Handbook

on

Disaster Management

Disaster Management Cell

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Contents

Foreword

India is one of the major countries which witness natural and human induced disasters very frequently. Floods, droughts, cyclones, and earthquakes cause severe loss to human lives and physical resources. Communal riots, conflicts, fires, epidemics, accidents and other disasters compound the country's chronic troubles. The social and economic progress achieved over decades by the people, and advances in physical development, can be significantly devastated and degraded by disasters. The Government of India and State Governments through various agencies have been making efforts to meet the exigencies as arisen by natural and man made disasters. It is, however, experienced that all these efforts and contingency plans concentrate on the post disaster situation. Thus it is imperative to prevent and mitigate the disasters, and also prepare the community and other stakeholders for disaster response, rehabilitation and reconstruction of disasters affected victims and areas.

The Handbook on Disaster Management highlights various dimensions, approaches and issues pertaining to disasters management. It is hoped that the Handbook will be use of immense in understanding the dynamics of disaster management in the country.

We received suggestions from various individuals and organizations on this volume. We are thankful to all of them. Our special thanks are due to the Principal Secretary to the Government of U.P. in the Deptt. of Urban Development and Director of Urban Local Bodies for their support in the endeavor.

RCUES   Prof. Nishith Rai
Lucknow   Director

Preface

India is one of the most disasters prone countries of the world. About 60 percent of the landmass is reported to be susceptible to seismic activity and about 18 percent country's total area is drought prone. About 40 million hectares of land in the country has been identified as flood prone. The Indian Ocean is one of the six major cyclone prone reasons of the globe. Among the 32 states and union territories in the country, 22 are multi disasters prone.

Increasing urbanization, expansion of habitats into unsuitable vulnerable areas, higher population density, higher housing density, vulnerable housing and buildings constructions and non-engineered unsafe construction and aging buildings and other infrastructures are some of the factors that have increased vulnerability of hazards and disasters in urban areas. The poor planning of drainage and defunct drainage system in some of the major cities have also caused pro-longed water logging and urban floods. The natural disasters such as floods, droughts, cyclone, earthquakes etc. that adversely affect the agricultural income also result in migration of people from rural areas to urban centers. This may put immense pressure on civic services and infrastructure. The man made disasters such as accidents, epidemics, communal violence etc are more prone to urban centers.

Disasters can not be predicted, however the loss of disasters may be reduced significantly through proper planning, mitigation measures, preparedness and effective management system. Thus, it is imperative to develop perspective planning for the prevention, disaster response and rehabilitation and reconstruction of disaster's affected victims and areas. Present Handbook on Disaster Management highlights emerging perspective of different types of disasters and their effective management. I hope that the volume will be highly useful to those who are interested in this field.

(Dr. A.K. Singh)
Assistant Director

CHAPTER-I
INTRODUCTION

India is one of the world's major theaters of disasters-both natural and human made. Floods, droughts, cyclones, and earthquakes pound it end to end every year. Communal riots, conflicts, fires, epidemics, and other disasters compound the country's chronic troubles. The social and economic progress and advances physical development in any country achieved over decades can be significantly devastated and degraded by disasters. Urbanization, industrialization, globalization and liberalization of economy all have influenced human life. People are tend to live in disaster prone areas due to severe stress on land, high prices of land and construction of buildings, poverty, migration and non-regulation of urban housing constructions. Even, the natural protection measures are neglected to pave the way for economic development. The government of India through various stake-holding agencies has been making efforts to meet the exigencies as arisen by natural disasters. It is, however, experienced that all these efforts and contingency plans concentrate on the post disaster situation. A half backed approach is adopted for preventing the occurrence of disasters. There is need for fundamental change in national disaster policy itself. The community has to be associated at all levels of planning and implementation of the disaster management programmes.

Urbanization

Urbanization is a global phenomenon experienced by developed as well as developing countries. There is migration from villages to towns and

cities with results in growth of metropolitan cities since they provide multiple avenues, services and amenities viz. education, health care, employment, business and entertainment options etc. People also migrate for economic opportunities and urban life styles. (Though urbanization brings about development in social, economic and cultural spheres of life, it sometimes disturbs the ecological systems. Rapid and unplanned growth of urban agglomerations generates a series of negative environmental effects. Today urban India presents a very pathetic scene. Cities have become a site of rotting garbage, degrading drainage system and shocking night soil removal system. India's life line is in danger. Many Indian rivers are heading towards an environmental disaster due to discharging of untreated sewage into water bodies. Besides, poor have practically no access to sanitary toilets and in many towns and cities, the majority defecate in the open. The untreated sewage being dumped into the river and water bodies leads to health hazards.)

India is one of the least urbanized countries in the world. However, it has second largest urban population in the world. As per 2001 Census, 285 million populations i.e. 27.8 per cent of 1027 million total population of India is residing in 4368 cities and towns in the country, whereas in 1971, 20 per cent population lived in urban areas. In 2021, about two fifth populations are expected to live in urban areas with absolute size of 550 million populations. The characteristic of urbanization in India is concentration of urban population in larger urban centres. About two-thirds of its urban content are found concentrated in class-I towns i.e. towns with more than one lakh population. Four mega cities viz., Mumbai, Kolkata, Delhi, and

Chennai with a population of more than 6 millions each in 2001, account for almost one fourth populations living in cities.

In 1901, there was only one million plus city but in 2001, there were 35 such cities. The number of such cities is likely to increase by 75 in 2021 (Table-I.1). Interestingly, the total population of the country in hundred years (1901-2001) increased about four times, the urban population increased about eleven times and the rural population witnessed an increase of about six times, however, the urban content has shown an increase from 10.8 percent in 1901 to 27.8 percent (less than three fold) in 2001.

Table - 1.1
Urbanization in India

Year	Percentage of Urban Population	Number of Municipal Towns	Total Population (Millions)	Urban Population (Millions)
1901	10.8	1827	238.39	25.85
1911	10.3	1815	252.09	25.95
1921	11.2	1949	251.32	28.09
1931	12.0	2072	278.98	33.46
1941	13.9	2250	318.66	44.16
1951	17.3	2843	361.23	62.44
1961	18.0	2365	439.23	78.13
1971	19.9	2590	548.15	109.11
1981	23.3	3378	159.46	159.56
1991	25.7	3768	846.30	217.61
2001	27.8	5161	1027.0	285.0

Source: Census, 2001

The annual exponential growth rate of urban population is low. Even, in the recent, the growth has been reported to be declining. There have been just 2.06 percentage points increase in proportion of urban population to total population during 1991 to 2001. An analysis of the distribution of

urban population by size categories reveals that the process of urbanization in India has been large city oriented. This is proved that a high proportion of urban population being concentrated in class-I cities, which has gone up systematically over the decades in the last century, the massive increase in proportion of class-I cities from 26 per cent in 1901 to 85.20 per cent in 1991while it declined to 68.67 per cent in 2001, has been attributed to faster growth of large cities. The number of class one cities has grown to 423 in 2001 from 24 in 1901. There has been more than five fold increase in the number of class one cities since 1951 (Table- I.2).

Table - I.2
Number of Towns and Percentage of Urban Population in Different Size Categories

Year	Class I	Class II	Class III	Class IV	Class V	Class VI	Total
1901	24 (26.00)	43 (11.29)	130 (15.64)	391 (20.83)	744 (20.14)	479 (6.10)	1827
1911	23 (27.48)	40 (10.51)	135 (16.4)	364 (19.73)	707 (19.31)	485 (6.57)	1815
1921	29 (29.70)	45 (10.39)	145 (15.92)	370 (18.29)	734 (18.67)	571 (7.03)	1949
1931	35 (31.20)	56 (11.65)	183 (16.8)	434 (18.00)	800 (17.14)	509 (5.21)	2072
1941	49 (38.23)	74 (11.42)	242 (16.35)	498 (15.78)	920 (15.08)	407 (3.14)	2250
1951	76 (44.63)	91 (9.96)	327 (15.72)	608 (13.63)	1124 (12.97)	569 (3.09)	2365
1961	102 (51.42)	129 (11.23)	437 (16.94)	719 (12.77)	711 (6.87)	172 (0.77)	2365
1971	148 (57.24)	173 (10.92)	558 (16.01)	827 (10.94)	623 (4.45)	147 (0.44)	2590
1981	218 (60.37)	270 (11.63)	743 (14.33)	1059)19.54)	758 (3.50)	253 (0.50)	3378
1991	300 (65.20)	345 (10.95)	947 (13.19)	1167 (7.77)	740 (2.60)	197 (0.29)	3768
2001	393 (68.67)	401 (9.67)	1151 (12.23)	1344 (6.84)	888 (2.36)	191 (0.23)	4368

Source: India Infrastructure Report, 2006.

The startling fact is that the proportion of population living in smaller towns has shown declining trend over the period while there is massive growth in population of larger towns. Importantly, growth of population in smaller towns has been reported negative while growth of population in larger cities and towns has been found massive. During 2001, the high proportion of urban population to total population has been reported to be in Delhi, Pondicherry, Goa, Chandigarh, Maharastra, Mizoram, Lakshadeep, Tamil Nadu, Karnataka, Gujarat etc. The high rate of growth of urban population during 1991-2001 has been reported high in Dadra and Nagar Haveli (14.59 per cent) followed by Arunachal Pradesh (7.00 per cent), Andman Nicobar (4.14 per cent), Sikkim (4.83 per cent), and Delhi, (4.14 per cent). During 2002, there were 384 urban local bodies in India. Out of total urban local bodies in India, 107 ULB's were Municipal Corporations, 1443 Municipal Councils and 2091 Nagar Panchayats. The highest number of local bodies were reported in Tamil Nadu (719) followed by Uttar Pradesh (628), Madhya Pradesh and Maharastra.

Increasing urbanization, expansion of habitat into unsuitable vulnerable areas; higher population density, higher housing density, vulnerable housing and buildings construction; non engineered unsafe construction; and aging buildings and other infrastructure are some of the factors that have increased vulnerability of hazards and disasters in urban areas.

Thus, disaster risk management includes measures which reduce disaster related losses of life, property or assets by either reducing the hazard or vulnerability of the elements at risk. Disaster management is

conceptualized as the body of policy and administrative decisions and operational activities which pertain to the various stages of a disaster at all levels. Broadly disaster management can be divided into pre-disaster and post-disaster contexts. There are three key stages of activity that are taken up within disaster management. They are (i) pre-disaster-mitigation, prevention, preparedness, risk assessment; (ii) during a disaster-emergency response, relief distribution, search and rescue, shelter, medical and trauma care etc., (iii) post disaster-rehabilitation and reconstruction of disaster affected persons and areas.

An Overview

The Indian subcontinent is vulnerable to droughts, floods, cyclones and earthquakes. Land slides, avalanche and forest fires also occur frequently (Table- 1.3).

