VULNERABILITY ATLAS OF INDIA

Towards A Paradigm shift
from
Post-disaster Reconstruction & Relief
to
Pre-disaster Pro-active approach

Presentation by:
Dr. Anand S. Arya, FNA, FNAE
"Padmashree' awarded by President, 2002
Professor Emeritus, Deptt. of Earthquake Engg., I.I.T. Roorkee
National Seismic Advisor (EVR) GoI-UNDP (DRM) New Delhi

7th – 8th NOV, 2007, at 2nd Asian Ministerial Conference, New Delhi

BACKGROUND

- International Decade for Natural Disaster Reduction (IDNDR) 1990-2000

1. UN declaration of 1990-2000 as IDNDR highlighted the miseries caused by natural disasters and the need for action
2. At the mid-term Review of IDNDR held at Yokohama in May 1994, stakeholders shared experiences, assessed the state of the problem and emphasized an urgent shift in strategy

BACKGROUND

The Yokohama Message:

1. Most affected by disasters are the poor and the socially disadvantaged in developing countries
2. Disaster Prevention, mitigation and preparedness are better than disaster response.
3. Disaster response alone yields temporary relief at a very high cost.
4. Prevention contributes to lasting improvement in safety.

HAZARD VULNERABILITY IN INDIA

Indian Subcontinent: among the world's most disaster prone areas:

- 57% of land vulnerable to Earthquakes
- 8% of land vulnerable to Cyclones
- 5% of land (40 million hectares) vulnerable to River Floods

Hazard Vulnerability in India

Earthquakes

1. 12% land is liable to severe earthquakes
2. 18% land is liable to MSK VIII
3. 27% land is liable to MSK VII

Wind and Cyclones

1. 1891-1990: 262 cyclones (92 severe) in a 50 km wide strip on the East Coast
2. Less severe cyclonic activity on West Coast (33 cyclones in the same period)
3. In 19 severe cyclonic storms, death toll > 10,000 lives
4. In 21 cyclones in Bay of Bengal (India & Bangladesh) 1.25 million lives have been lost

HAZARD VULNERABILITY IN INDIA

Floods

1. Floods in the Indo-Gangetic-Brahmaputra plains are an annual feature
2. On an average, a few hundred lives are lost and millions are rendered homeless·
3. Lakhs of hectares of crops are damaged every year
4. More than a million kutcha houses are destroyed each year.

THE EXPERT GROUP: GOVERNMENT OF INDIA

Constitution of the Expert Group

In July 1994, 2 months after the Yokohama conference, the Government of India, Ministry of Urban Development constituted an Expert Group to examine the related issues and evolve recommendations for improving preparedness and prevention with respect to housing and related infrastructure

THE EXPERT GROUP

Experts & Organisations

1. Dr.A.S.Arya (Chairman), University of Roorkee
2. Dr.G.S.Mandal, India Meteorological Deptt.
3. Dr.V.C.Thakur, Wadia Instt. Of Himalayan Geology
4. Dr.Prem Krishna, University of Roorkee
5. Dr.N.Lakshmanan, Structural Engineering Research Centre.
6. Sh.S.K.Chaudhuri, Central Water Commission
7. Sh.T.N.Gupta, (Member Convenor), BMTPC, Ministry of Urban Development.

ISSUES ADDRESSED

The Expert Group appointed by the Govt. of India examined the current status of work being carried out in following areas:

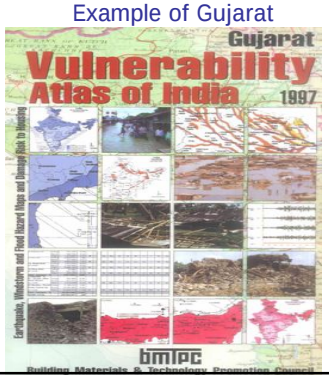
1. Monitoring of Hazards
2. Vulnerability Assessment
3. Prediction and Forecasting
4. Retrofitting of Existing Unsafe Structures and Buildings
5. Hazard Mapping;
6. Disaster Risk Assessment and Mapping
7. Preparation of Building Guidelines
8. Assessing Gaps in the Above and filling them as much as possible.

Policy:- Collect, collate, analysis and presents only available authentic information/data.

