-VIII	Haryana	Bhiwani, Hisar,Jhajjar, Rohtak, Sonipat
	Jammu and Kashmir	Kulgam, Rajauri, Reasi
	Punjab	Muktsar
	Uttarakhand	Garhwal, Rudraprayag

- District having two or more MSK Intensity regions has been listed in the highest intensity group. The total population exposed to different damage intensities (as per 2011 census data) have been represented in Table below.

Intensity	Population (in lakhs)
IX-X	231.8
VIII-IX	323.6
VII-VIII	251.6
VI-VII	136.3

Isoseismals incomplete for Intensity less than VII. Appendix-A

The scenario depicted above requires coordination at the National, State and district level. It would require almost 11-12 Emergency Support Functions to be activated by the various departments. Since the area also houses large number of defence establishments participation of the armed forces will also be essential.

Planning for conduct of the Scenario has been scheduled with a detailed review of the existing plans. Training of the stakeholders with full support from NDMA to SDMA and DDMAs for the conduct Tabletop and Mock Exercises at the district, departmental and state levels will be organized. A mega Mock exercise is also planned to be conducted at Chandigarh as a culminating event of this initiative.

4. Delhi Earthquake Preparedness Campaign & Mega Mock Drill

Delhi lies in seismic zone IV and being the National Capital, its high vulnerability to earthquakes has been a matter of great concern. While the country in general is well prepared to deal with disasters which come with some early warning, quick onset disasters without any early warning like earthquakes is a challenge not only for us in the country but elsewhere in the world as well.

For the first time in the country, the earthquake preparedness campaign was organized in NCT of Delhi during October 2011 and February 2012. There were two main objectives of this Mega Drill. Firstly to generate greater public awareness about the vulnerability of Delhi to disasters with specific emphasis on earthquakes and steps to be taken by people to save themselves, their family and the community in the event of an earthquake. And also raise awareness that it is not earthquake that kills but it is the buildings that collapse and result in injury and death and therefore, the importance of constructing safe buildings, which comply with earthquake resistant norms. The second objective was to test the response capabilities of various agencies at the state and district levels and identify gaps.

The campaign included sensitization and orientation workshops for the Hon'ble Members of the Delhi Assembly and also for the Hon'ble Judges of the Delhi High Court. Besides, drills were also conducted in Schools, RWAs, Malls, Metro Stations, Cinema halls, etc. throughout the NCT of Delhi.

There were also Information, Education and Communication (IEC) interventions with the campaigns in print media, FM Radio, outdoor media, rallies, nukkad natak, workshops, etc. over 3 crore SMSs were also sent to people in the NCT of Delhi. Mr. Kapil Dev was the goodwill ambassador.

All these initiatives culminated in the Mega Mock Exercise on 15th February 2012. Delhi Disaster Management Authority (DDMA) in close collaboration and guidance of National Disaster Management Authority conducted this exercise in all the 9 Districts of the NCT at over 400 places simultaneously, with the participation of more than 15,000 Officials. About 400 Army observers were also deployed to cover the exercise. There was large scale involvement of volunteers, Civil Defence Volunteers and Resident Welfare Associations (RWAs).

This was the biggest ever exercise conducted in the country till date.

5. Seismicity of the Region and Earthquake Vulnerability

The region is highly vulnerable to earthquake. Most part of these States falls under seismic zone V and IV. The region has already experienced some of the most devastating earthquakes like Kangra in 1905 and Kinnaur in 1975. As no early warning for the earthquakes can be provided, preparedness for response is extremely important .

6. Kangra Earthquake, 1905

On 04th April 1905 an earthquake of Magnitude 7.8 Mw occurred at 6.19 a.m. in Kangra region of Himachal Pradesh. Nearly 20,000 people lost their lives. Kangra and Dharamshala including Mcleodganj was completely devastated. Extensive damages were also reported from Lahore, Gurdaspur, Pathankot, Jalandhar, Ludhiana, Ambala, Shimla and Dehradun. Tremors were felt in Delhi as far as Calcutta as well.