Table -1.3
Major Disasters in India Since 1970

S. No.	Disaster	Impact
Cyclone		
1.	29 October 1971, Orissa	Cyclone and tidal waves killed 10,000 people
2.	19 November 1977 Andhra Pradesh	Cyclone and tidal waves killed 20,000 people
3.	29 and 30 October 1999 Orissa	Cyclone and tidal waves killed 9,000 and 18 million people were affected
Earthquake		
4.	20 October 1991 Uttarkashi	An earthquake of magnitude 6.6 killed 723 people
5.	30 September 1993 Latur	Approximately 8000 people died and there was a heavy loss to infrastructure
6.	22 May 1997 Jabalpur	39 people dead

7.	29 March 1997, Chamoli	100 people dead
8.	20 January 2001, Bhuj, Gujarat	More than 10,000 dead and heavy loss to infrastructure
Landslide		
9.	July 1991, Assam	300 people killed, heavy loss to roads and infrastructure
10.	August 1993, Nagaland	500 killed and more than 200 houses destroyed and about 5 kms. Road damaged
11.	18 August 1998, Malpa, Uttarakhand	210 people killed. Villages were washed away
Floods		
12.	1978 Floods in North East India	3,800 people killed and heavy loss to property
13.	1994 Floods in Assam, Arunachal Pradesh, Jammu and Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, Goa, Kerala and Gujarat	More than 2000 people killed and thousands affected
14.	2004 Tsunami, Coastal areas of Tamil Nadu, Andhra Pradesh, Andaman Nicobar Islands and Pondicherry.	More than 10,000 people were killed and damage of $1068 million to properties.

Source: Natural Hazards and Disaster Management, Text Book in Geography for Class XI CBSC, Delhi.

Among the 32 states and Union Territories in the country, 22 are multi-disaster prone. About 40 million hectares of land in the country has been identified as flood prone and on an average 18.6 million hectare of land is flooded annually. About 57 per cent of area of the country is vulnerable to seismic activity. About 18 per cent of country's total area is drought prone, approximately 50 million people are annually affected by droughts and about 68 per cent of total sown area of the country is drought prone. India has a long coastline of 8040 km. which is exposed to tropical cyclones arising in the Bay of Bengal, the Arabian Sea and Indian Sea. The Indian Ocean is one of the six major cyclonic prone regions of the globe. The

Coromandal coastline is more cyclones prone, with 80 per cent of the total cyclones generated in this region. Risk to the existing housing stock in various states and union-territories had been estimated by Expert Group Set up by the Ministry of Urban Development, Government of India. About 3.9 million houses are susceptible to earthquakes of very high intensity, about 20 million houses are susceptible to damage due to winds and about 9.3 million houses are susceptible to damage due to floods. Besides the risk of earth quakes, cyclones and floods are liable to very high damage and destruction of vulnerable houses under heavy rains. Some 49 per cent of the total housing stock is liable to very high damage from natural hazards, while about 1 per cent of the total housing stock gets destroyed every year. It is to be noted that in earth quake, 80 per cent of the casualties are due to collapsing buildings. Brick and stone buildings without proper support are liable to collapse. Non-engineered buildings continue to be built in the areas prone to natural disasters. Unemployment, poverty backwardness, migration from rural areas and increasing price of land and construction, million of people are occupying disaster prone areas. Thus about 6 per cent increase in disaster affected population has been reported.

According to the World Bank assessment, the natural disasters alone accounted India whopping amount of $13 million during 1986-2001, depleting 2 per cent of the GDP and 12 per cent of national revenue. Compared to the loss of $13.4 billion during 1981-95 and $2.9 million during 1965-80, the present swelling in the volume of losses is certainly frightening and demands urgent attention of development planners. The dilapidated and poorly built houses in urban areas increase the risks of

disasters. Lack of tenurial rights over the urban space and shortage of housing facilities have forced to urban poor to live in the most unsafe environment. The Indian sub-continent is highly prone to natural disasters. Floods, droughts, cyclones and earthquakes are a recurrent phenomenon in India. Between 1988 and 1997 disaster Killed 5116 people and affected 24-79 million every year (Table -1.4).

Table - 1.4
Damage Due to Natural Disasters in India

Year	People Affected (lakh)	Houses & Buildings Damaged	Amount of Property Damage/Loss (Rs. crore)
1985	595.6	2449878	40.6
1986	550.0	204927	30.74
1987	483.4	2919380	20.57
1988	101.5	242533	40.63
1989	30.1	782340	20.41
1990	31.7	1019930	10.71
1991	342.7	1190109	10.90
1992	190.9	570969	20.05
1993	262.4	1529916	50.80
1994	235.3	1051223	10.85
1995	543.5	2088355	40.73
1996	549.9	2376693	50.43
1997	443.9	1103549	N.A.
1998	521.7	1563405	0.72
1999	501.7	3104064	1020.97
2000	594.34	2736355	800.00
2001	788.19	846878	12000.00

Source: Annual Reports, NDM Division, Ministry of Agriculture, Government of India, Delhi.

The changing topography due to environmental degradation has also increased the vulnerability in the country. In 1988, 11.2 per cent of total land area was flood prone, but in 1998 floods inundated 37 per cent geographical area. Three major disasters that India have experienced in the recent past are

the super cyclone in Orissa (1999), earthquake in Gujarat (2001) and Tsunami (2004) in Tamil Nadu, Pondicherry, Andaman Nicobar Islands and parts of other southern states. Frequent disasters lead to erosion of development gains and restricted options threatened by hazards.

The continent of Asia is particularly vulnerable to disasters strikes. Between the years 1991 to 2000 Asia has accounted for 83 per cent of the population affected by disasters globally. Within Asia, 24 per cent of deaths due to disasters occurred in India, on account of its size population and vulnerability. Floods and high winds account for 60 per cent of all disasters in India. Many parts of the Indian sub-continent are susceptible to different types of disasters owing to the unique topography and climatic characteristics. About 54 per cent of the sub continent's landmass is vulnerable to earthquakes while about 4 crore hectares is vulnerable to periodic floods. The country has suffered four major earthquakes in the span of last 50 years along-with a series of moderate intensity earthquakes that have occurred at regular intervals. Since 1988, six earth quakes have struck different parts of the country. Tsunami in India killed 10749 persons while $1068 million loss or damage to properties was reported.

CHAPTER-II
HAZARDS AND DISASTERS

Hazard may be conceptualized as a dangerous condition or events that threaten or have the potential for causing injury to life or damage to property or the environment. They can be categorized in various ways but, they are basically grouped in two broad headings:

1. Natural Hazards (hazards with meteorological, geological or even biological origin)
2. Unnatural Hazards (hazards with human-caused or technological origin)

It is also important to know that natural phenomena are extreme climatologically, hydrological, or geological, processes that do not pose any threat to persons or property. A massive earthquake in an unpopulated area is a natural phenomenon, *not a hazard*. It is when these natural phenomena interact with the man made environment or fragile areas which causes wide spread damage.

Hazards may be grouped into two broad categories, namely natural and manmade. Natural hazards are those hazards which are caused because of natural phenomenon. Cyclones, tsunamis, earthquake, and volcanic eruption are exclusively of natural origin. Manmade hazards are hazards which occur due to human negligence. Manmade hazards are associated with industries or energy generation facilities and include explosions, leakage of toxic waste, pollution, dam failure, wars or civil strife etc. There may be

another category which includes landslides, floods, drought, fires are socio-natural hazards since their causes are both natural and manmade.

Hazard refers to the potential occurrence, in a specific time period, and geographic area, of a natural phenomenon that may adversely affect human life, properly or activity to the extent of causing a disaster. A hazard occurrence becomes a disaster when it results in loss of life, displacements and homelessness, destruction and damage to infrastructure and property. Methods of predicting various hazards and the likelihood and frequency of occurrence vary widely by type of hazard.

Risk refers to the expected or anticipated losses (lives lost, people injured, properly damaged, and economic activities or livelihoods disrupted) from the impact of a given hazard on a given element at risk over a specific period of time.

Vulnerability

Vulnerability may be conceptualized as the extent to which a community structure, service, or geographic area is likely to be damaged or disrupted by the impact of particular hazard on account of their nature, construction and proximity to hazardous terrain or a disaster prone area. The vulnerable buildings and infrastructure are more prone to earthquake hazards. Hence structures should be built strong enough to resist maximum force exerted by any event or for combination of event. Social and economic conditions also determine the vulnerability of a society to an extent. Interestingly, risk is a measure of the expected losses (deaths, injuries, property, economic activity etc.) due to a hazard of a particular magnitude occurring in a given area over a specific time period. The level of risk

depends upon (i) nature of the hazard; (ii) vulnerability of the elements which are affected; and (iii) economic value of those elements.

Vulnerability is defined as *"The extent to which a community, structure, service, or geographic area is likely to be damaged or disrupted by the impact of particular hazard, on account of their nature, construction and proximity to hazardous terrain or a disaster prone area."*

Human vulnerability is the relative lack of capacity of a person or community to anticipate, cope with, resist and recover forms the impact of a hazard. Vulnerability has two components. One is the exposure to hazards and the other is the difficulty in coping with and recovering from them (due to lack of resources). Human vulnerability increases with:

(a)   Rapid urbanization

(b)   Population growth

(c)   Lack of knowledge about how to effectively resist the effects of disasters.

(d)   Poverty

Physical Vulnerability: It is the extent to which a structure is likely to be damaged or disrupted by a hazard event. It assumes importance in case of earthquakes.

Economic Vulnerability: It is the extent to which the economic activities such as employment generation in services, trade, industrial and agricultural production is disrupted or likely to be damaged. Economic vulnerability affects the reconstruction work directly.

Disasters

The term 'disaster' owes its origin to the French World '*Desastre*" which refers to bad or evil star. A disaster can be defined as 'a serious disruption in the functioning of the community or a society causing wide spread material, economic, social or environmental losses which exceed the ability of the affected society to cope using its own resources.' A disaster is a result from the combination of hazard, vulnerability and insufficient capacity or measures to reduce the potential changes of risk. A disaster is the product of a hazard such as earthquake, flood or wind storm coinciding with a vulnerable situation which might include communities, cities or villages. A disaster happens when hazard impose on the vulnerable population and causes damage, casualties and disruption. Without vulnerability or hazard there is no disaster. A disaster occurs when hazards and vulnerability meet. Hazard, thus may be termed as a dangerous condition or event that threat or has the potential for causing injury to life or damage to property or the environment.

There has been increase in the number of natural disasters over the past years, on account of urbanization and population growth; as a result impact of natural disasters is now felt to a larger extent. According to the United Nations, in 2001 alone, natural disasters of medium to high range caused at least 250,000 deaths around the world, more than double the previous year, and economic losses of around 836 billion. The natural disasters are not bound by political boundaries and have no social or economic considerations. They are borderless as they affect both developing and developed countries. Since 1991, two third of the victims of natural disasters were from developing countries, while just 2 per cent were from highly developed nations. Those living in developing countries and

especially those with limited resources tend to be more adversely affected. The continent of Asia is particularly vulnerable to disaster strikes.

A disaster is the product of a hazard such as earthquake, flood or windstorm coinciding with a vulnerable situation which might include communities, cities or villages. There are two main components in this definition: hazard and vulnerability. Without vulnerability or hazard there is no disaster. A disaster occurs when hazards and vulnerability meet.