Vulnerability Atlas of India:

An Indispensable tool for pre disaster proactive approach for Disaster Management

Example of Gujarat



HAZARD MAPS

The monitoring of hazards is carried out by the following organisations in the country:

- Seismic occurrence and cyclone hazard monitoring by Indian Meteorological Department (IMD)
- Flood monitoring by the Central Water Commission.

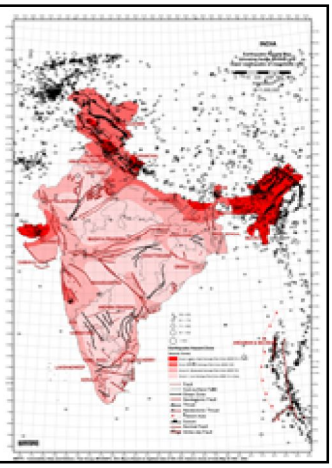
In addition noteworthy contributions are also provided by:

1. Geological Survey of India and the Department of Earthquake Engineering, University of Roorkee
2. The Bureau of Indian Standards Committees on Earthquake Engineering and Wind Engineering have a Seismic Zoning Map and the Wind Velocity Map including cyclonic winds for the country.
3. The Central Water Commission has a Flood Atlas of India

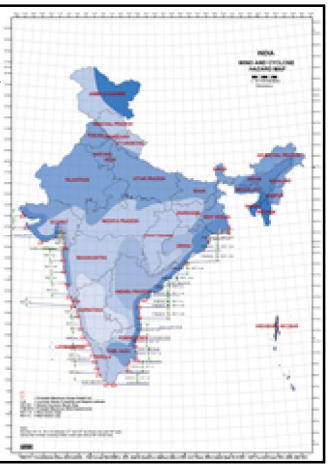
HAZARD MAPS

- The Group used these hazard maps to prepare 1:2.5 million scale maps by superposing the above available data on Survey of India map
- The earthquake, wind storm and flood hazard maps are drawn for each State and Union Territory separately.
- The intensities of earthquakes on MSK scale and intensity of the wind hazard related with wind speed are drawn on the maps to show various intensity zones.
- Flood prone areas were categorised in terms of unprotected and protected areas.