7. 1992 Scenario by Prof Arya

The renowned Seismologist Prof A S Arya reconstructed Kangra earthquake scenario in 1992. He created a scenario of an earthquake of magnitude 8.o Mw and projected that it could cause complete collapse of nearly 1,45,000 houses, partial collapse of 2,68,000 houses. The loss of life could range from 88,999 to 3,44,000 depending on the time of the day. In 2005 Muzaffarabd Earthquake of magnitude 7.7 Mw, which occurred during day time, the actual number of lives lost was 73,338. The total death toll during Muzaffarabad was very close the number as predicted in the reconstructed Kangra Earthquake Scenario.

8. Involvement of States and UT

Under this scenario, even though Jammu & Kashmir and Uttarakhand will also be affected, this exercise for practical purposes will be limited only for Himachal Pradesh, Punjab, Haryana and Chandigarh UT. These States/ UT will actively participate in this exercise. While, the other earthquake vulnerable states like Jammu & Kashmir, Uttarakhand, NE States, Bihar, Uttar Pradesh will be the observers.

9. Districts Involved

All the districts from Himachal Pradesh and Punjab and 13 out of 21 districts from Haryana will be involved in this exercise.

NDMA will be taking up this campaign in close cooperation with the States of Himachal Pradesh, Haryana, Punjab and Union Territory of Delhi. This exercise will culminate in a Mega Mock Exercise in the tri cities of Chandigarh, Mohali and Panchkula and Shimla in the month of February 2013.

10. Conclusion:

This is the first ever initiative being under taken in the country at the multi state level. The success of this scenario will depend upon the full participation of the SDMAs, DDMAs, various line departments and other stakeholders in coordination with the NDMA and other central agencies. It is also hoped that this nine months long initiative will continue to maintain its momentum under the leadership of Hon'ble Chief Ministers duly supported by the Chief Secretaries.

Annexure – B

List of Participants

Sr. No.	Name	Designation
1.	Sh. P. Mitra	Addl. Chief Secretary (Agriculture)
2.	Sh. S.K. Dash	Addl. Chief Secretary (SJE &TE)
3.	Sh. T.G. Negi	Addl. Chief Secretary (Tpt.,IPH)
4.	Sh. Prem Kumar	Addl. Chief Secretary (F&S, Coop & TD)
5.	Sh. Ajay Mittal	Principal Secretary to CM and PWD
6.	Dr. P.C. Kapoor	Principal Secretary (Ind. Labour & Emp.)
7.	Sh. P.C. Dhiman	Principal Secretary (Home & Health)
8.	Dr. Shrikant Baldi	Principal Secretary (Finance)
9.	Sh. SKBS Negi	Principal Secretary (RD and PR)
10.	Sh. Ajay Bhandri	Secretary (GAD)
11	Dr. Nagin Nanda	Secretary-cum-Dir., Env. SC & Tech.
12.	Sh. S.C. Pal	Addl. Secretary (Forest)
13.	Sh. Gopal Chand	Addl. Secretary (Rev.)
14.	Sh. D.C. Rana	SPO –GOI-UNDP
15.	Dr. S.S. Randhawa	Scientist, SCSTE
16.	Maj. Gen.(Retd) R.K. Kaushal	Sr. Specialist (Policy & Plans)
17.	Sh. R.S. Saxena	C/O NDMA, New Delhi

Annexure – D

Departments at State Level

- Disaster Management / SDMA / DDMA
- Revenue
- Home
    - Police
    - Civil Defense
    - Home Guards
    - Fire Department
- Urban Department
- Health
- Agriculture
- Public Works Department / PHED / Rural Works Dept
- Animal Husbandry
- Water Resource and Water Supply
- Power/Electricity
- Forest Department
- Transport
- Information and Public relation department
- Food and Civil Supplies
- Irrigation
- Rural Development
- Panchayati Raj Department
- Education
- Industries, Labour and Employment Department
- Tourism Department
- Remote Sensing Centers of All the States

Ministries/Departments at National Level:

- Ministry of Home Affairs (MHA)
- Ministry of Defense (MoD)
- Ministry of Telecommunication Environment and Forest
- Health and Family Welfare (MoHFW)
- Rural Development and Drinking Water Supply (MoDW)
- Earth Sciences (MoES)
- Urban Development (MoES)
- Water Resources (MoWR)
- Agriculture (MoA)