There are several important characteristics that make disasters different from accidents. The loss of a sole income earner in a car crash may be a disaster to a family, but only an accident to the community. Variables such as causes, frequency, and duration of the impact, speed of onset, and scope of the impact, destructive potential, and human vulnerability etc determine the difference.

Disasters are events that disrupt the functioning of a society. They cause widespread human, material, or environmental losses that exceed the ability of the affected society using its own resources. Earthquakes, floods, and cyclones, landslides are not disasters in themselves. They become disasters when human life, livelihoods and properly are adversely and severely affected.

There are different ways to classify disasters. Disasters are often classified according to their cause, their speed of onset (sudden or slow). Disasters classified according to cause are named after the hazard, which results in the disastrous social and economic consequences. Thus, this classification includes earthquakes, floods, cyclones, tornadoes, landslides, mudflows, droughts, pest and insect infestation, etc. (Chart- 2.1)

Chart- 2.1
Hazard Classification and Related Disaster Types

A. Water & Climate Related	B. Geological Disasters	C. Chemical, Industrial and Nuclear Disasters	D. Accident Related Disasters	E. Biological Disasters
❖ Floods & Drainage Management**	❖ Earthquakes**	❖ Chemical and Industrial Disasters**	❖ Urban Fires**#	❖ Biological Disasters and Epidemics$
❖ Cyclones**	❖ Land Slides and Mudflows**	❖ Nuclear Disasters**	❖ Mine Flooding**#	❖ Pest Attacks$
❖ Tornadoes & Hurricanes**	❖ Dam Failure and Dam Bursts**		❖ Oil Spill**#	❖ Cattle Epidemics$
❖ Hail Storms**	❖ Mine Fires		❖ Major Building Collapse**#	❖ Food Poisoning$#
❖ Cloud Bursts**			❖ Electrical Disasters and Fires**#	
❖ Snow Avalanches**			❖ Air Road and Rail Accidents**#	
❖ Heat & Cold Waves**			❖ Festival Related**#	
❖ Sea Erosion**			❖ Boat Capsizing#	
❖ Thunder & Lightening**			❖ Village Fires#	
❖ Droughts**			❖ Serial Bomb Blasts#	

** Engineering related;   # Accident / Terrorism related $ Biological related

Speed of onset

The speed of the disaster's onset is another way to distinguish between disasters and the types of responses that may be required. A rapid onset disaster refers to an event or hazard that occurs suddenly, with little warning, taking the lives of people, and destroying economic structures and material resources. Earthquakes, floods, storm winds, tornadoes, may cause such disasters or mud flows. Slow onset disasters occur over time and slowly deteriorate a society's and a population's capacity to withstand the effects of the hazard or threat. Hazards causing these disaster conditions typically include droughts, famines, environmental degradation, desertification, and deforestation and pest infestation.(Chart -2.2)

Chart- 2.2
Types of Disasters in India by Nature of Onset and Cause Based Classification

Nature of onset	Type of Disaster	Causes Natural Human		States in which Prevalent
Rapid	Cyclone	-		A.P. TN, Orissa, WB, Kerala
	storm surges	-	-	Kerala, Orissa, WB
	Floods	-	-	Assam, Bihar, Gujarat, Orissa, Tripura, UP, WB, Haryana, Punjab, AP, HP, J&K, Karnataka, Maharashtra, Meghalaya, Rajasthan, Mizoram Maharashtra, UP, J&K, Assam
	Earthquake	-	-	Gujarat, WB, Maharashtra
	Epidemics	-	-	MP
	Industrial			-
	Fire	-	-	HP, J&K, UP, Assam
	Landslides	-	-	

Rapid/Slow	Refugees/ Displaced War	-	States bordering neighbouring countries
			States bordering Neighbouring countries
	Civil unrest	-	UP, HP, Punjab, Assam, J&K, Karnataka, MP
		-	
Slow	Drought	- -	AP, Gujarat, Karnataka, Maharashtra, Rajasthan, Assam, Orissa, MP
			AP, Gujarat, Karnataka, Maharashtra, Rajasthan, Assam, Orissa, MP
	Famine		Rajasthan, HP, UP, MP
			Gujarat, Maharashtra, WB
	Environmental Epidemics Civil unrest		UP, HP, Punjab, Assam, J&K, Karnataka, MP

Source: Care-India Disaster Response Planning Guide

CLASSIFICATION OF DISASTERS

Disasters are often classified according to their speed of onset i.e. sudden or slow.

1. Sudden onset disasters (Rapid onset disasters) e.g. earthquakes, tsunamis, floods, tropical storms, volcanic eruptions, landslides, etc. (mostly geological and climatic disasters).

2. Slow onset disasters e.g. drought, famine, land-depredation, climate change, desertification, deforestation, pest infestation.

Popular Classification of Disasters

(i) Natural Disasters

1. Heavy Rains, 2. Floods, 3. Draughts, 4. Earthquake, 5. Volcano Eruption, 6. Avalanche, 7. Landslide, 8. Epidemic, 9. Cyclone, 10. Heat Wave, Cold Wave.

(ii) Manmade Disasters

  (a) Un-Intentional or Inadvertent:

      (1) Poor Maintenance, (2) Low Quality Work, (3) Human Error

  (b) Wilfully and Intentional:

      1. Sabotage, 2. Mischief, 3. Revenge. 4. Riots, 5. Mob Furry,

      6. Enemy Attack

  (c) Industrial and Technological - (Mostly system/Process Malfunction)

      1. Nuclear Radiation. 2. Gas Leak. 3. Explosion. 4. Fire

Nature Based classification of Disasters

1.   Elemental Disasters

    (a)   Earthquake

    (b)   Tidal waves

    (c)   Floods

    (d)   Volcanic eruptions

    (e)   Landslides

2.   Foreseeable Disasters

    (a)   Famines

    (b)   Epidemics

3.   Deliberate Disasters

    (a)   Wars

    (b)   Civil wars

    (c)   Guerrilla warfare

    (d)   Insurgency activities

    (e)   Terrorism

4. Accidental Disasters

    (a)   Industrial catastrophes

    (b)   Nuclear Catastrophes

Elemental disasters are distinguished from other disasters because they are instantaneous and prompted, by climatic or geological forces. Their destructive capability depends more on the number of vulnerable people in a given area than on their inherent severity. In many parts of the world, man-made errors exacerbate the damage such elemental disasters cause.

Foreseeable disasters have complex root causes in which climatic and human activity interact over extended periods, leaving large numbers of people vulnerable. Such as interaction creates a vicious circle whose recurrence is often predictable.

Deliberate disasters have roots in social economic and politics inequity. This can result in both high intensity hostile enemy actions in forms of declared battles or wars or low intensity conflicts such as guerrilla warfare, terrorism, sabotage, riots, communal discord or riots, civil strife, internal disturbance, arson or crowd violence.

Accidental disasters are a byproduct of negligence of risk-assessment while making scientific and technological advances. Recent incidents of Bhopal, Chernobyl, Three Mile Island etc. attest to the grave threat posed by such disasters.

As per another classification based on predominant agent, disasters could be categorized as of three types, i.e. first the natural, secondly the man-made, and lastly as hybrid disasters.

Natural disasters are the result of natural phenomena, for instance, earthquake, volcanic eruption, hurricane, tornado, avalanche or flood.

Man-made disasters are of an anthropogenic origin, and exemplifies some of the terrible accidents that have resulted from human beings interaction with artificial environment, which they themselves have created.

Hybrid Disasters arise from a linkage of anthropogenic events and natural events. For example, spread of disease from a community in which the disease is endemic to a community which has no natural immunity, destruction of forests and resulting increased floods; large scale deaths due to smog, etc.

Natural disasters

1. **Climate and Wind Related**
    ❖ Wind storm (tropical storms)/ storm surges/ hailstorm/ snowstorm
    ❖ Cyclone/Tropical cyclones
    ❖ Tornadoes
    ❖ Hurricane
    ❖ Tidal waves
    ❖ Typhoons
    ❖ Blizzard
    ❖ Fog

2. **Climate and Water Related**
    ❖ Floods/ drainage/ river bank erosion/ dam-bursting/ levee failure
    ❖ Cloud bursts
    ❖ Flash flood

❖ Heavy (excessive) rains/ glaze (freezing rain) storms

❖ Drought

❖ Snowfall/ cold spell waves/ bitter winters/ hail/ frost

3. **Earth Related (Geological)**

❖ Earthquakes/severe tremors

❖ Tsunamis

❖ Avalanches/snow avalanches

❖ Landslides

❖ Volcanic eruptions

❖ Rock falls

❖ Mudslides

❖ Subsidence

❖ Shifting sands

4. **Ocean Related**

❖ Ocean currents EI Nino / La Nina

5. **Space Related**

❖ Asteroid collisions

❖ Lightning's

6. **Temperature Related**

❖ Heat wave

❖ White-out

❖ Forest fires/Bush fire

Man-Made Disasters

➢ War/battle/hostile enemy actions.

- Arson/sabotage/internal disturbance/riots crowd violence.
- Accidents of vehicles/trains/aircrafts/ships/traffic accidents/transport accidents.
- Industrial accidents disaster/explosion of boilers/ gas cylinders/gas chambers/gas leak technological disasters/ industrial explosions/ fires.
- Fire/forest fires/scrub fires/ wildfires/bushfire/grassland fires.
- Nuclear explosion disaster/accidents/radioactive fallout/leakages/ commercial nuclear power/radiation: Non-radon plant failure/accidents.
- Ecological disasters like deforestation/desertification environmental pollution/ social erosion/air pollution water pollution.
- Famine/food crises /food contamination/food security/food additives.
- Epidemics/ pest infestations epidemics/insect infestations infections diseases proliferation/destitution refugee cities.
- Population Explosion.
- Land degradation/salinization / alkalinization.
- Toxic chemicals and hazardous wastes/release/dumping/carriage/ chemical time bombs/ chemical accidents.
- Chemicals in workplace.
- Indoor air/radon/non-radon.
- Toxic air pollutants.
- Stratospheric ozone depletion/ground-level ozone formation.
- Acid rain/acidification.
- Thermal radiation.
- Ocean water intrusion/sea-level rise/ coastal flooding/marine pollution.
- Groundwater contamination/depletion.
- Wildlife extinction.

- Fish deaths.
- Freshwater contamination/biological/metal and toxic/eutrophication /sedimentation.
- Pollution climate change/global warming/greenhouse effect.
- Renewable resource depletion.
- HIV / AIDS.
- Demographic disaster/population bombs.
- Biotechnological hazards threats/GMOs (Genetically modifying organisms).
- Refugee crises/settler migration.
- Slums/shanty habitats/shelter problems war victims/war deaths/ civil war/riot.
- Sanctions.
- Plastic panics.
- Apartheid forced removals.
- Poverty & deprivation.
- Smoking.
- Mountaineering.
- Germ (Biological) and chemical warfare.
- Nuclear warfare.
- Failures of public buildings or other structures.
- Animal and plant invasions (locusts).
- Oil spills.
- Mining disasters.
- Radio-active dumping at sea.
- Terrorism.