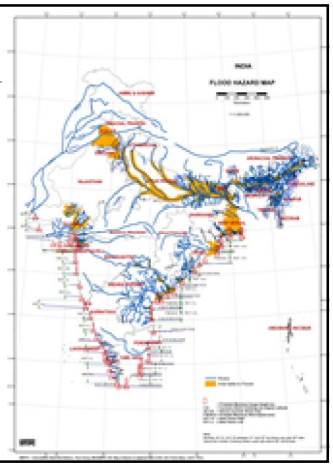
EARTHQUAKE HAZARD MAP OF INDIA



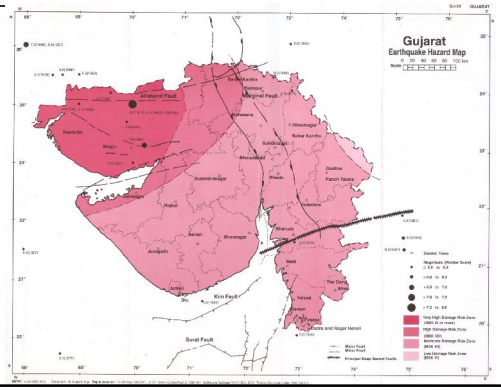
WIND & CYCLONE HAZARD MAP OF INDIA



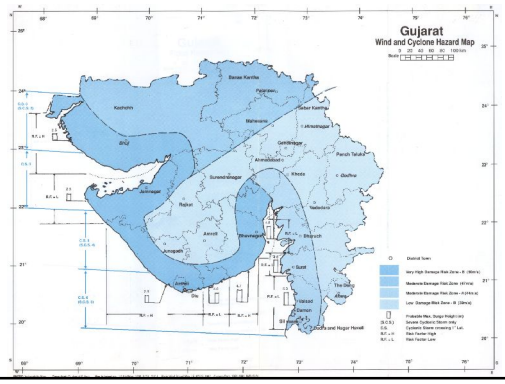
FLOOD HAZARD MAP OF INDIA



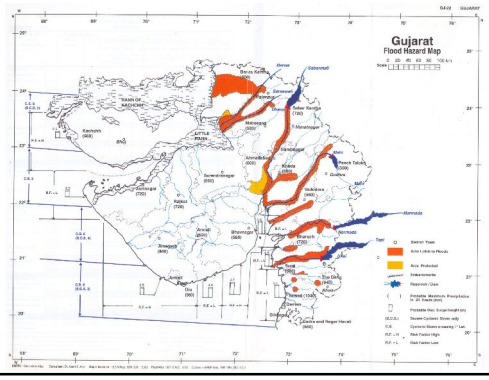
EARTHQUAKE HAZARD MAP OF GUJARAT



WIND & CYCLONE HAZARD MAP OF GUJARAT



FLOOD HAZARD MAP OF GUJARAT



EARTHQUAKE HAZARD MAPS

- Based on Seismic Zoning map of India given in IS:1893 1984.
- Seismo-tectonic features are marked as per ONGC map
- Epicenters and years of occurrence of earthquakes (>5.0 intensity), as per IMD catalogue of earthquakes

Note:- Smaller magnitudes not included, since lacking uniformity in detection and location.

CYCLONE AND HAZARD MAPS

- Based on wind speed maps given in IS 875 1987 (Part III).
- Along with design wind speed, the number of cyclones which have crossed each latitude of the sea coast in the past are also marked.

FLOOD HAZARD MAPS

- Based on the Flood Atlas of India prepared by the Central Water Commission.
- Maps show unprotected areas close to the river liable to flooding, as well as areas that have been protected using bunds.
- Other low lying areas outside river flood plains (which are also flooded during heavy rains due to choked drainage path) could not be plotted because of lack of data, which has to be collected by each state administration.

HOUSING RISK TABLES

- The building typology considered in the vulnerability atlas of India has been taken from Census of Housing 1991 in the Vulnerability Atlas, 1997
- The census houses include dwellings, residences, shop sum residences, workshops cum residences, hotels sarais, dharamsalas, tourist houses, inspection houses, business houses and offices, restaurant sweet shops and eating places, cinemas and panchayat ghars, places of worship and those lying vacant.

BUILDING TYPES IN THE CENSUS

The Census of Housing, 2001 Census of India,

a) Type of Roof:

i) Pitched or sloping including tiles, slate; corrugated iron, zinc or other metal sheets; asbestos cement sheets; plastic polythene, thatch, grass, leaves, bamboo, etc.

ii) Flat including brick, stone and lime; reinforced brick concrete/reinforced cement concrete.

b) Type of Wall:

i) Mud, unburnt bricks, stone laid in mud or lime mortar

ii) Burnt bricks laid in cement, lime or mud mortar

iii) Cement concrete

iv) Wood or Ekra walling

v) Corrugated iron, zinc or other metal sheets

vi) Grass, leaves, reeds/bamboo/thatch, plastic polythene & others

c) Type of Flooring:

Various types like mud, stone, concrete, wood or bamboo, mosaic floor tiles, etc.

BUILDING TYPES IN THE CENSUS (contd.)

Thus building categories will be taken as below:

Category - A :Buildings in field-stone, rural structures, unburnt brick houses, clay houses

Category - B: Ordinary brick building; buildings of the large block and prefabricated type, half-timbered structures, building in natural hewn stone

Category - C :Reinforced building, well built wooden structures

Category - X :Other materials not covered in A,B and C. These are generally light structures

BUILDING TYPES IN THE AS ADOPTED BY BMTPC

As adopted by BMTPC for Vulnerability Atlas of India

a) Type of Wall:

Type A1 – built using mud or unburnt brick or block

A2 – built using stone in any mortar

B - built using burnt brick using any mortar

C1 - built using concrete wall or concrete frame

C2 - constructed using wood frame and panelling

X - those not following under the above types, such as Grass, Thatch, Bamboo, Plastic, Polythene; G.I., Metal, Asbestos Sheets, any other material (all collected under one type X here)

The building categories defined under MSK Intensity Scales combine Types A1 and A2 under A, Type B under B and Types C1 & C2 under C. There is no category defining X types but this is retained in the Vulnerability Atlas as X.

BUILDING TYPES IN THE AS ADOPTED BY BMTPC (CONTD.)

As adopted by BMTPC for Vulnerability Atlas of India

a) Type of Roof:

Category - R1: Light Weight (Grass, Thatch, Bamboo, Wood, Mud, Plastic, Polythene, GI Metal, Asbestos Sheets, Other Materials)

Category - R2: Heavy Weight (Tiles, Slate)

Category - R3: Flat Roof (Brick, Stone, Concrete)

With these groupings, the vulnerability of each subgroup could be defined separately for any given Intensity of earthquake. The risk levels of the various categories of houses for the earthquake hazards are shown in Table-3, and explained in the following sections.

