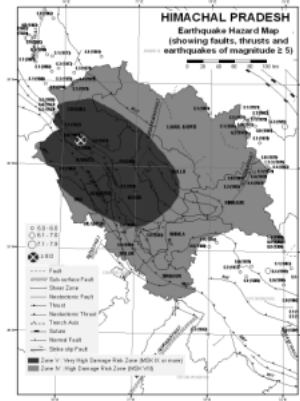


M 8 Mandi Multi-State Earthquake Scenario Project An Overview



Aim of Today's Meeting

- Introduce to State/District Authorities of HP
 - Importance
 - Details
 - Identify Roles & Responsibilities
 - State departments and districts
 - Future activities
 - Data requirements
- NDMA's Multi-State Earthquake Scenario Project



Objectives of the Project

- Main
 - Understand **consequences** of a large earthquake in the Himalaya
 - Facilitate **mainstreaming** earthquake risk management in state governments
 - Undertake **awareness campaign** and **mock-drill**

towards improved Mitigation, Preparedness and Response in HP against Earthquakes in the Himalayan region



Earthquake Concerns in North India

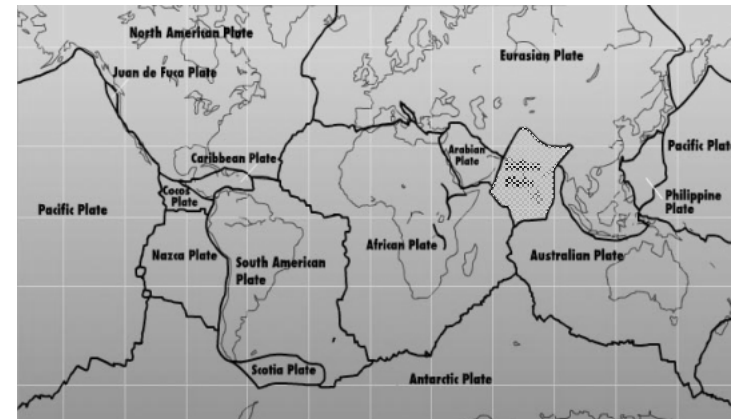


Why Worry About EQ Risk?

- Prevalent High Seismic Hazard in North India
 - Continued Seismic Activity
 - Earth's surface divided into several “plates” that are undergoing relative motion
 - Relative motion along the plate boundaries causes earthquakes



Earth's Plates



Indian Seismicity

- Several large earthquakes in Himalaya in last 200 years
 - M8+ Kumaon earthquake, 1803
 - M7.7 Kathmandu earthquake, 1833
 - M8.1 Shillong earthquake, 1897
 - M7.8 Kangra earthquake, 1905
 - M8.2 Bihar-Nepal earthquake, 1934
 - M8.5 Arunachal Pradesh earthquake, 1950

- But, none during last 60 years...