Epidemics

> Vector-borne diseases.(Pleague)

> Water-borne diseases.

> Food-borne diseases.

> Person-to-person diseases (contact and respiratory spread).

> Complications from wounds.

> Veterinary epidemics (within and across species)

Significant Disasters

Blizzards and Snowstorms: A snowstorm is a winter storm in which the primary form of precipitation is snow. When such a storm is accompanied by winds above 32 mph that severely reduce visibility, it becomes a blizzard. Hazards from snowstorms and blizzards include traffic-related accidents, hypothermia for those unable to find shelter, as well as major disruptions to transportation and fuel and power distribution system.

Drought: A drought is a long-lasting weather pattern consisting of dry conditions with very little or no precipitation. During his period, food and water supplies can run low, and other conditions, such as famine, can result. Droughts can last for several years and are particularly damaging in areas in which the residents depend on agriculture for survival.

Earthquakes: An earthquake is a sudden shift or movement in the tectonic plate in the Earth's crust. On the surface, this is manifested by a moving and shaking of the ground, and can be massively damaging to poorly built structures. The most powerful earthquakes can destroy even the best built of structures. In addition, they can trigger secondary disasters, such as tsunamis and volcanic eruptions. Earthquakes occur along fault line, and are

unpredictable. They are capable of killing hundreds of thousands of people, such as in the 1976 Tangshan and 2004 Indian Ocean earthquakes.

Epidemic: An epidemic is a massive outbreak and spread of an infectious disease, and is historically the most dangerous of all natural disasters. Different epidemics are caused by different diseases, and different epidemics have included the Black Death, smallpox, and AIDS. The Spanish flu of 1918 was the deadliest ever epidemic, it killed 25-40 million people. The Black Death, which occurred in the 14th Century, killed over 20 million people, one third of Europe's population.

Famine: Famine is a natural disaster characterized by a widespread lack of food in a region, and can be characterized as a lack of agriculture foodstuffs, a lack of livestock, or a general lack of all foodstuffs required for basic nutrition and survival. Famine is almost always caused by pre-existing conditions, such as drought, but its effects may be exacerbated by social factors, such as war. Particularly devastating examples include the Ethiopian famine and the Irish Potato Famine.

Flood: A flood is a natural disaster caused by too much rain or water in a location, and could be caused by many different sets of conditions. Floods can be caused by prolonged rainfall from a storm, including thunderstorms, rapid melting of large amounts of snow, or rivers which swell from excess precipitation upstream and cause widespread damage to areas downstream, or less frequently the bursting of man-made dams. A river which floods particularly often is the Huang He in China, and a particularly damaging flood was the Great Flood of 1993.

Forest Fire: A forest fire is a natural disaster consisting of a fire which destroys a forested area, and can be a great danger to people who live in forests as well as wildlife. Forest fires are generally started by lightning but also by human negligence or arson, and can burn thousands of square kilometers.

Hailstorm: A hailstorm is a natural disaster where a thunderstorm produces a numerous amount of hailstones which damage the location in which they fall. Hailstorms can be especially devastating to farm fields, ruining crops and damaging equipment. A particularly damaging hailstorm hit Munich, Germany on August 31, 1986, felling thousands of trees and causing millions of dollars in insurance claims.

Heat Wave: A heat wave is a disaster characterized by heat which is considered extreme and unusual in the area in which it occurs. Heat waves are rare and require specific combinations of weather events to take place, and may include temperature inversions, katabatic winds, or other phenomena. The worst heat wave in recent history was the European Heat Wave of 2003.

Hurricanes: A hurricane is a cyclonic storm system which forms over the oceans. It is caused by evaporated water which comes off of the ocean and becomes a storm. The Coriolis Effect causes the storms to spin, and a hurricane is declared when this spinning mass of storms attains a wind speed greater than 74mph. In different parts of the world hurricanes are known as cyclones or typhoons. The former occur in the Indian Ocean, which the latter occur in the Eastern Pacific Ocean. The most damaging hurricane ever was Hurricane Andrew, which hit southern Florida in 1992.

Ice Storm: An ice storm is a particular weather event in which precipitation falls as rain, due to atmosphere conditions, but the in an area in which the temperature is below the freezing point of water. The rain falls to the ground, and immediately turns to ice, accumulating in that fashion. A heavy ice storm can cause large accumulations of ice cause trees to fall over or lose branches, and power lines to snap. The worst recent ice storm was the 1998 Ice Storm that struck eastern Canada and areas of the US northeast.

Lahar: A lahar is a type of natural disaster closely related to a volcanic eruption, and involves a large amount of material; including mud, rock, and ash sliding down the side of the volcano at a rapid pace. These flows can destroy entire towns in seconds and kill thousands of people. The Tangiwai disaster in an excellent example, as is the one which killed an estimated 23,000 people in Armero, Colombia, during the 1985 eruption of Nevado del Ruiz.

Landslides and Mudslides: A landslide is a disaster closely related to an avalanche, but instead of occurring with snow, it occurs involving actual elements of the ground, including rocks, trees, and parts of houses, and anything else which may happen to be swept up. Landslides can be caused by earthquakes, volcanic eruptions, or general instability in the surrounding land. Mudslides, or mud flows, are a special case of landslides, in which heavy rainfall causes loose soil on steep terrain to collapse and slide downwards; these occur with some regularity in parts of California after periods of heavy rain.

Sinkholes: A localized depression in the surface topography, usually caused by the collapse of a subterranean structure, such as a cave. Although rare,

large sinkholes that develop suddenly in populated areas can lead to the collapse of buildings and other structures.

Tornado: A tornado is a natural disaster resulting from a thunderstorm. Tornadoes are violent currents of wind which can blow at up to 318mph. Tornadoes can occur one at a time, or can occur in large tornado outbreaks along a squall line. The worst tornado ever recorded in terms of wind speed was the tornado which swept through Moore, Oklahoma on May 3, 1999. This tornado has wind speeds of 318mph and was the strongest ever recorded.

Tsunami: A tsunami is a giant wave of water which rolls into the shore of an area with a height of over 15 m (50 ft.). It comes from Japanese words meaning harbor and wave. Tsunami can be caused by under sea earthquakes as in the 2004 Indian Ocean Earthquake, or by landslides such as the one which occurred at Lituya Bay, Alaska. The tsunami generated by the 2004 Indian Ocean Earthquake currently ranks as the deadliest tsunami in recorded history. The highest Tsunami ever recorded was estimated to be 85m (278 ft.) high. It appeared off Ishigaki Island, Japan.

Volcanic Eruption: This natural disaster is caused by the eruption of a volcano, and eruptions come in many forms. They range from daily small eruptions which occur in places; like Kilauea, in Hawali, or extremely infrequent supervolvano eruptions in places like Lake Toba. Greatest Volcanic explosion occurred when Krakatoa in Indonesia blew up in 1883, hurling rocks 55km (34 miles) in the air! The explosion was heard in Australia and generated a 40m. (131 ft.) High Tsunami; 36,000 people died. The greatest volcanic eruption was of Mt.Tambora on Sumbawa, Indonesia

in 1815 which threw up more than 100 cubic km. (24cu. miles) of ash. The island was lowered by 1250m (4100 ft.); 92,000 people died.

Ice Age: An ice age is a geologic period, but could also be viewed in the light of a catastrophic natural disaster, since in an ice age, the climate all over the world would change and places which were once considered habitable would then be too cold in permanently inhabit. A side effect of an ice age could possibly be a famine, caused by a worldwide drought.

Volcano: A super volcano is a eruption which is thousands of times more massive than a normal eruption, the lower threshold for an eruption being declared that of a super volcano is that such an eruption must expel at least 1000 cubic kilometers of material. The last eruption of this magnitude occurred over 75,000 year ago at Lake Toba. If such an eruption were to occur today, a wholesale general die-off of both animals and humans would occur, as well as a significant short-term climate change.

Risk reduction can take place in two ways:

Chapter-3

EARTHQUAKE

The Indian sub-continent lies upon the Indian plate which is moving northward and collides with the Eurasian Plate. Due to this collision, the Himalayas are generated in the process. This is the main cause of earthquakes from Himalayas to the Arakan Yoma. The same process, results in earthquakes in Andaman and Nicobar Islands. Sometimes earthquakes of different magnitudes occur within the Indian Plate. The location of Indian ubcontinent is found to be valuable in the center of seismic activities. During last 200 years 712 earthquakes have occurred in Indian sub continent. Some of the significant earthquakes are shown in table 3.1

Table - 3.1
Significant Earthquakes in India

Date	Location	Magnitude M>6
1819 June 16	Kutch, Gujarat	8.0
1869 January 10	Near Cachar, Assam	7.5
1885 May 30	Sopor, J & K	7.0
1897 June 12	Shillong Plateau	8.7
1905 April 4	Kangra, Himachal Pradesh	8.0
1918 July 8	Srimangal, Assam	7.6
1930 July 2	Dhubri, Assam	7.1
1934 January 15	Bihar-Nepal Border	8.3
1941 June 26	Andaman Islands	8.1
1943 October 23	Assam	7.2
1950 August 15	Arunachal Pradesh-China Border	8.5
1956 July 21	Anjar, Gujarat	7.0
1967 December 10	Koyna, Maharashtra	6.5
1975 January 19	Kinnaur, Himachal Pradeh	6.2
1988 August 6	Manipur-Myanmar Border	6.6
1991 October 20	Uttarkashi, U.P. Hills	6.6
1993 September 30	Latur-Osmanabad, Maharashtra	6.3
1997 May 22	Jabalpur, Madhya Pradesh	6.0

1999 March 29	Chamoli District, Uttar Pradesh	6.8
2001 January 26	Bhuj, Gujarat	6.9
2005	Muzaffarabad Jammu & Kashmir	7.4

Source: http://www.ind.ernet.in/section/seismo/static/signif.htm

The magnitude of the earthquake is measured by Richard Scale. The intensity of earthquake and its consequences vary depending upon the level of scale (Chart-2.1)

Chart 3.1
Modified Mercalli Intensity Scale

Scale	Effect
1.	Not felt except by a very few under especially favorable circumstances.
2.	Felt only by a few persons at rest, especially on upper floors of building. Delicately suspended objects may swing.
3.	Felt quite noticeably indoors, especially on upper floors of buildings, but perhaps not recognizable as an earthquake. Standing automobiles may rock slightly.
4.	During the day, felt indoors by many, outdoors by few. At night, may wake some. Dishes, Windows, doors disturbed; walls make a cracking sound. Standing automobiles rock noticeably.
5.	Felt by nearly everyone, many awakened. Some dishes, windows, broken: cracked plaster, unstable objects overturned. Trees, poles and other tall objects sometimes visibly disturbed. Pendulum clocks may stop.
6.	Felt by all, many run outdoors. Some heavy furniture moved; fallen plaster or damaged chimneys. Damage slightly.

7. Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight-to-moderate damage in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken. Noticed by automobile drivers.

8. Damage slight in structures designed to withstand earthquakes; considerable in ordinary substantial buildings, with partial collapse; great damage in poorly built structures. Panel wall thrown out of frame. Collapse of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Well water levels changed. Drivers of automobiles disturbed.