VULNERABILITY AND RISK ASSESSMENT

- A combination of local hazard intensity and vulnerability of existing house types has been used for carrying out risk analysis given in the district-wise tables (Previous slide).
- The Vulnerability Atlas provides ready macro-level information for use by the authorities for natural disaster mitigation and preventive actions.
- The effort toward vulnerability assessment of buildings under seismic, cyclone flood intensities was made by the expert group through long discussions

HOUSING RISK TABLE BASIS, 1997

TABLE - 5A

Damage Risk to Housing under various Hazard Intensities

Category (Type of Wall and Roof)	EQ Intensity MSK				Wind Velocity m/s				Flood		
	>IX	VIII	VII	<VI	55 & 50	47	44 & 39	33	Prone	Protected*	Outside**
A1. Mud wall (All roofs)	VH	H	M	L	VH	H	M	L	VH	M	L
A2.a. Unburned Brick Wall (Sloping roofs)	VH	H	M	L	VH	H	M	L	VH	M	L
A2.b. Unburned Brick Wall (Flat roofs)	VH	H	M	L	VH	H	M	L	VH	M	L
A3.a. Stone Wall (Sloping roofs)	VH	H	M	L	VH	H	M	L	VH	M	L
A3.b. Stone Wall (Flat roofs)	VH	H	M	L	H	M	L	L	VH	M	L
B.a. Burned Brick Wall (Sloping roofs)	H	M	L	VL	H	M	M	L	H	L	VL
B.b. Burned Brick Wall (Flat roofs)	H	M	L	VL	M	L	L	VL	H	L	VL
C1.a. Concrete Wall (Sloping roofs)	M	L	VL	NIL	H	M	M	L	L	VL	VL
C1.b. Concrete Wall (Flat roofs)	M	L	VL	NIL	L	VL	VL	VL	L	VL	VL
C2. Wood Wall (All roofs)	M	L	VL	NIL	VH	H	M	L	H	M	VL
C3. Ekra wall (All roofs)	M	L	VL	NIL	VH	H	M	L	H	M	VL
X1. GI and other metal sheets (All roofs)	M	VL	NIL	NIL	VH	H	M	L	H	M	VL
X2. Bamboo, Thatch, Grass, Leaves, etc. (All roofs)	M	VL	NIL	NIL	VH	VH	H	L	VH	M	L

* With probability of more severe damage under failure of protection works
** The local damage may be more severe under heavy rains

Building Category
Category - A : Buildings in field-stone, rural structures, unburnt brick houses, clay houses
Category - B : Ordinary brick buildings, building of the large block and prefabricated type, half-timbered structures, building in natural hewn stone
Category - C : Reinforced building, well built wooden structures
Category - X : Other types not covered in A, B, C. These are generally light.

Source: Vulnerability Atlas of India - 1997

VULNERABILITY ATLAS OF INDIA, 2006

NEED FOR REVISING AND UPDATING THE ATLAS

- Three new States created (Jharkhand, Uttaranchal, Chhattisgarh)
- More than 90 new districts established
- Seismic zoning map of India revised by BIS in 2002, with major changes in peninsular India
- Additional damaging earthquakes occurred (Chamoli-1999; Bhuj-2001)
- New housing census data available in 2001(wall and roof types listed separately)
- GSI published Seismo tectonic Atlas of Indian and its environs in 2002
- Devastating cyclone occurred in Gujarat in 1998 and super cyclone in Orissa in 1999
- Devastating floods in Uttar Pradesh , Bihar, Assam and West Bengal
- Landslide zonation Atlas published by BMTPC in 2003

PEER GROUP FOR REVISION

- Dr. A.S. Arya (Chairman), National Seismic Advisor, GoI
- Sh. S.R. Kalsi, India Meteorological Department
- Sh. Prabhash Pandey, Geological Survey of India
- Sh. M. K. Sinha, Central Water Commission
- Sh. M. Mohanty, Department of Science & Technology
- Dr. Prem Krishna, Indian Institute of Technology-Roorkee
- Dr. N. Lakshmanan, Structural Engineering Research Centre
- Dr. S. K. Thakkar, Indian Institute of Technology-Roorkee
- Sh. T. N. Gupta, Former ED, BMTPC
- Sh. R. K. Celly, (Member Convenor) BMPTC-MOUD
- Sh. J.K. Prasad (Co –Convenor) BMTPC- MOUD