- Railways (MoR)
- Civil Aviation (MoCA)
- Building Material Promotion Technology Council (BMPTC)
- Indian Meteorological Department
- Border Roads Organization
- Bhakra Beas Management Board
- National Highway Authority of India (NHAI)
- National Hydel Power Corporation (NHPC)
- National Remote Sensing Center (NRSC)
- Pawan Hans
- National Disaster Response Force (NDRF)

National Disaster Management Authority

Multi-State Earthquake Preparedness Campaign

Why This Initiative??

- Earthquakes occur at large intervals, making it difficult to predict their impacts.
- The inadequate level of awareness about earthquakes.
- There is inadequate scientific human resource and data for development of such scenarios.
- States of Himachal Pradesh, Punjab, Haryana, Uttarakhand, J&K and UT of Chandigarh fall close to prominent fault lines making these States highly vulnerable to this hazard.

National Disaster Management Authority

Presentation on

Mw=8.0 Mandi, Earthquake Disaster Scenario for Conduct of Multi-State Exercise

Objectives

- Understand the direct and indirect consequences of a big Earthquake.
- Evaluate the State/District Disaster Management Plans and identify gaps.
- Updating Response Plans at various levels.
- Mass Casualty Management.
- Coordination between DDMAs, SDMAs and NDMA and all other stakeholders.
- Generate Awareness.

Aim

To understand the implications of a possible major earthquake and its likely impact on several States on ***preparedness, response and coordination.***

Magnitude Scale

Magnitude	Description	Earthquake Effects	Occurrence Globally
Less than 2.0	Micro	Micro earthquakes, not felt	Continual
2.0–2.9	Minor	Generally not felt, but recorded.	1,300,000 per year (est.)
3.0–3.9			
4.0–4.9	Light	Noticeable shaking of indoor items, rattling noises. Significant damage unlikely.	13,000 per year (est.)
5.0–5.9	Moderate	Can cause major damage to poorly constructed buildings over small regions. At most slight damage to well-designed buildings.	1,319 per year
6.0–6.9	Strong	Can be destructive in areas up to about 160 kms (99 mi) across in populated areas.	134 per year
7.0–7.9	Major	Can cause serious damage over larger areas.	15 per year
8.0–8.9	Great	Can cause serious damage in areas several hundred kms across.	1 per year
9.0–9.9	Great	Devastating in areas several thousand kms across.	1 per 10 years (est.)
10.0+	Massive	Never recorded, widespread devastation across very large areas; see below for equivalent seismic energy yield.	Extremely rare

Earthquake Intensity
MSK-Medvedev Sponheuer Karnik Scale

Intensity (I-XII) defined based on strength of shaking and its impact

Intensity	Impacts of Earthquake
MSK V	Awakening. Felt Indoors by all
MSK VI	Frightening, moderate damage, heavy furniture may move
MSK VII	Many well built building suffer moderate damage
MSK VIII	Most well built buildings suffer severe damage
MSK IX	Most well built buildings suffer extensive damage
MSK X	Most Well-built buildings suffer irreparable damage
MSK XI	Ground considerably distorted by broad cracks
MSK XII	Ground surface radically changed

Major Earthquakes in India

- Chamoli 1999 M_w=6.6
- Bhuj 2001 M_w=7.7
- Indian Ocean Earthquake 2004 M_w=9.34
- Kashmir 2005 M_w=7.6
- Sikkim 2011 M_w=6.9
- Indian Ocean Earthquake 2012 M_w=8.5,8.2

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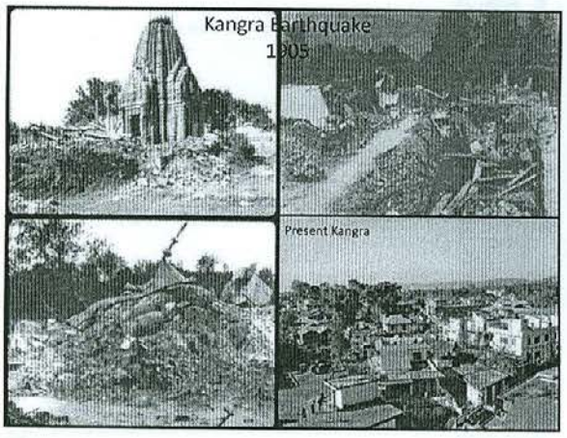
Better Compliance with Building Codes