9. Damage considerable in specially designed structures; great in substantial buildings, with partial collapse. Well designed frame structures thrown out of plumb. Buildings shifted off foundations. Ground cracked conspicuously, underground pipes broken.

10. Some well-built wooden structures destroyed; most masonary and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from riverbanks and steep slopes. Water splashed (slapped) over banks.

11. Few, if any structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.

12. Damage total. Practically all structures damaged greatly or destroyed. Wave forms sea on ground surface. Lines of sight and level distorted during the event. Objects thrown up into the air.

Earthquakes with magnitudes in excess of 7.0 have occurred in these areas, and have had intensities higher than IX. Most of the earthquakes which occurred were rated at 5-6 scale (60 per cent) while more than one third earthquakes were in between 6-7 Richter scale. Again, about half of the earth quakes have occurred in North East India alone (Table - 3.2)

Table -3.2
Earthquake Occurrence in India

Sl. No.	Seismic Region	No. of Earthquakes having M=				Max. MM Intensity	Average Return Period observed	Total
		5-5.9	6-6.9	7-7.9	>8.0			
1.	Kashmir and Western Himalayas (J&K, Himachal Pradesh, Sub-mountain parts of Punjab)	25	7	2	1	X	2.5-3 years	35 (4.91)
2.	Central-Himalayas (Uttarakhand, Nepal, Himalayas, North Bihar)	68	28	4	1	XI	1 yr.	101 (14.18)
3.	North East India	200	130	15	4	>X	<4 months	349 (49.01)
4.	Indo-Gangetic Basin & Rajasthan (Rajasthan, Punjab, Haryana, Delhi, Plains of U.P., Bihar and Bengal)	14	6	-	-	VIII	5 years	20 (2.81)
5.	Cambay and Rann of Kutchh	6	5	3	1	X-X	7 years	15 (2.11)
6.	Peninsular India	32	10	-	-	VIII	2.5-3 years	42 (5.89)
7.	Andaman & Nicobar	80	68	1	1	>IX	<8 months	150 (21.06)
	Whole in India	425	254	25	8	-	<2 months	712 (100.00)

Source: Dr. A.S. Arya Progress towards Earthquake Risk Reduction in India, INCEDE Report

During the earthquakes, majority of losses is due to collapse of buildings and damage to infrastructure. More than half of the houses are built

with stone walls and 35 per cent have burnt brick units which are highly vulnerable to sustain damage of seismic intensties namely VII, VIII and IX.

Several key factors that contribute to vulnerability of human populations to earthquakes:

- Location of settlements in an earthquake prone area, especially on soft ground, on area prone to landslides or along fault lines.
- Dense collection of weak buildings with high occupancy.
- Non-engineered buildings constructed by earth, rubble, buildings with heavy roofs (more vulnerable than light weight structures), poor quality and maintenance of buildings
- Weak or flexible storey intending for parking purposes.

HAZARD ZONES

As per the latest seismic zoning map of India the country is divided into four Seismic Zones. Zone V marked in red shows the area of Very High Risk Zone, Zone IV marked in orange shows the area of High Risk Zone. Zone III marked in yellow shows the region of Moderate Risk Zone and Zone II marked in blue shows the region of Low Risk Zone. Zone V is the most vulnerable to earthquakes, where historically some of the country's most powerful shock has occurred.

As per India's Seismic Vulnerability Atlas, 58 cities of India fall within seismic vulnerability Zones. Out of which 13 cities are located in Zone V, 16 Cities in Zone IV and 29 cities are situated in Zone III (Table - 3.3)

Table - 3.3
Classification of Cities in Seismic Zones

Zone	No.	Cities
V	13	Aizwal, Bhuj, Chamoli, Dharamshala, Guwahati, Itanagar, Kohima, Kullu, Pithoragarh, Port Blair, Shillong, Srinagar
IV	16	Amritsar, Chandigarh, Darjeeling, Dehradun, Delhi, Gangtok, Gorakhpur, Gurgaon, Haridwar, Jammu, Jamnagar, Ratnagiri, Shimla, Meerut, Patna, Uttarkashi
III	29	Ahmedabad, Bhubaneshwar, Bikaner, Bokaro, Mumbai, Kolkata, Calicut, Coimbatore, Cochin, Cuttack, Gandhinagar, Gaya, Jabalpur, Kanpur, Lucknow, Pune, Puri, Mangalore, Nellore, Panaji, Patiala, Porbandar, Pune, Puri, Rajkot, Surat, Trivandrum, Vadodara, Vijayawada, Warangal

Source: Anup Karanth, GOI-UNDP-DRM Programme, December 2006

Geographically, Zone V includes the Andamand and Nicobar Islands, all of North Eastern India, parts of north western Bihar, eastern parts of Uttaranchal, Kangra Valley in Himachal Pradesh, Srinagar area in Jammu and Kashmir and Rann of Kutchh in Gujarat.
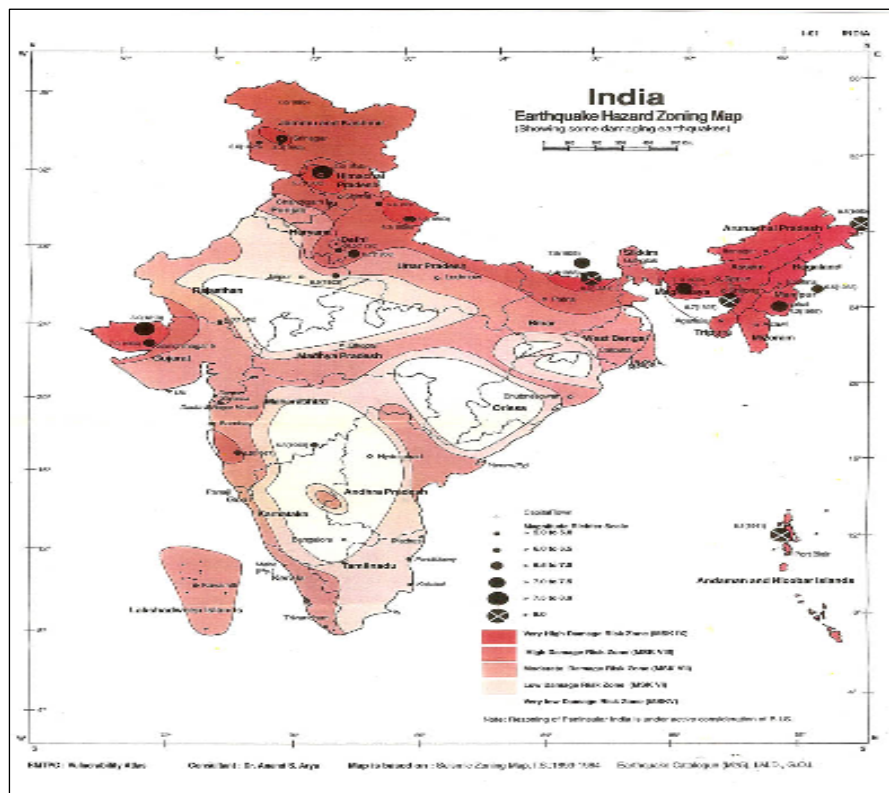
Geographically this zone includes the Andaman & Nicobar Islands, all of North-Eastern India, parts of north-western Bihar, eastern sections of Uttaranchal, the Kangra Valley in Himachal Pradesh, near the Srinagar area in Jammu & Kashmir and the Rann of Kutchh in Gujarat. Earthquakes with magnitudes in excess of 7.0 have occurred in these areas, and have had intensities higher than IX.

Much of India lies in Zone III, where a maximum intensity of VII can be expected. New Delhi lies in Zone IV whereas Mumbai and Chennai lie in Zone III. All states and UTs across the country have experienced earthquakes. The magnitude of the earthquake is also influenced by the sensitivity of geographical areas depending upon the tectonic location of the land.

TECTONIC MAP OF INDIA
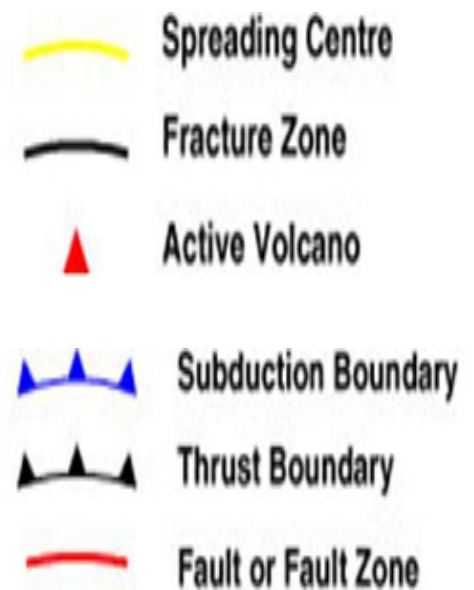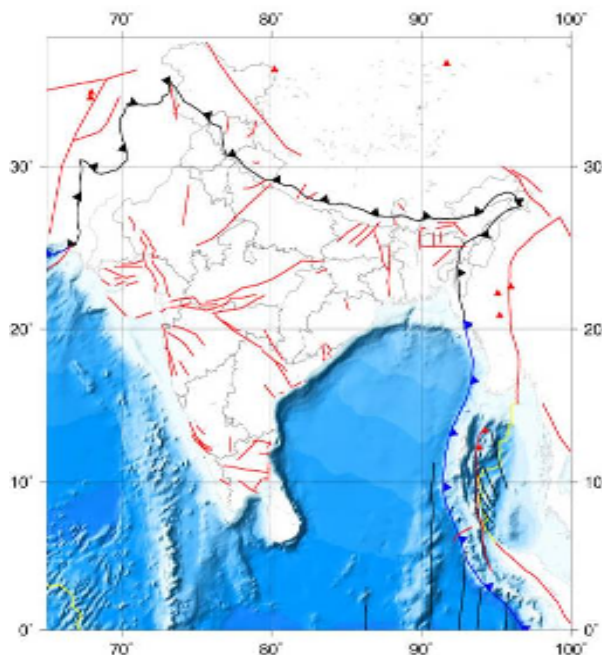
TYPICAL EFFECTS

The effects of earthquake may in change physical damage to property, humanism and also disrupt the social and infrastructural services due to occurasion of earthquakes. Damage or loss of buildings and service structures, fires, floods due to dam failures, landslides could occur.

The casualties often high, near to the epi-center and in places where the population density is high (say, multistoried buildings) and structures are not resistant to earthquake forces. Multiple fracture injuries, moderately and severely injured is the most widespread problem, breakdown in sanitary conditions and large number of casualties could lead to epidemics. Severe problems due to failure of the water supply distribution network and storage reservoirs are noticed. Fire hydrants supply lines if vulnerable could hamper fire service operations. Transport network is generally severely affected due to failure of roads and bridges, railway tracks, failure of airport runways and related infrastructure. Electricity and Communication also affect due to collapse of transmission towers, transponders, transformers etc.