MAJOR REVISION

- Total Digitisation of Maps and Tables
- Survey of India map of 1:2 million scale taken as base map
- Seismic zoning maps as per BIS 2002 map with Seismo tectonic features as per GSI Atlas
- Flood maps showing unprotect and protected flood prone areas in one Zone
- Earthquake and Cyclone occurrences upto 2004 incorporated
- Landslide hazard zoning map of India and selected zones included
- All new States & Districts included along with data on housing and areas falling in various zones
- Therefore, the Atlas provides all data updated upto 2004

HOUSING RISK TABLE BASIS, 2006

TABLE - 5

Damage Risk to Housing under Various Hazard Intensities

	Category Type of Wall	Level of Risk								
		Seismic Zone				Wind Velocity m/s				Flood Prone
		V	IV	III	II	55 & 50	47	44 & 39	33	
A1	Mud and Unburnt Brick	VH	H	M	L	VH	H	M	L	VH
A2	Stone Wall	VH	H	M	L	H	M	L	VL	VH
B	Burnt Bricks Wall	H	M	L	VL	H	M	L	VL	H/M
C1	Concrete Wall	M	L	VL	VL	L	VL	VL	VL	L/VL
C2	Wood wall	M	L	VL	VL	VH	H	M	L	H
X	Other Materials	M	VL	VL	VL	VH	H	M	L	VH
	Category Type of Roof									
R1	Light Weight Sloping Roof	M	M	L	VL	VH	VH	H	M	VH
R2	Heavy Weight Sloping Roof	H	M	L	VL	H	M	L	VL	H
R3	Flat Roof	Damage Risk as per that for the Wall supporting it								

Building Category : (By Wall Material)
Category - A : Buildings in field-stone, rural structures, unburnt brick houses, clay houses
Category - B : Ordinary brick building, buildings of the large block and prefabricated type, half-timbered structures, building in natural hewn stone
Category - C : Reinforced concrete building, well built wooden structures
Category - X : Other materials not covered in A,B,C, like light sheets and biomass materials
Note : Damage Risk is indicated assuming heavy flat roof in cases A, B and C (Reinforced Concrete) building

Building Category : (By Roof Material)
Category - R1 - Light Weight Sloping Roof (Grass, Thatch, Bamboo, Wood, Mud, Plastic, Polythene, GI Metal, Asbestos Sheets, etc)
Category - R2 - Heavy Weight Sloping Roof (Tiles, Slate)
Category - R3 - Flat Roof (Brick, Stone, Concrete)

Notes: 1. Flood prone area includes that protected area which may have more severe damage under failure of protection works. In some other areas the local damage may be severe under heavy rains and chocked drainage.
2. Source of Housing Data : Census of Housing, GOI, 2001

EQ Zone V : Very High Damage Risk Zone (MSK > IX)
EQ Zone IV : High Damage Risk Zone (MSK VIII)
EQ Zone III : Moderate Damage Risk Zone (MSK VII)
EQ Zone II : Low Damage Risk Zone (MSK < VI)

Level of Risk : VH = Very High; H = High; M = Moderate, L = Low; VL = Very Low

HOUSING RISK TABLE OF INDIA

TABLE - 4

Distribution of Houses by Predominant Materials of Roof and Wall and Level of Damage Risk