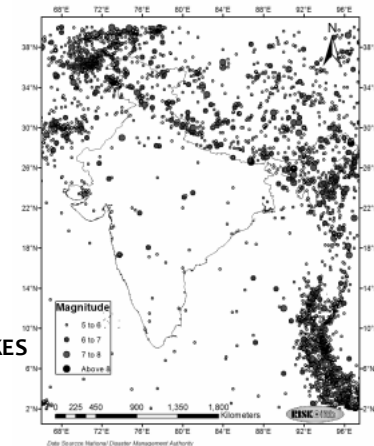
Indian Seismicity

Data Source

1850 to 2011

CATALOG OF $M \geq 5$ EARTHQUAKES

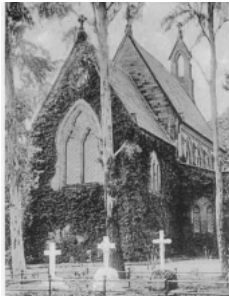
NDMA Project





1905 Kangra Earthquake

- Magnitude M 7.8



Before



After

Palampur Church



1905 Kangra Earthquake

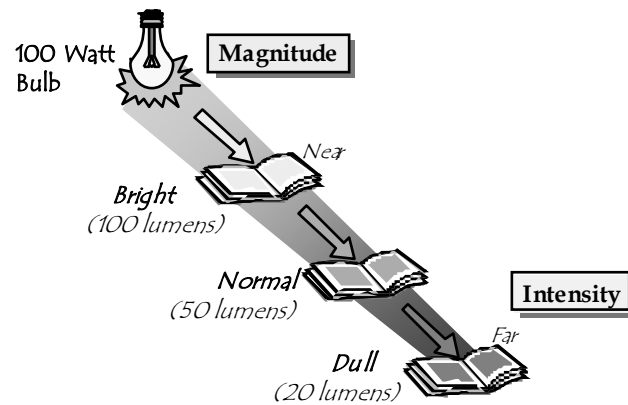
- Magnitude M 7.8



Mission House, Kangra



Magnitude versus Intensity



Earthquake Intensity

- MSK Scale

Strength of shaking and its impact at a SPECIFIC SITE

- XII : Landscape changes
 - Ground surface radically changed
- XI : Destruction
 - Ground considerably distorted by broad cracks
- X : General destruction of buildings
 - Most well-built buildings suffer irreparable damage
- IX : General damage of buildings
 - Most well-built buildings suffer extensive damage



Earthquake Intensity

- **MSK Scale**

Strength of shaking and its impact at a SPECIFIC SITE

- **VIII : Destruction of buildings**
 - Most well-built buildings suffer major damage
- **VII : Damage to buildings**
 - Many well-built buildings suffer moderate damage
- **VI : Frightening**
 - Few well-built buildings suffer moderate damage
 - Heavy furniture may move
- **V : Awakening**
 - Few weak buildings suffer moderate damage
 - Felt indoors by all



Effects of Earthquake Shaking

- **Ground shaking triggered**

- Landslides
- Soil liquefaction

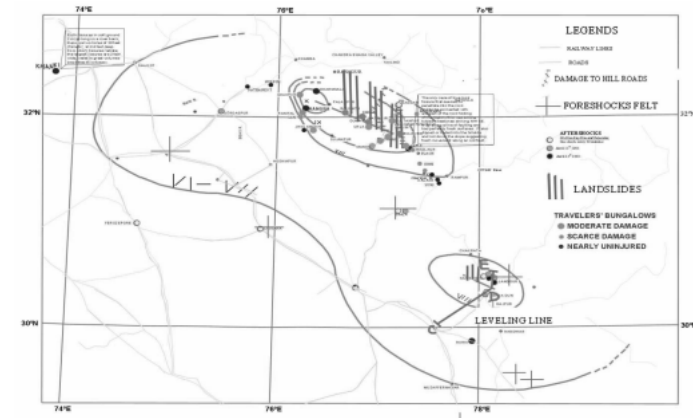
- **Impact**

- Built environment
 - **Buildings**
 - Residential, commercial, industrial, offices, ...
 - **Lifelines**
 - Roads, bridges, hospitals, water, power, communication, ...
 - **Dams ???!**
- People, administration, economy and defence capability



1905 Kangra Earthquake

- **Isoseismals (Rossi-Forel Scale)**

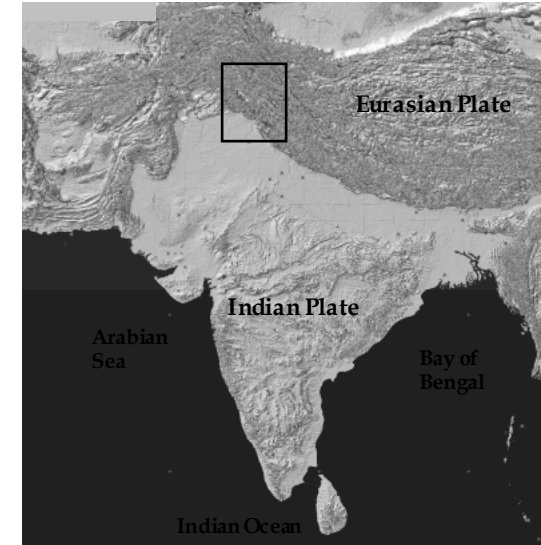


Projected Earthquake Scenario



The Earthquake

- Hypothetical Earthquake
 - Magnitude M 8.0
 - Epicentre near Mandi
 - on Main Boundary Thrust (MBT)
 - Earthquake in “seismic gap”



Significance

- Average number of earthquakes / year

Description	Magnitude	~ Annual Number
Great	≥ 8.0	1
Major	7.0 – 7.9	18
Strong	6.0 – 6.9	120
Moderate	5.0 – 5.9	800
Light	4.0 – 4.9	6,200