MITIGATION STRATEGIES

Engineered structures (designed and built) to withstand ground shaking. Architectural and engineering inputs put together to improve building design and construction practice. *Analyze soil type* before construction and do not build structures on soft soil. To accommodate on weak soils adopt safety measures in design.

- Follow **Indian Standard Codes** for construction of buildings.
- Enforcement of the **Byelaws** including **Land use** control and restriction on density and heights of buildings

- ***Strengthening*** of important lifeline buildings which need to be functional after a disaster. Upgrade level of safety of hospital, fire service buildings etc.

- ***Public awareness***, sensitization and training programmes for *A*rchitects, *B*uilders, *C*ontractors, *D*esigners, *E*ngineers, *F*inanciers, *G*overnment functionaries, *H*ouse owners, *M*asons etc. Reduce possible damages from secondary effects such as like fire, floods, landslides etc. e.g. identify potential landslide sites and restrict construction in those areas. The principles and construction features for earthquake resistance structure are shown in chart-2.2

Chart 3.2
Principles and Construction Features for Quake-Resistance

Principle	Effect in an earthquake	Construction Features
Structural stability	Avoid overturning and collapse	• Subsoil bears loads • Adequate tying elements • proper aspect ratios • Geometrical regularity • Uniform rigidity distribution • Mansonary courses planned
Minimize building inertia	Lessen over-turning moments	• Light building materials • Thin walls
Strong and well-tied framework	Transfer of inertial forces to ground	• Tie-bands • Triangulation of frame • Corner reinforcement
In-plane stiffness In both directions	Resistance to inertial forces	• Few openings, suitably placed • Cross walls and Buttresses
Low CG	Lessen over-turning probability	• Low storey heights • Light building materials
Shear centre close to CG	Reduce local stress and initiation of collapse	• Symmetrical and regular • Building forms • Avoid long lengths • Simple designs with minimum projections/openings/cut outs.

Increase absorption of ductility of steel/bamboo	• Use ductile materials at point of inertial forces tensile stresses, • Structure reinforcement at corner joints • Provide several support for key structural elements and • Multiple columns support for long portions of a building.

COMMUNITY BASED MITIGATION

Community preparedness along with public education is vital for mitigating the earthquake impact earthquake drills and public awareness programme. **Community based Earthquake Risk Management Project** should be developed and sustainable programmes launched. Retrofitting of schools and important buildings, purchase of emergency response equipment and facilities, establishing proper insurance can be the programmes under Earthquake Risk Management Project. A large number of local masons and engineers may be trained in disaster resistant construction techniques. A large number of masons, engineers and architects can get trained in this process.

A Guide to Earthquake Reduction

(i) **Prepare a Home Earthquake Plan**

➢ Choose a safe place in every room-under a sturdy table or desk or against an inside wall where nothing can fall on you.

➢ Practice **drop, cover, and hold on**. Drop under a sturdy desk or table, hold on, and protect your eyes by pressing your face against your arm. If there's no table or desk nearby, sit on the floor against an interior wall

away from windows or tall furniture that could fall on you. Teach children to **drop, cover, and hold on.**

➢ Choose an out-of-town family contact.

➢ Consult a professional to find out additional ways to protect your home, by implementing structural mitigation techniques.

➢ Take a first aid class.

➢ Get training in how to use a fire extinguisher.

➢ Bolt bookcases, kichten cabinets, and other tall furniture to wall studs.

(ii)   Prepare a Disaster Supplies Kit for Home-

➢ First aid kit and essential medications.

➢ Potable water.

➢ Protective clothing, rainwear, and bedding.

➢ Battery-powered radio, flashlight, and extra batteries.

➢ Special items for infant, elderly, or disabled family members.

➢ Identify where you could go if told to evacuate. Choose safe places-a relative's/friend's home in another town, a motel, or a shelter.

(iii)   What to Do when the Shaking Begins

➢ **Drop, cover, and hold on**. Move only a few steps to a nearby safe place. Stay indoors until the shaking stops and you're sure it's safe to exit. Stay away from windows. In a high-rise building, expect the fire alarms and sprinklers to Government off during a quake.

➢ If you are in bed, hold on and stay there, protecting your head with a pillow.

- ➤ If you are outdoors, find a clear spot away from buildings, trees, and power lines. Drop to the ground.
- ➤ If you are in a car, slow down and drive to a clear place (as described above). Stay in the car until the shaking stops.

(iv)   What to Do After the Shaking Stops
- ➤ Check yourself for injuries. Protect yourself from further danger by putting on long pants, a long-sleeved shirt, sturdy shoes, and work gloves.
- ➤ Check others for injuries. Give first aid for serious injuries.
- ➤ Look for and extinguish small fires. Eliminate fire hazards.
- ➤ Listen to the radio/TV for instructions.
- ➤ Expect aftershocks. Each time you feel one, **drop, cover, and hold on.**
- ➤ Inspect your home for damage. Get everyone out if your home is unsafe.

(v)   Make Your Home Fire Safe
- ➤ Smoke alarms save lives. Install a smoke alarm outside sleeping area and on additional levels of your home.
- ➤ If people sleep with doors closed, install smoke alarms inside sleeping areas, too.
- ➤ Use the test button to check each smoke alarm once a month. When necessary, replace batteries immediately. Replace all batteries at least once a year.
- ➤ Clean cobwebs and dust from your smoke alarms monthly.

> ➤ Consider having one or more working fire extinguishers in your home. Get training from the fire department in how to use them.

(vi) Plan Your Escape Routes

> ➤ Determine at least two ways to escape from every room of your home.
> ➤ Consider escape ladders for sleeping areas on the second or third floor. Learn how to use them and store them near the window.
> ➤ Select a location outside your home where everyone would meet after escaping.
> ➤ Practice your escape plan at least twice a year.

(vii) Escape Safely

> ➤ Once you are out, stay out! Call the fire department.
> ➤ If you see smoke or fire in your first escape route, use your second way out. If you must exit through smoke, crawl low under the smoke to your exit.
> ➤ If you are escaping through a closed door, feel the door before opening it. If it is warm, use your second way out.
> ➤ Smoke, heat, or flames block your exit routes, stay in the room with the door closed. Signal for help using a bright-colored cloth at the window.

If there is a telephone in the room, call the fire brigade and tell them where you are.

Chapter- 4

TSUNAMI

Tsunami Disaster in the Indian Ocean was one of the worst natural disasters in modern times. Over 200,000 people died and more than 1.5 million people lost their homes and their livelihoods. Major tsunamis occurred in India are shown in Table - 4.1

Table - 4.1
Tsunamis in India

Date	Location	Impact
1524	Near Dabhol, Maharashtra	Sufficient data not available
02 April 1762	Arakan Coast, Myanmar	Sufficient data not available
16 June 1819	Rann of Kutchh, Gujarat	Sufficient data not available
31 October 1847	Great Nicobar Island	Sufficient data not available
31 December 1881	An earthquake of 7.9 in the Richter scale in Car Nicobar Island	Entire east cost of India and Andaman & Nicobar Islands; 1 m tsunamis were recorded at Chennai
26 August 1883	Explosion of the Krakatoa volcano in Indonesian	East coast of India was affected; 2 m tsunamis were recorded at Chennai
26 June 1941	An 8.1 Richter Scale earthquake in the Andaman Archipelago	East coast of India was affected but no estimates of height of the tsunami is available
27 November 1945	An 8.5 Richter scale earthquake at a distance of about 100 km south of Karachi	West coast of India from north to Karwar was affected; 12 m tsunami was felt at Kandla
26 December 2004	Banda Aceh, Indonesia; Tamil Nadu, Kerala, Andhra Pradesh, Andaman and Nicobar Islands, India; Sri Lanka, Thailand, Malaysia, Kenya, Tanzania	The East cost of India was affected. The waves measured around 10 m high killing more than 10,000 precious lives

Source: NDMD, MOH, Government of India, Delhi

The recent tsunami strike in December 2004 severely hit the coastal states of Tamil Nadu, Kerala, Andhra Pradesh and union territory of Andaman Nicobar Islands. According to Government reports, 10739 people in India lost their lives and 6913 were injured. It was reported that 5640 persons are still missing. The highest human losses were in the Andaman Nicobar Islands and the state of Tamil Nadu. Overall damages were estimated at about $660 million and losses to $410 million (UN, 2005).

CONCEPT AND CAUSES

If the earthquake or under water land movement is near the coast then tsunami may strike suddenly and if the earth movement is far in the sea then it may take few minutes to hours before striking the coast. The onset is extensive and often very destructive. The general causes of Tsunamis are geological movements. It is produced in *three major ways*. The most common of these is fault movement on the sea floor, accompanied by an earthquake. To say that an ***earthquake*** causes a tsunami is not completely correct. Rather, both earthquakes and tsunamis result from fault movements. Probably the second most common cause of tsunamis is a ***landslide*** either occurring underwater or originating above the sea and then plunging into the water. The third major cause of tsunamis is ***volcanic activity***. The flank of a volcano, located near the shore or underwater, may be uplifted or depressed similar to the action of a fault. Or, the volcano may actually explode. In 1883, the violent explosion of the famous volcano, Krakatoa in Indonesia, produced tsunamis measuring 40 meters which crashed upon Java and Sumatra. Over 36,000 people lost their lives as a result of tsunami waves from Krakatoa. The giant tsunamis that are capable of crossing oceans are

nearly always created by movement of the sea floor associated with earthquakes which occur beneath the sea floor or near the ocean.

Tsunami is not a single giant wave. It consists of ten or more waves which are termed as a "tsunami wave train". Since scientists cannot predict when earthquakes will occur, they cannot predict exactly when a tsunami will be generated. Studies of past historical tsunamis indicate where tsunamis are most likely to be generated, their potential heights, and flooding limits at specific coastal locations. With use of satellite technology it is possible to provide nearly immediate warnings of potentially tsunamigenic earthquakes. Warning time depends upon the distance of the epi-center from the coast line. The warning includes predicted times at selected coastal communities where the tsunami could travel in a few hours. In case of tsunami genie earthquakes or any other geological activity people near to the coastal areas may get very little time to evacuate on receiving of warning.

All structures located within 200 mts. of the low lying coastal area are most vulnerable to the direct impact of the tsunami waves as well as the impact of debris & boulders brought by it. Settlements in adjacent areas will be vulnerable to floods & scour. Structures constructed of wood, mud, thatch, sheets and structures without proper anchorage to foundations are liable to be damaged by tsunami waves & flooding. Other elements at risk are infrastructure facilities like ports & harbours, telephone and electricity poles, cables. Ships & fishing boats/nets near the coast also add to the destruction caused by tsunami waves.

EFFECTS OF TSUNAMI:

Local tsunami events or those less than 30 minutes from the source cause the majority of damage. The force of wave can raze everything in its path. It is the flooding effect of a tsunami, however, that most greatly affects human settlements by water damage to homes and businesses, roads, bridges and other infrastructure. Ships, port facilities, boats/trawlers, fishing nets also get damaged.

There is evidence of ever increasing impact upon the environment on account of the effects of tsunamis. The range varies from generation of tonnes of debris on account of structural collapse of weaker buildings, release of toxic chemicals into the environment on account of chemical leak/spillage/process failure/utility breakages/ collateral hazards and negative impact on the already fragile ecosystems.