INDIA

Wall / Roof		Census Houses		Level of Risk under								
		No. of Houses	%	EQ Zone			Wind Velocity m/s				Flood Prone Area in %
				V	IV	III	II	55 & 50	47	44 & 39	33	
				Area in %				Area in %				
INDIA				10.9	17.3	30.4	41.4	5.0	40.2	48.0	6.7	7.9
WALL												
A1 - Mud &	Rural	65,807,212	26.4									
Unburnt Brick Wall	Urban	7,991,950	3.2									
	Total	***73,799,162***	***29.6***	*VH*	*H*	*M*	*L*	*VH*	*H*	*M*	*L*	*VH*
A2 - Stone Wall	Rural	20,347,899	8.2									
	Urban	5,133,918	2.1									
	Total	***25,481,817***	***10.3***	*VH*	*H*	*M*	*L*	*H*	*M*	*L*	*VL*	*VH*
Total - Category - A		**99,280,979**	**39.9**									
D - Burnt Bricks Wall	Rural	62,715,919	25.2									
	Urban	49,175,710	19.7									
	Total	***111,891,629***	***44.9***	*H*	*M*	*L*	*VL*	*H*	*M*	*L*	*VL*	*H/M*
Total - Category - B		***111,891,629***	***44.9***									
C1 - Concrete Wall	Rural	2,253,979	0.9									
	Urban	4,286,359	1.7									
	Total	***6,540,338***	***2.6***	*M*	*L*	*VL*	*VL*	*L*	*VL*	*VL*	*VL*	*L/VL*
C2 - Wood wall	Rural	2,363,200	0.9									
	Urban	833,792	0.3									
	Total	***3,196,992***	***1.2***	*M*	*L*	*VL*	*VL*	*VH*	*H*	*M*	*L*	*H*
Total - Category - C		***9,737,330***	***3.9***									
X - Other Materials	Rural	24,049,304	9.7									
	Urban	4,136,627	1.7									
	Total	***28,185,931***	***11.4***	*M*	*VL*	*VL*	*VL*	*VH*	*H*	*M*	*L*	*VH*
Total - Category - X		***28,185,931***	***11.3***									
TOTAL BUILDINGS		**249,095,869**										

HOUSING RISK TABLE OF INDIA

ROOF												
R1 - Light Weight Sloping Roof	Rural	69,342,567	27.8									
	Urban	17,350,091	7.0									
	Total	***86,692,658***	***34.8***	*M*	*M*	*L*	*VL*	*VH*	*VH*	*H*	*M*	*VH*
R2 - Heavy Weight Sloping Roof	Rural	65,299,492	26.2									
	Urban	13,036,138	5.2									
	Total	***78,335,630***	***31.4***	*H*	*M*	*L*	*VL*	*H*	*M*	*L*	*VL*	*H*
R3 - Flat Roof	Rural	42,895,454	17.2									
	Urban	41,172,127	16.5									
	Total	***84,067,581***	***33.7***	*Damage Risk as per that for the Wall supporting it*								
TOTAL BUILDINGS		**249,095,869**										

Housing Category : Wall Types
Category - A : Buildings in field-stone, rural structures, unburnt brick houses, clay houses
Category - B : Ordinary brick building; buildings of the large block & prefabricated type, Half-timbered structures, building in natural hewn stone
Category - C : Reinforced building, well built wooden structures
Category - X : Other materials not covered in A,B,C, These are generally light.
Notes : 1. Flood prone area includes that protected area which may have more severe damage under failure of protection works. In some other areas the local damage may be severe under heavy rains and chocked drainage.
2. Damage Risk for wall types is indicated assuming heavy flat roof in categories A, B and C (Reinforced Concrete) building
3. Source of Housing Data : Census of Housing, GOI, 2001

Housing Category : Roof Type
Category - R1 : Light Weight (Grass, Thatch, Bamboo, Wood, Mud, Plastic, Polythene, GI Metal, Asbestos Sheets, Other Materials)
Category - R2 : Heavy Weight (Tiles, Slate)
Category - R3 - Flat Roof (Brick, Stone, Concrete)
EQ Zone V : Very High Damage Risk Zone (MSK > IX)
EQ Zone IV : High Damage Risk Zone (MSK VIII)
EQ Zone III : Moderate Damage Risk Zone (MSK VII)
EQ Zone II : Low Damage Risk Zone (MSK < VI)
Level of Risk : VH = Very High; H = High;
M = Moderate; L = Low; VL = Very Low

BMTPC Building Materials & Technology Promotion Council

Peer Group, MoH&UPA, GOI

HOUSING RISK TABLE OF BALESHWAR

Distribution of Houses by Predominant Materials of Roof and Wall and Level of Damage Risk