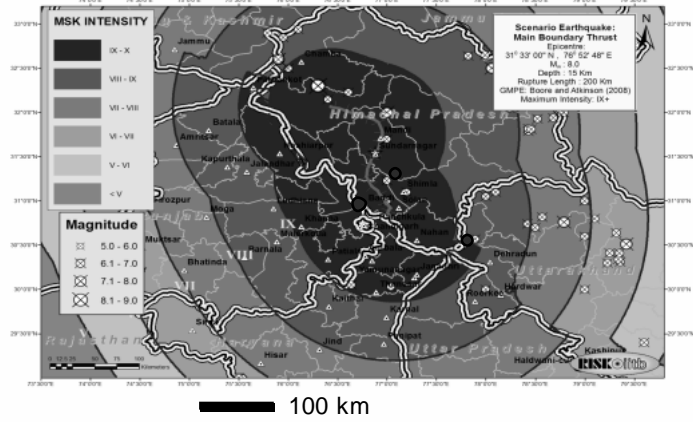
Significance

- Change in energy with magnitude

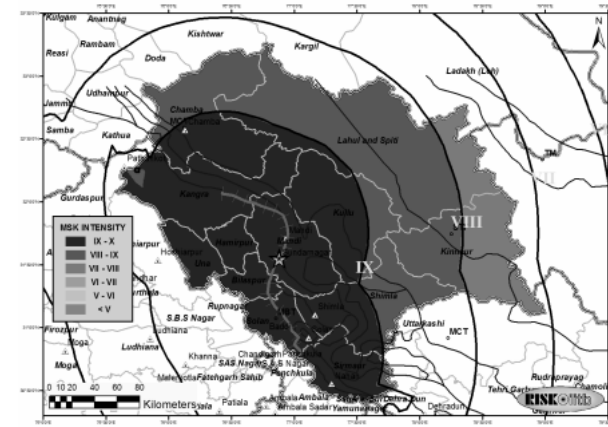
Magnitude Change	Displacement Change	Energy Change
1.0	10 times	32 times
2.0	100 times	1000 times

- M 8.0 Earthquake
 - Represents a GREAT earthquake likely to occur in the Himalaya

Projected Intensity Distribution



Projected Intensity Distribution : HP



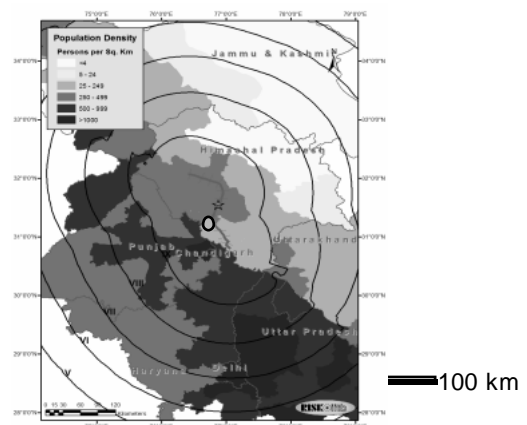
Projected Scenario Earthquake

- Exposed Area under the Scenario

Intensity	Area (km ²)	
	HP, Punjab, Haryana, UT C	HP
X to IX	56,167	28,606
IX to VIII	87,015	21,139
VIII to VII	86,424	5,928

Projected Scenario Earthquake

- Exposed Population





Projected Scenario Earthquake

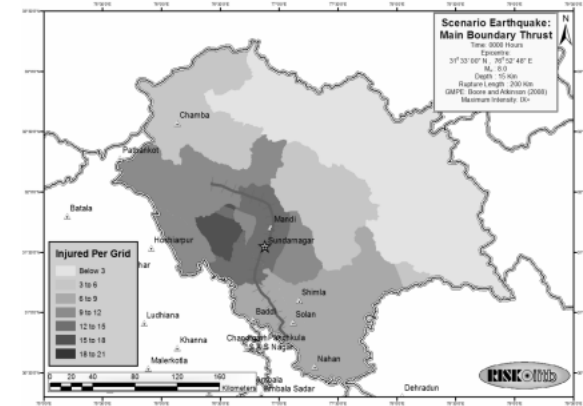
- Exposed Population

Intensity	Population (in Lakhs)	
	HP, Punjab, Haryana, UT C	HP
X to IX	231.8	57.7
IX to VIII	323.6	9.7
VIII to VII	251.6	0.6