Deaths occur principally from drowning as water inundates homes or neighborhoods. Many people may be washed out to sea or crushed by the giant waves. There may be some injuries from battering by debris and wounds may become contaminated.

Sewer pipes may be damaged causing major sewage disposal problems. Drinking water shortage arises due to breakage of water mains and contamination. Open wells and ground water may become unfit for drinking due to contamination of salt water and debris.

Flooding by tsunami causes damage to the standing crops and also to the food supplies in the storage facilities. The land may be rendered infertile due to salt water incursion from the sea.

PREPAREDNESS MEASURES

A hazard map should be prepared with designated areas expected to be damaged by flooding by tsunami waves. Historical data could be of help in showing areas inundated in the past. Keeping in mind the vulnerable areas, evacuation routes should be constructed and mapped. The plan should be followed by evacuation drill.

A well networked system in place can warn the communities of the coastal areas when the threat is perceived. Tsunami warning should be disseminated to local, state, national as well as the international community so as to be prepared as they are capable of crossing across continents. The information can be broadcasted to the local emergency officers and the general public. On receiving of the warning the action should be to evacuate the place as decided in the evacuation plan.

Communities in the coastal areas are faced by the wrath of cyclones, storm surge and tsunami waves. It is important that the community is better prepared to take suitable actions on receiving the threat and follow emergency evacuation plans and procedures. A community which choose to ignore warning may get severely affected if they are not prepared to take immediate measures.

MITIGATION STRATEGIES

Site Planning and Land Management

Within the broader framework of a comprehensive plan, site planning determines the location, configuration, and density of development on particular sites and is, therefore, an important tool in reducing tsunami risk.

- The designation and zoning of tsunami hazard areas for such open-space uses as agriculture, parks and recreation, or natural hazard areas is recommended as the first land use planning strategy. This strategy is designed to keep development at a minimum in hazard areas.

- In areas where it is not feasible to restrict land to open-space uses, other land use planning measures can be used. These include strategically controlling the type of development and uses allowed in hazard areas, and avoiding high-value and high-occupancy uses to the greatest degree possible.

- The capital improvement planning and budgeting process can be used to reinforce land use planning policies.

Engineering Structures

As most of the structures along the coast area comprises of fisherman community, which are constructed of light weight materials without any engineering inputs. Therefore there is an urgent need to educate the community about the good construction practices that they should adopt such as:

- Avoid building or living in buildings within several hundred feet of the coastline as these areas are more likely to experience damage from tsunamis.

- Construct the structure on a higher ground level with respect to mean sea level.

- Elevate coastal homes: Most tsunami waves are less than 3 meters in height. Elevating house will help reduce damage to property from most tsunamis. Structural columns resist the impact while other walls are expendable. It is important also to take note that adequate measures are brought into the design to cater for earthquake forces.

- Construction of water breakers to reduce the velocity of waves.

- Use of water & corrosion resistant materials for construction.

- Construction of community halls at higher locations, which can act as shelters at the time of a disaster.

Flooding will result from a tsunami. Tsunami waves will flood the coastal areas. Flood mitigation measures could be incorporated. Building barriers or buffers such as special breakwaters or seawalls can be an effective risk reduction measure against gushing waters in case of Tsunami/Storm surge during cyclones.

CHAPTER- 5

CYCLONE HAZARDS AND DISASTERS

INDIAN CYCLONES

The coastal areas are subjected to severe wind storms and cyclonic storms. A full-grown cyclone is a violent whirl in the atmosphere 150 to 1000 km across, 10 to 15 km high. Gale winds of 150 to 250 kmph or more spiral around the center of very low pressure area. Torrential rains, occasional thunder and lightning flashes - join these under an overcast black canopy. Through these churned chaotic sea and atmosphere, the cyclone moves 300 to 500 km, in a day to hit or skirt along a coast, bringing with it storm surges as high as 3 to 12 metres, as if splashing a part of the sea sometimes up to 30 km inland leaving behind death and destructions. A storm surge is the sudden abnormal rise in the sea level caused by cyclone. The sea water flows across the coast as well as inland and then recedes back to the sea. Great loss of life and property takes place in the process.

Cyclones affect both the Bay of Bengal and the Arabian Sea. They are rare in Bay of Bengal from January to March. Isolated ones forming in the South Bay of Bengal move west-north-westwards and hit Tamil Nadu and Sri Lanka coasts. In April and May, these form in the South and adjoining Central.

Bay and move initially northwest, north and then recurve to the northeast striking the Arakan coasts in April and Andhra-Orissa-West Bengal-Bangla desh coasts in May. Most of the monsoon (June-September) storms develop in the central and in the North Bay and move west-north-westwards affecting Andhra-Orissa-West Bengal coasts. Post monsoon (October-December) storms form mostly in the south and the central Bay, recurve between 15^0o and 18^0o N affecting Tamil Nadu-Andhra Orissa-West Bengal-Bangladesh coasts.

Cyclones do not form in Arabian Sea during the months of January, February and March and are rare in April, July, August and September. They generally form in southeast Arabian Sea and adjoining central Arabian Sea in the months of May, October, November and December and in east central Arabian Sea in the month of June. Some of the cyclones that originate in the Bay of Bengal travel across the peninsula weaken and emerge into Arabian Sea as low pressure areas. These may again intensify into cyclonic storms. Most of the storms in Arabian Sea move in west-north-westerly direction towards Arabian Coast in the month of May and in a northerly direction towards Gujarat Coast in the month of June. In other months, they generally move northwest north and then recurve northeast affecting Gujarat-Maharashtra coasts; a few, however, also move west north westwards towards Arabian coast.(Table-5.1)

Table - 5.1
Noteworthy Tropical Cyclones

Sl.No.	Year	Area	Death toll
1.	1971	Eastern Coast	9658
2.	1972	Andhra Pradesh and Orissa	100
3.	1977	Chennai, Kerala & Andhra Pradesh	14,204
4.	1979	Andhra Pradesh	594
5.	1981	Gujarat	470
6.	1982	Gujarat & Maharashtra	500
7.	1984	Tamil Nadu & Andhra Pradesh	512
8.	1985	Andhra Pradesh	5,000
9.	1990	Andhra Pradesh	957
10	1990	Orissa	250
11.	1999	Orissa	8,913

Source: Office of the US Foreign Disaster Assistance

Major cyclones occurred in Indian ocean are shown in Table 5.2. The Bangladesh cyclone of 1991 hit India too and caused death of 1.32 lakh persons.

Table - 5.2
Recent Cyclones in Indian Region

Cyclone	Peak wind Intensity m/s	OCS* M/S	MSDW** m/s	Size dia. of area of 17 m/s or more wind	Peak Surge Lives	Loss of Human million	Loss of Property Rupees
Chirala Cyclone (1977)	70	28.5	31.0	750	5.2	10000	3500
Machilipatnam Cyclone (1979)	58	22.2	20.0	600	3.5	700	1700
Sriharikota Cyclone (1984)	58	11.5	12.2	300	3.2	604	4000
Bangladesh Cyclone (1985)	58	28.4	28.0	800	4.5	2500	1377
Kavali Cyclone (1989)	65	10.3	13.2	250	3.5	51	140
Machilipatnam Cyclone (1990)	65	23.2	23.9	550	3.5	967	22480
Bangladesh Cyclone (1991)	65	23.0	24.2	500	6.0	132000	-

|							
Orissa Cyclone (1999)	72	42.0	20.0	10000	5.5	-	-

*Outer Core Strength
**Main Strength of Destructive Wing
Source: Bhandari, N.M. et. al., Structural Damage due to Cyclones and their Retrofitting, World Congress on Disaster Management, WFEO'S Vol. II, 2004

HAZARD ZONES

The wind zone map illustrates the area vulnerable to high wind speeds. The macro-level wind speed zones of India have been formulated and published in IS 875 (Part-3) – 1987. There are six basic wind speeds considered for zoning, namely:
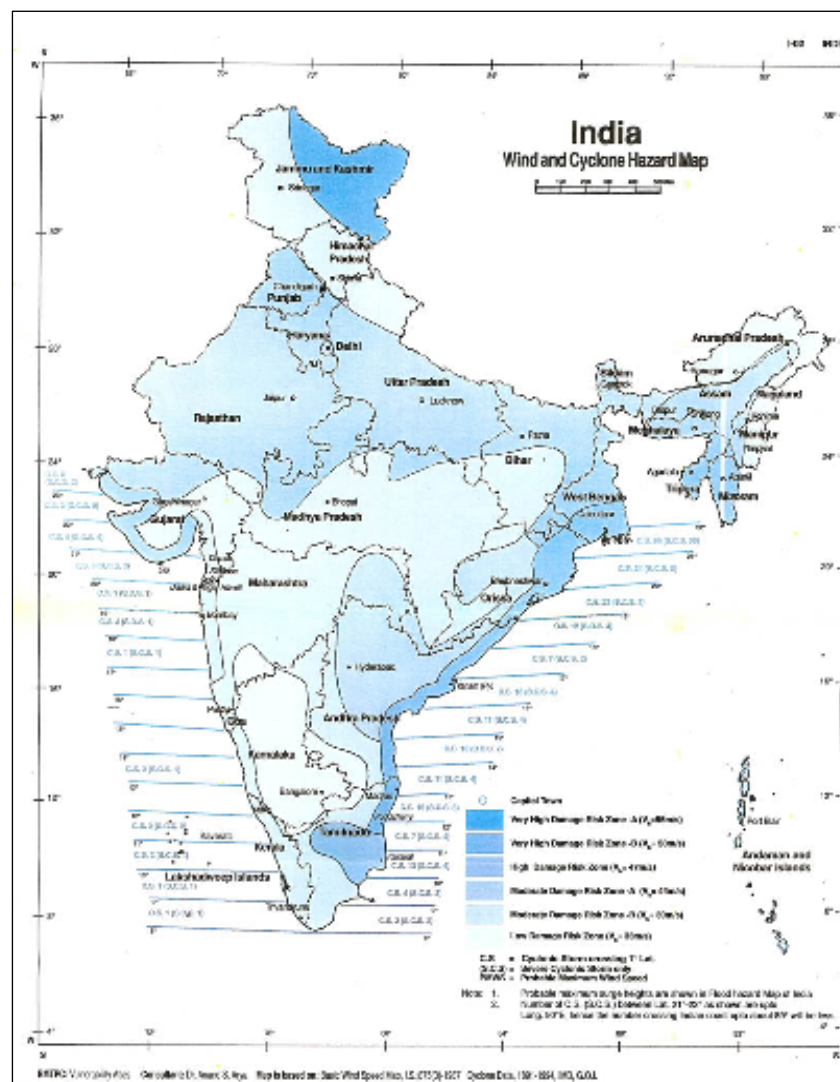
The criteria followed by the Meteorological Department of India to classify the low pressure systems in the Bay of Bengal and in the Arabian Sea as adopted by the World Meteorological Organisation (WMO) is shown in Box:

Wind Circulation and Disturbances

Types of Disturbances	Associated wind speed in the Circulation	
	Knot	Km/hr
1. Low Pressure Area	Less than 17 knots	< 31 kmph
2. Depression	17 to 27 knots	31 to 49 kmph
3. Deep Depression	28 to 33 knots	50 to 61 kmph
4. Cyclonic Storm	34 to 47 knots	62 to 88 kmph
5. Severe Cyclonic Storm	48 to 63 knots	89 to 118 kmph
6. Very Severe Cyclonic Storm	64 to 119 knots	119 to 221 kmph
7. Super Cyclonic Storm	120 knots and above	222 kmph and above

Level of Risks	Wind Speed (km/hr)
Very High Damage Risk Zone-A	198
Very High Damage Risk Zone-B	180 km/hr
High Damage Risk Zone	169.2 km/hr
Moderate Damage Risk Zone-A	158.4 km/hr
Moderate Damage Risk Zone-B	140.4 km/hr
Low Damage Risk Zone	118.8 km/hr

The cyclone affected areas of the country are classified in 50 and 55m/s zones. It is known that in certain events, the wind gusts could appreciably

exceed the given basic wind speeds. For design of structures and classification of vulnerability and risk to buildings, the above macro-level zoning is considered as sufficient.