Table No. : OR 08 **State : ORISSA** **BALESHWAR**

Wall / Roof		Census Houses		Level of Risk under								
		No. of Houses	%	EQ Zone			Wind Velocity m/s				Flood Prone Area in %
				V	IV	III	II	55 & 50	47	44 & 39	33	
				Area in %				Area in %				
						38.7	61.3	100				46.3
WALL												
A1 - Mud	Rural	330,591	67.6									
Unburnt Brick Wall	Urban	23,314	4.8									
	Total	***353,905***	***72.4***			*M*	*L*	*VH*				*VH*
A2 - Stone Wall	Rural	2,179	0.4									
	Urban	41										
	Total	***2,220***	***0.4***			*M*	*L*	*H*				*VH*
Total - Category - A		***356,125***	***72.8***									
B - Burnt Bricks Wall	Rural	43,990	9.0									
	Urban	30,155	6.2									
	Total	***74,145***	***15.2***			*L*	*VL*	*H*				*H/M*
Total - Category - B		***74,145***	***15.2***									
C1 - Concrete Wall	Rural	2,149	0.4									
	Urban	1,448	0.3									
	Total	***3,597***	***0.7***			*VL*	*VL*	*L*				*L/VL*
C2 - Wood wall	Rural	2,297	0.5									
	Urban	876	0.2									
	Total	***3,173***	***0.7***			*VL*	*VL*	*VH*				*H*
Total - Category - C		***6,770***	***1.4***									
X - Other Materials	Rural	48,283	9.9									
	Urban	3,970	0.8									
	Total	***52,253***	***10.7***			*VL*	*VL*	*VH*				*VH*
Total - Category - X		***52,253***	***10.7***									
TOTAL BUILDINGS		**489,293**										

HOUSING RISK TABLE OF BALESHWAR

ROOF											
R1 - Light Weight Sloping Roof	Rural	338,129	69.1								
	Urban	29,159	6.0								
	Total	***367,288***	***75.1***			*L*	*VL*	*VH*			*VH*
R2 - Heavy Weight Sloping Roof	Rural	65,563	13.4								
	Urban	5,873	1.2								
	Total	***71,436***	***14.6***			*L*	*VL*	*H*			*H*
R3 - Flat Roof	Rural	25,797	5.3								
	Urban	24,772	5.1								
	Total	***50,569***	***10.4***	*Damage Risk as per that for the Wall supporting it*							
TOTAL BUILDINGS		**489,293**									

Probable Maximum Precipitation at a Station of the district in 24 hrs is 600 mm

Housing Category : Wall Types

Category - A : Buildings in field-stone, rural structures, unburnt brick houses, clay houses

Category - B : Ordinary brick building, buildings of the large block & prefabricated type, half-timbered structures, building in natural hewn stone

Category - C : Reinforced building, well built wooden structures

Category - X : Other materials not covered in A,B,C. These are generally light.

Notes : *1. Flood prone area includes that protected area which may have more severe damage under failure of protection works. In some other areas the load damage may be severe under heavy rains and chocked drainage.*

2. Damage Risk for wall types is indicated assuming heavy flat roof in categories A, B and C (Reinforced Concrete) building

3. Source of Housing Data : Census of Housing, GOI, 2001

Housing Category : Roof Type

Category - R1 - Light Weight (Grass, Thatch, Bamboo, Wood, Mud, Plastic, Polythene, GI Metal, Asbestos Sheets, Other Materials)

Category - R2 - Heavy Weight (Tiles, Slate)

Category - R3 - Flat Roof (Brick, Stone, Concrete)

EQ Zone V : Very High Damage Risk Zone (MSK = IX)

EQ Zone IV : High Damage Risk Zone (MSK VIII)

EQ Zone III : Moderate Damage Risk Zone (MSK VII)

EQ Zone II : Low Damage Risk Zone (MSK = VI)

Level of Risk : VH = Very High; H = High; M = Moderate; L = Low; VL = Very Low

BMTPC Building Materials & Technology Promotion Council — Peer Group, MoHUPA, GOI

ATLAS AN INDISPENSABLE TOOL FOR DISASTER MANAGEMENT PLANNING

- The Atlas gives hazard maps and vulnerabilities of housing upto district level which is the working Disaster Management Unit.
- Members of Parliaments and Legislatures can study the hazard mapping and vulnerabilities, and consider development planning including disaster mitigation.
- National Planning and Management Authorities can identify multi-hazard prone districts and prioritise mitigation and preparedness actions and development plans accordingly.
- Village communities and house holders can locate themselves on the hazard maps and district risk tables to understand their vulnerabilities, and consider appropriate actions for achieving their own safety.

CONCLUSION

- Proper utilization of the maps and data furnished in the Vulnerability Atlas of India in Disaster Management is being taken up in all States of India.
- Proper implementation of the various guidelines is gradually proceeding in the country through awareness, sensitization and training programmes.

THANK YOU
FOR YOUR ATTENTION