S. No.	Earthquakes	Mag	How much bigger than Haiti Eq.	PGA (Peak Ground Acceleration)	Casualties	Injured	Bldgs. Damaged	People Affected	Economic Loss
1	Japan (2011)	9.0	> 900 times	2.99 g	24178	5281	125000	4.4 Million	USD 10 Bn.
2	New Zealand (2011)	6.3	21 times smaller	1.88 g	375	300	>1000	NA	USD 11.92 Bn.
3	Chile (2010)	8.8	>700 times	0.65g	562	>1000	5,00,000	2 million	> USD 15 Bn.
4	Haiti (2010)	7.0	-	0.50 g	3,16,000	3,00,000	10,00,000	3 million	USD 8.1 Bn.

11



Major Earthquakes in India

- Shillong *1897* M_w=8.1
- Kangra *1905* M_w=7.8
- Bihar-Nepal *1934* M_w=8.2
- Assam *1950* M_w=8.5
- Koyna 1967 M_w=6.5
- Kinnaur 1975 M_w=6.8
- Latur 1993 M_w=6.2
- Jabalpur 1997 M_w=6.2

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4th April 1905 Kangra Earthquake

District and towns completely devastated	-Kangra and Dharamshala including Mcleodganj
Extensive damage	-Lahore, Gurdaspur, Pathankot, Jalandhar, Ludhiana, Ambala, Shimla and Dehradun.
Tremors were felt	-In Delhi and as far as Calcutta

6/19/2012

Kangra Earthquake: Mw 8.0 Reconstructed in 1992 by Prof A S Arya

- Could cause complete collapse of 1,45,000 houses
- Partial collapse of 2,68,000 houses.
- The loss of life could range from 88,999 to 3,44,000 depending on the time of the day and season when it occurs.

(*Reference: Current Science, Vol.62,nos 1 & 2, 25th Jan'92*)

13

Delhi Earthquake Preparedness Campaign and Mega Mock Exercise Oct'11- Feb'12

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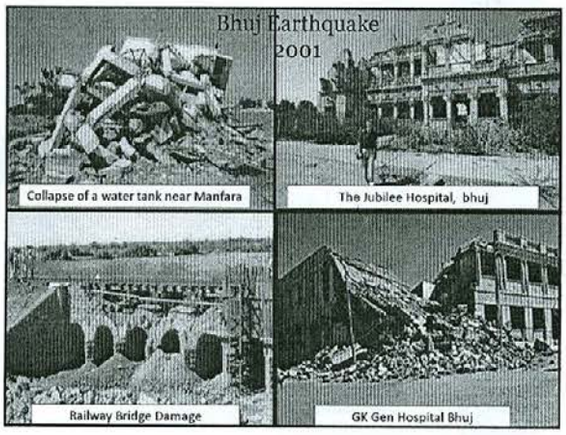
Bhuj Earthquake 2001



Run up Activities (Oct'11-Feb'12)

•IEC Interventions

- Media campaign:
- FM Radio
- News Papers
- Outdoor Media – BQS, Unipole, Metro, Bridge Panel, etc.
- SMS
- Rallies, Flyer distribution, Nukkad Nataks, Public Lectures, Apada Mitra
- Mr. Kapil Dev was the Goodwill ambassador of the campaign