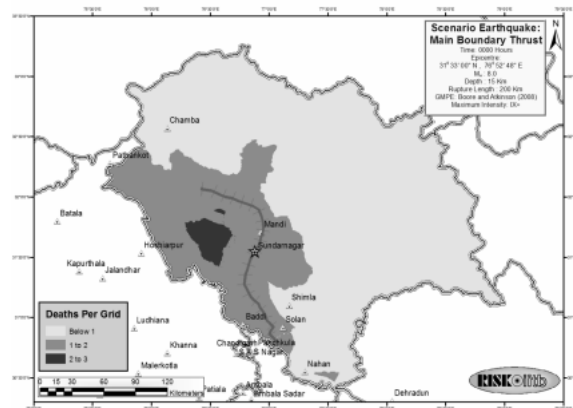
Projected Scenario Earthquake : HP

- Projected Injuries



Projected Scenario Earthquake : HP

- Projected Loss of Lives



Projected Scenario Earthquake : HP

- Estimated Injuries and Loss of Life
 - Mid-night estimate

State	Population (Census, 2011)	Projected Deaths	Projected Injuries
Himachal Pradesh	68,56,509	2.3% ~1,60,000	16% ~11,00,000

- Projected Ex-gratia
 - ~Rs. 700 Crores



Projected Scenario Earthquake : HP

• Estimated Injuries and Loss of Life

S No	District	Population (Census, 2011)	% Injured	% Deaths	
1	Chamba	5,18,844	19.9	2.4	
2	Kangra	15,07,223	15.5	2.3	
Zone V	3	Lahul & Spiti	31,528	19.3	2.2
	4	Kullu	4,37,474	19.2	2.5
	5	Mandi	9,99,518	19.7	2.5
	6	Hamirpur	4,54,293	16.1	2.5
	7	Una	5,21,057	11.4	2.2
	8	Bilaspur	3,82,056	15.0	2.2
Zone IV	9	Solan	5,76,670	10.4	1.8
	10	Sirmaur	5,30,164	15.8	2.3
	11	Shimla	8,13,384	17.0	2.4
	12	Kinnaur	84,298	13.8	2.0



Projected Scenario Earthquake

• Effects on Urban Areas in HP

Intensity	Some Cities/Towns
X to IX	Shimla
	Chamba, Mandi, Nahan, Solan
	Bilaspur, Dharmsala, Hamirpur, Kullu, Una
IX to VIII	Rampur



Earthquake Concern & Risk

• Concerns

- A large earthquake close to a city, like Shimla, can have devastating effects
 - Extent of damage influenced by local soil properties

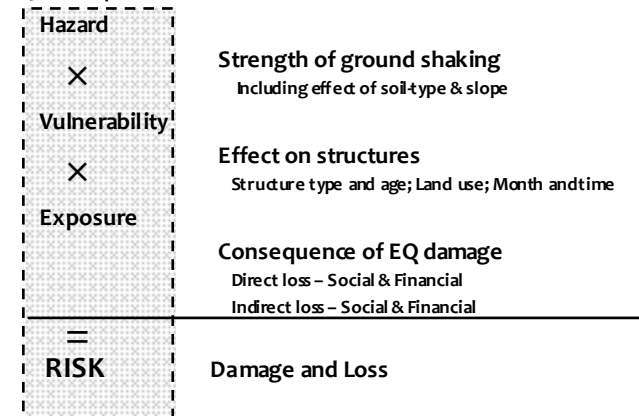
• Earthquake Risk

- Considers impact of the event
 - Potential damage and loss
- Risk management is effective, only if it is understood before attempting to manage it



Earthquake Risk

• 3 Components





Earthquake Risk

- 3 Components

Hazard

×

Strength of ground shaking
including effect of soil-type & slope

Completed



Earthquake Risk

- 3 Components

Vulnerability

×

Effect on structures
Structure type and age; Land use; Month and time

- IITs will provide information to help assess vulnerability
- Participating agencies will identify their structures, and assess impact of scenario earthquake on these



Earthquake Risk

- 3 Components

Exposure

Consequence of EQ damage
Direct loss – Social & Financial

- Participating agencies will assess this
- Agencies can use the risk information for other preparedness & awareness programs



Earthquake Risk Assessment

- 3 contributors to Seismic Risk
 - Hazard
 - Exposure of population
 - Vulnerability of Built Environment

- Risk assessment will require collection of data
 - Data formats will be provided



Earthquake Risk Assessment

- **Seismic Vulnerability Assessment by stakeholder agencies**
 - Select Critical Buildings
 - e.g., School Buildings, Hospital Buildings, Important Public Offices (Governance Continuity), Police Stations and Prisons, Fire Station Buildings
 - Select Critical Lifeline structures
 - e.g., Bridges, Cross Country Pipelines, Communication Towers, Water Reservoirs, Dams