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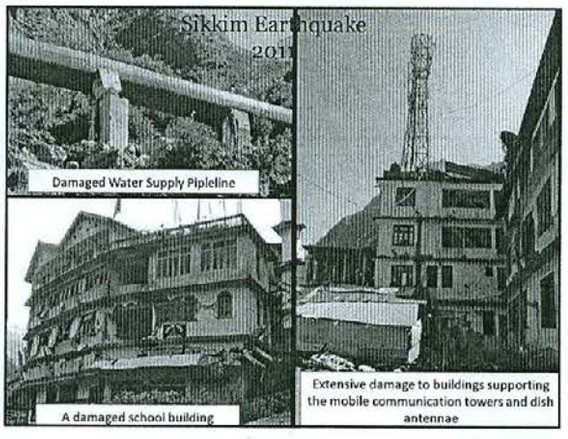
Sikkim Earthquake 2011



Media Campaign

Run up Activities

Orientation and Sensitization Workshops for

- Members of Delhi Legislative Assembly
- High Court Judiciary, Judges and Lawyers of District Courts
- Government Departments, Residence Welfare Associations, Slum areas

Mock Drills were conducted in

- Schools & Colleges
- Malls,
- Metro Stations,
- Hotels
- Resident welfare Associations

Details of Mock Drill

- Exercise conducted in all the 9 Districts of National Capital Territory.
- Mock Drill was conducted at 400 places simultaneously.
- More than 15,000 Officials participated.
- 400 plus Officials from Army came as observers.
- Involvement of all the Agencies.

Mega Mock Drill Assumptions

- The exercise started at 11:30 hrs on 15th February
- Scenario was an earthquake on Delhi-Moradabad fault line, at 11:30 hrs on 15 Feb 2012.
- Hypothetical Epicenter of the earthquake was 275 km East of Delhi, near Moradabad

Lessons Learnt

- Need for establishment of Delhi Disaster Response Force.
- Need for State-of-the art emergency operation centers at the state and district level with redundancy.
- Common communication system for all the stakeholders.
- Standardisation of SOPs of Various ESFs.
- Implementation of Incident Response System.

Assumptions

- Tremors lasted for 48 seconds
- Extreme weather conditions

Resulting in:

- Massive collapse of infrastructure
- A significant number of casualties
- Walled city, East, NE and West Delhi, suffered the maximum
- Fire and Gas leaks at number of places

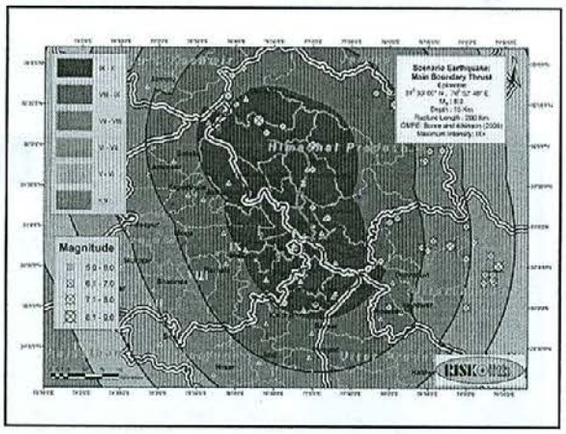
Lessons Learnt

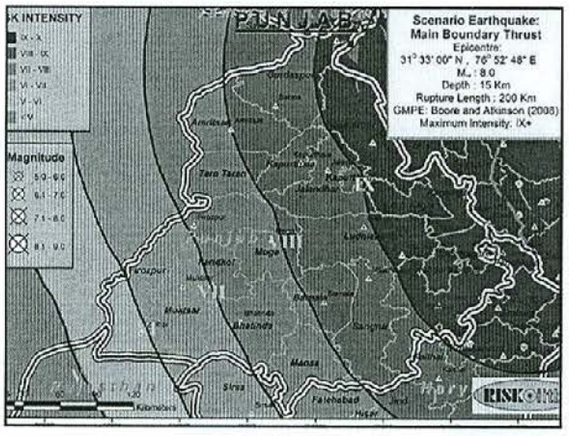
- State-of-the-art equipment and systematic inventory of resources.
- Need for adequate number of ambulances.
- Survey of Vulnerable Buildings

Proposed Mandi Scenario

States Likely to be Affected

- Haryana
- Punjab
- Himachal Pradesh
- Chandigarh
- Jammu & Kashmir
- Uttarakhand



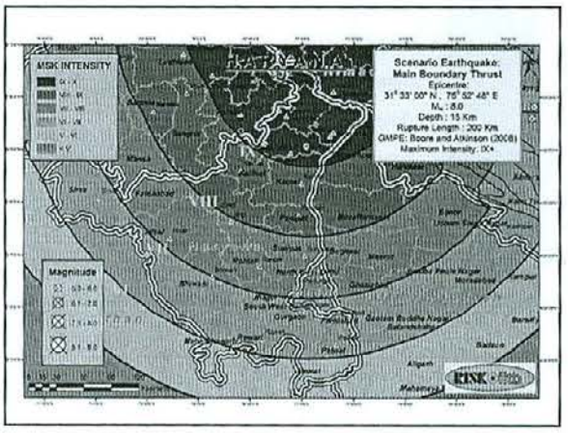


Details of Scenario

- Epicenter = Sundarnagar (Mandi District, HP)
- Magnitude= Mw 8.0
- Maximum Intensity =IX+
- Intensity range = VII to X
- Depth=15km
- Rupture Length=200km

Punjab

State	Intensity	Districts
Punjab (20 /20 districts)	IX – X	Gurudaspur, Hoshiarpur, Jalandhar, Rupnagar , SBS Nagar, Ludhiana, SAS Nagar, Fatehgarh Sahib, Patiala *Chandigarh UT* (May suffer extensive infrastructure/ building damage)
	VIII – IX	Amritsar, Kapurtala, Tarn Taran, Moga, Faridkot, Sangrur, Barnala, Bhatinda, Mansa (May suffer severe building damage)
	VII – VIII	Muktsar (May suffer severe to moderate building damage)



Himachal Pradesh

State	Intensity	District
Himachal Pradesh (12/12 distt.)	IX – X	Chamba, Lahul and Spiti, Kangra, Kullu, Mandi, Hamirpur, Una, **Shimla**, Bilaspur, Solan, Sirmaur (May suffer extensive infrastructure/ building damage)
	VIII – IX	Kinnaur (May suffer severe building damage)

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Haryana

State	Intensity	District
Haryana (13/21 distts.)	IX – X	Panchakula , Ambala, Yamunanagar, Kurukshetra, Karnal, *Chandigarh UT* (May suffer extensive infrastructure/building damage)
	VIII – IX	Kaithal, Jind, Panipat (May suffer severe building damage)
	VII – VIII	Hisar, Sonipat, Rohtak, Bhiwani, Jhajjar (May suffer severe to moderate building damage)

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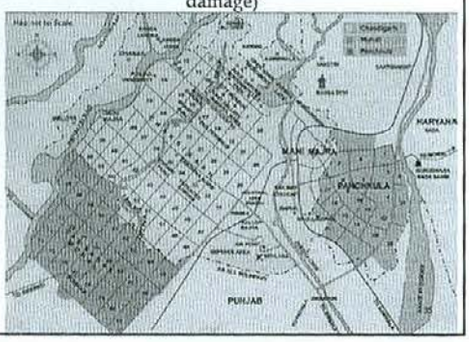
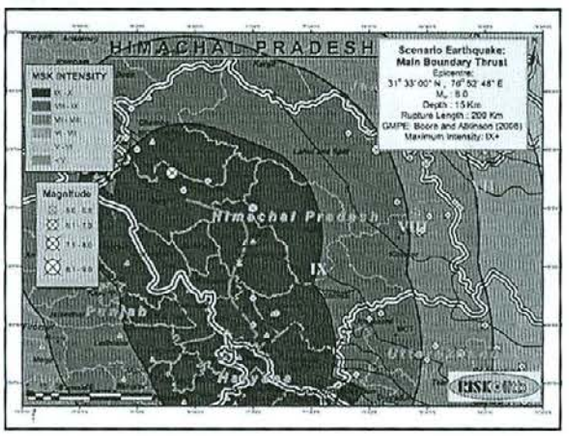
Union Territory Chandigarh

Intensity IX –X

(May suffer extensive infrastructure/building damage)





Scenario Development

- The exercise would be based on proposed Mandi earthquake scenario with realistic events built on scientific principles.
- This will enable the Administration and other Stakeholders to provide realistic responses.
- To develop the scenario, data/ information is required from departments and districts of the participating States.
- Key officers from the Administration to be involved in all stages of scenario development.