Rapid Visual Screening

- **RVS Method**
 - Stakeholder Agencies to
 - **Identify**
 - Specific select buildings and lifeline structures to be surveyed
 - **Collect**
 - Structural data of select buildings and lifeline structures
 - **Assess**
 - Vulnerability of select buildings and lifeline structures



Earthquake Risk Assessment

- **Seismic Vulnerability Assessment**
 - Simple and Quick Preliminary Assessment (RVS Method)
 - **Understand level of vulnerability**
 - **Prioritise structures for Detailed Assessment**
 - RVS Method will be provided by IITs



Rapid Visual Screening

- **RVS Method**
 - Outcomes
 - **Prioritisation of Structures**
 - If Structural Score is above a cut-off value, the structure will require detailed assessment
 - **Refinement of Earthquake Scenario**
 - Inputs from States will be used by IITs



Data Requirement

- **Exposure**
 - Housing occupancy information
 - **Census Housing Data**
 - Population data
 - Rural :: Block Level
 - Urban :: Ward Level
 - Critical and Lifeline Buildings and Structures
 - **10 per district in all 12 districts**
 - 120 of them



Management of Project



Earthquake Risk

- **HP State Agencies to assess**
 - Impact on their functionality and financial resources
 - Their expected responsibilities
 - Effectiveness of coordination systems
 - **Other organisations**
 - **Within organisations**



Benefits to HP

- **Many**
 - Realistic understanding of consequences of a large earthquake
 - Upgraded/strengthened state and district DMPs
 - Improved implementation of tabletop exercises
 - ...



Role of HP Government

- 1. **Departments**
 - Suggested
 - Disaster Management / SDMA / DDMA
 - Revenue
 - Home
 - Police
 - Civil Defense
 - Home Guards
 - Urban Department
 - Fire Department
 - Health



Role of HP Government

- 2. **Departments**
 - Suggested
 - 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
 - State Remote Sensing Centres



Role of HP Government

- 3. **Coordinate compilation of lifeline structures inventory**
 - Assess seismic vulnerability of select critical buildings and lifelines
- 4. **Facilitate tabletop exercises as per project requirements**



Management of Scenario Project

- **Project monitored**
 - Administrative Level
 - NDMA at top level
 - SDMA at its top level
 - Technical Level
 - IITs
- **Nodal Officer of each stakeholder organisation**
 - Responsible for progress in her/his organisation
- **GeoHazards Society**
 - Facilitate and monitor progress of various state-level activities



Data Requirement

• Vulnerability

- Select Buildings and Lifelines Structures
 - e.g.,
 - School Buildings
 - Hospital Building
 - Important Public Offices (Governance Continuity)
 - Police Stations and Prisons
 - Bridges
 - Cross Country Pipelines
 - Water Reservoirs
- Dams
 - BBMB
 - Power Companies



Timeline

Activity	Timeline
Nomination of Trainers for • Vulnerability Assessment (by Rapid Visual Survey (RVS)) • Incident Response System • Table Top Exercise, Mock Exercise	Immediate



Timeline

Activity	Timeline
Training of Trainers : IRS	From September 2012
Training of Trainers : RVS Lifeline Buildings and Structures Critical Buildings	
Training of Trainers : Table Top and Mock Exercises	
Collection of Data : Buildings and Lifeline Structures	



Timeline

Activity	Timeline
Table Top and Mock Exercises	End Sep. 2012 – Jan. 2013
Launch of Media & Awareness Campaigns, and Press Meet	End of Sep. 2012
Scenario-specific Table Top Exercise	From end of Nov. 2012



Timeline

Activity	Timeline
Review of State/DDMPs and their Gap Analysis on the basis of EQ scenario and Table Top Exercises	From 1 st week of Dec. 2012
Mid-term Review	Mid-Dec. 2012
Finalization of State, District & Agency Disaster Mitigation Plans	End of Dec. 2012



Timeline

Activity	Timeline
Briefing Hon'ble Members of Assembly of HP State	Winter Session
Briefing Hon'ble MPs and Union Ministers from HP State	Jan. 2013
FINAL State-level Table Top Exercises	End of Jan. 2013
Multi-State Table Top Exercise	Early Feb. 2013



Thank you...



Jai Hind!!