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NDMA'S Role

- Scenario Building led by IIT Bombay and IIT Madras.
- Assist training of the trainers in various disciplines.
- Conceptualise and conduct Mass Awareness Programmes in partnership with the states.
- Guide the Multistate Table Top Exercise and Mega Mock Drill.

Awareness Campaign

Joint Campaign by States in Partnership with NDMA

- Print- Stress on vernacular media.
- Electronic- Local channels to be preferred.
- Publicity departments in the States to have full ownership to make innovative contribution.
- Extensive use of SMS

(Programme to be finalized by August and launched from September onwards)

Major Events of The Campaign (By NDMA)

Training of Trainers for :

- Incident Response System
- Engineers for Rapid Visual Assessment
- State Response Force

Mega Mock exercise at Chandigarh & Shimla

Time line –February 2013

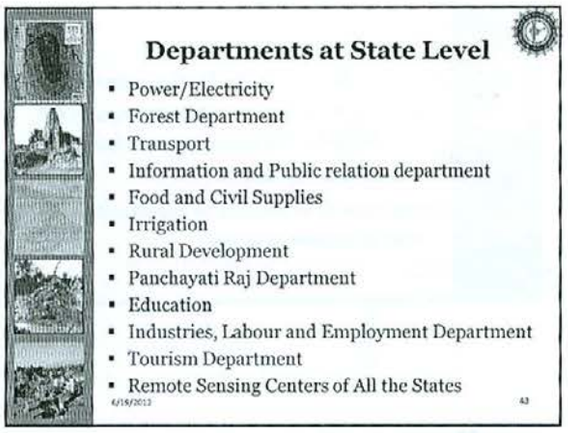
- Involving
  1. Tri-city (Chandigarh, Panchkula and SAS Nagar -Mohali)
  2. Shimla
- Participation of all States/UT (States of Punjab, Haryana, Himachal Pradesh and Chandigarh UT).
- Observers from Jammu & Kashmir and Uttarakhand.

Scenario Based Response Plan

- Gap Analysis
- Damage Assessment
- Resource Mapping
- Intra State Coordination Mechanism
- Inter State Coordination Mechanism
- Updating Existing Plans
- State and District Level

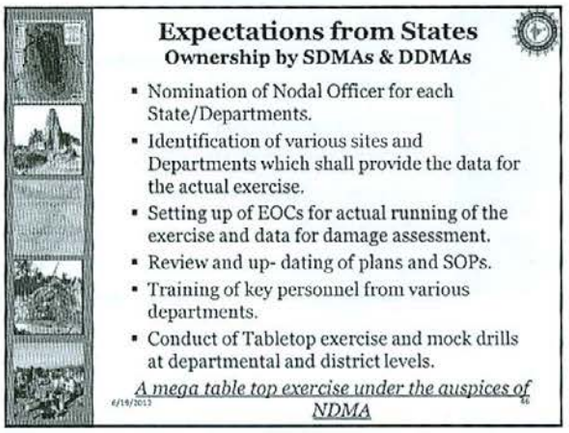
Departments at State Level

- Disaster Management / SDMA / DDMA
- Revenue
- Home
  - Police
  - Civil Defense
  - Home Guards
- Urban Department
  - Fire Department
- Health
- Agriculture
- Public Works Department / PHED / Rural Works Dept
- Animal Husbandry
- Water Resource and Water Supply



Departments at State Level

- Power/Electricity
- Forest Department
- Transport
- Information and Public relation department
- Food and Civil Supplies
- Irrigation
- Rural Development
- Panchayati Raj Department
- Education
- Industries, Labour and Employment Department
- Tourism Department
- Remote Sensing Centers of All the States



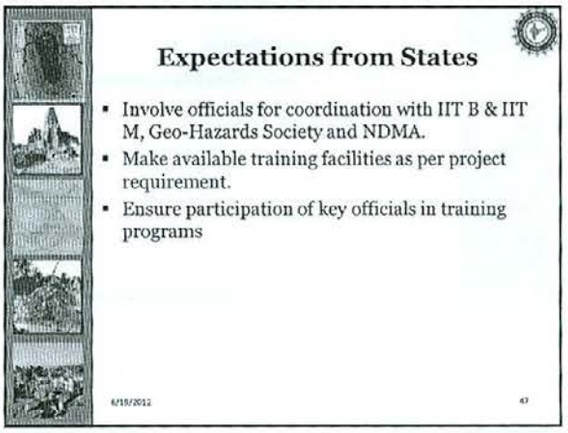
Expectations from States
Ownership by SDMAs & DDMAs

- Nomination of Nodal Officer for each State/Departments.
- Identification of various sites and Departments which shall provide the data for the actual exercise.
- Setting up of EOCs for actual running of the exercise and data for damage assessment.
- Review and up- dating of plans and SOPs.
- Training of key personnel from various departments.
- Conduct of Tabletop exercise and mock drills at departmental and district levels.

A mega table top exercise under the auspices of NDMA

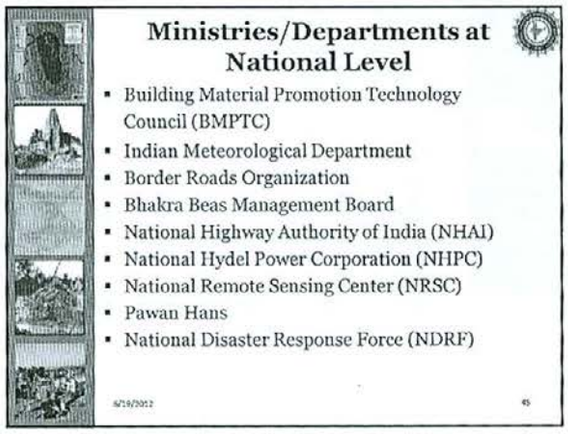
Ministries/Departments at National Level:

- Ministry of Home Affairs (MHA)
- Ministry of Defense (MoD)
- Ministry of Telecommunication Environment and Forest
- Health and Family Welfare (MoHFW)
- Rural Development and Drinking Water Supply (MoDW)
- Earth Sciences (MoES)
- Urban Development (MoES)
- Water Resources (MoWR)
- Agriculture (MoA)
- Railways (MoR)
- Civil Aviation (MoCA)



Expectations from States

- Involve officials for coordination with IIT B & IIT M, Geo-Hazards Society and NDMA.
- Make available training facilities as per project requirement.
- Ensure participation of key officials in training programs



Ministries/Departments at National Level

- Building Material Promotion Technology Council (BMPTC)
- Indian Meteorological Department
- Border Roads Organization
- Bhakra Beas Management Board
- National Highway Authority of India (NHAI)
- National Hydel Power Corporation (NHPC)
- National Remote Sensing Center (NRSC)
- Pawan Hans
- National Disaster Response Force (NDRF)

Expectations from States

Effective Coordination Mechanisms

- IRS framework
- Coordination amongst various agencies (Central and State) and NDMA.
- Preparation of the Standard Operating Procedures for Response, Capacity Building and Preparedness.
- Vulnerability assessment

-Assess the impact of earthquake scenario on legal, functional & administrative responsibilities and financial resources.

- Identification and Structure safety audit of Life Line Buildings i.e., Type & age of the Structure and Land Use.
- Mitigation Measures

-Strengthening (Retrofitting) of Lifeline structures and resources.

-Effective Non Structural Measures

-Robust Disaster Management Plans.

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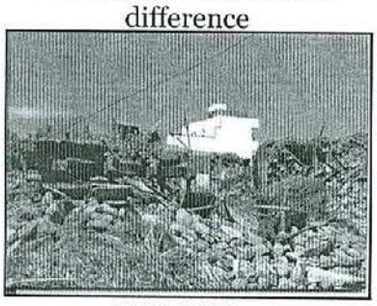
Intervention can make a difference



LATUR EARTH QUAKE

September 30, 1993; M 6.2; Lives Lost ~10,000

An engineered structure remains un-affected While all non-engineered structures fell

Photo by Harsh Gupta

THANK YOU

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