Surge Prone Coasts of India

Storm surge heights depend on the intensity of the cyclone, i.e., very high-pressure gradient and consequent very strong winds and the topography of seabed near the point where a cyclone crosses the coast. Sea level also rises due to astronomical high tide. Elevation of the total sea level increases when peak surge occurs at the time of high tide. Vulnerability to storm surges is not uniform along Indian coasts.

The following segments of the ***East Coast of India*** are most vulnerable to high surges:
- North Orissa and West Bengal coasts.
- Andhra Pradesh coast between Ongole and Machilipatnam.
- Tamil Nadu coast, south of Nagapatnam.

The ***West Coast of India*** is less vulnerable to storm surges than the east coast of India in terms of both the height of storm surge as well as frequency of occurrence. However, the following segments are vulnerable to significant surges:
- Maharashtra coast, north of Harnai and adjoining south Gujarat coast and the coastal belt around the Gulf of Bombay.
- The coastal belt around the Gulf of Kutch.

The coastal belt plantation (green belt plantation along the coastal line in a scientific interweaving pattern) can reduce the adverse impact of hazards of cyclone, tsunami, and flood. However, the frequent cutting of plants, trees and clearance of forest and mangroves, the cyclone and tsunami waves trend freely in land. The lakh of productive forest cover allows water to immediate large areas and cause destruction. Thus, community based mitigation strategies are to be introduced.

VULNERABILITY

All lightweight structures and those built of mud, wood, older buildings with weak walls and structures without proper anchorage to the foundations will be at great risk. Settlements located in low lying coastal areas will be vulnerable to the direct effects of the cyclones such as wind, rain and storm surge. Settlements in adjacent areas will be vulnerable to floods, mudslides or landslides due to heavy rains. Other elements at risk are fences, telephone & electricity poles, cables, light elements of structures–roofs, signboards, hoardings, coconut crowns, fishing boats & large trees.

EFFECTS OF CYCLONE HAZARD

First, in a sudden, brief onslaught, high winds cause major damage to infrastructure and housing, in particular fragile constructions. They are generally followed by heavy rains and floods and, in flat coastal areas by storm surge riding on tidal waves and inundating the land over long

distances of even up to 15km inland. Structures will be damaged or destroyed by the wind force, flooding and storm surge. Light pitched roofs of most structures especially the ones fitted on to industrial buildings will suffer severe damage. Caused by flooding and flying elements, contamination of water supplies may lead to viral outbreaks, diarrhea, and malaria. Ground and piped water supply may get contaminated by flood waters. High winds and rains will ruin the standing crop and food stock lying in low lying areas. Plantation type crops such as banana and coconut are extremely vulnerable. Salt from the sea water may be deposited on the agricultural land and increase the salinity. The loss of the crop may lead to acute food shortage.

Severe disruption in the communication links as the wind may bring down the electricity and communication towers, electricity and telephone poles, telephone lines, antennas and satellite disk and broadcasting services. Transport lines (road and rail) may be curtailed. Relief materials may not reach the affected site.

MITIGATION STRATEGIES

Meteorological records of the wind speed and the directions give the probability of the winds in the region. Cyclones can be predicted several days in advance. The onset is extensive and often very destructive. Past records and paths can give the pattern of occurrence for particular wind speeds. A hazard map will illustrate the areas vulnerable to the cyclone in any given year. It will be useful to estimate the severity of the cyclone and various damage intensities in the region. The map is prepared with data

inputs of past climatological records, history of wind speed, frequency of flooding etc.

Land use control should be designed so that least critical activities are placed in vulnerable areas. Location of settlements in the flood plains is at utmost risk. Setting of key facilities must be marked in the land use. Policies should be in place to regulate land use and enforcement of building codes. Vulnerable areas should be kept for parks, grazing or play grounds.

Engineered structures need to be built to withstand wind forces. Good site selection is also important. Majority of the buildings in coastal areas are built with locally available materials and have no engineering inputs. Good construction practice should be adopted such as:

- Cyclonic wind storms inundate the coastal areas. It is advised to construct on stilts or on earth mound.
- Houses can be strengthened to resist wind and flood damage. All elements holding the structures need to be properly anchored to resist the uplift or flying off of the objects.
- A row of planted trees will act as a shield. It reduces the energy.
- Buildings should be wind and water resistant.
- Buildings storing food supplies must be protected against the winds and water.
- Protect river embankments. Communication lines should be installed underground.
- Provide strong halls for community shelter in vulnerable locations.

Flooding will result from a cyclonic storm. Storm surge will flood the coastal areas. Heavy rains will bring in flash floods. There are possibilities of landslides too. Flood mitigation measures could be incorporated.

Improving vegetation cover – improvement of the vegetation will increase water infiltration capacity of the soil. The roots of the plants and trees will keep the soil intact and prevent erosion and slow runoff to prevent or lessen flooding. The use of tree planted in rows will act as a windbreak.

Coastal shelterbelt plantation can be developed to break severe wind speeds. It minimizes devastating effects. The Orissa calamity has also highlighted the need for urgent measures like shelterbelt plantation along cyclone-prone coastal areas. Species chosen for this purpose should not only be able to withstand the impact of strong cyclonic winds, but also check soil erosion.

Chapter-6

FLOOD

Floods are a recurring phenomenon in chronically flood prone regions in India. Floods affect around 7.56 million hectares of area (2.30 per cent of country's area) and 3.3 million hectares of crop lands every year (4 per cent of the cropped area). Eastern India, comprising Uttar Pradesh, Bihar, West Bengal, Assam, and Orissa account for about 70 per cent of the flood impacts in the country. The death toll due to major floods in India is shown in Table-6.1

Table - 6.1
Major Floods of India

Year	Number of people killed	Location
1961	2,000	North
1968	4,892	(1) Rajasthan, Gujarat - (2) Noth-East, West Bengal, Assam
1971	4,023	North India
1978	8,800	North, Northeast
1980	1,600	Uttar Pradesh, Bihar, Gujarat, Kerala, Haryana
1989	1,591	Maharashtra, Andhra Pradesh, Gujarat
1994	2,001	Assam, Arunachal Pradesh, Jammu and Kashmir, Himachal, Punjab, Uttar Pradesh, Goa, Kerala, Gujarat states
1995	1,479	Bihar, Haryana, Jammu & Kashmir, Punjab, Uttar Pradesh, West Bengal, Mahrashtra
1997	1,442	Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Gujarat, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kera, Maharashtra, Madhya Pradesh, Orissa, Punjab, Rajasthan, Sikkim, Uttar Pradesh, West Bengal states
1998	1,811	Assam, Arunachal, Bihar, Kerala, Meghalaya, Punjab, Sikkim, Uttar Pradesh, West Bengal states
2000	1,290	Gujarat, Andhra Pradesh, Assam, Arunachal Pradesh, Bihar, Himachal Pradesh, Kerala, Madhya Pradesh, Punjab, Uttar Pradesh, West Bengal

Source: NDMD, MOH, Government of India, Delhi

The flood of 2000 alone killed about 1300 persons in Gujarat, Andhra Pradesh, Assam, Arunachal Pradesh, Bihar, Himachal Pradesh, Kerala, Madhya Pradesh, Punjab, Uttar Pradesh and West Bengal. Even, floods have adversely affected economy and society of major metropolitan cities like Mumbai, Surat, Ahmadabad, Raipur, and Pune etc. in the recent past. The flood of Bihar in 2008 has adversely affected about 3 million peoples of the state. The annual damage due to heavy rains landslides and floods is shown in Table - 6.2.

Table - 6.2
Damage Due to Floods in India

Sl. No.	Year	Districts affected	Villages affected (No)	Population affected (Lakh)	Crop Area affected (Lakh Ha.)	Houses Damaged (no.)	Human life loss (no.)	Cattle loss (no.)	Estimated value of loss to houses (Rs. in crore)	Estimated of value of Public Properties (Rs. in crore)
1.	1999	202	33,158	328.12	8.45	884,823	1,375	3,861	0.72	
2.	2000	200	29,964	416.24	34.79	2,736,355	3,048	102,121	631.25	389.72
3.	2001	122	32,363	210.71	18.72	346,878	834	21,269	195.57	676.05

Source: Annual Reports, Natural Disaster Management Division, Ministry of Agriculture.

In 2001, 122 districts were hit by floods and affected 21.110 million population. Mapping of flood prone areas; land use regulation and control; construction of engineered structures; flood management; and community based mitigation such as sedimentation clearance, reforestation, etc. may reduce the adverse impact of floods in vulnerable areas.

Vulnerability of Floods

Anything in the flood plains will get inundated. Buildings built of earth, weak foundations and water soluble materials will collapse

endangering humans and their property. Basements of buildings are under risk. Utilities such as sewerage, water supply, communication lines, and power are put at risk. Food stock in the godowns, agricultural fields, salt pans, livestock, vehicles, machinery and equipments mounted on the ground, fishing boats are also put at risk.

Hazard Zones

The Vulnerability Atlas of India shows pictorially the areas liable to floods. The flood hazard map is based on the Flood Atlas of India brought out by the Central Water Commission, state wise marking both the areas which are liable to flooding as well as those which have been protected. The maps given in the Vulnerability Atlas of India show the district boundaries and the location of the district towns along with the rivers district wise identification of vulnerable areas will be easy. Besides the problems of flooding in the river plains, heavy intensity rains could cause local; flooding in certain areas where the drainage is either naturally poor or the drains are choked due to various reasons such as careless dumping of refuse in the drains and lack of maintenance. Much of the flooding in the towns and cities occur due to such cases. Under cyclonic winds in coastal areas, the sea coast of India can be flooded due to heavy down pour on the one hand and storm surge on the other. The depth of inland water inundation could be worked out by taking the storm surge heights. The rivers in India can be broadly divided into the following four regions for a study of flood problem.

1. Brahmaputra Region;
2. Ganga Region;
3. North West Region; and

Flood Hazard Map of India:
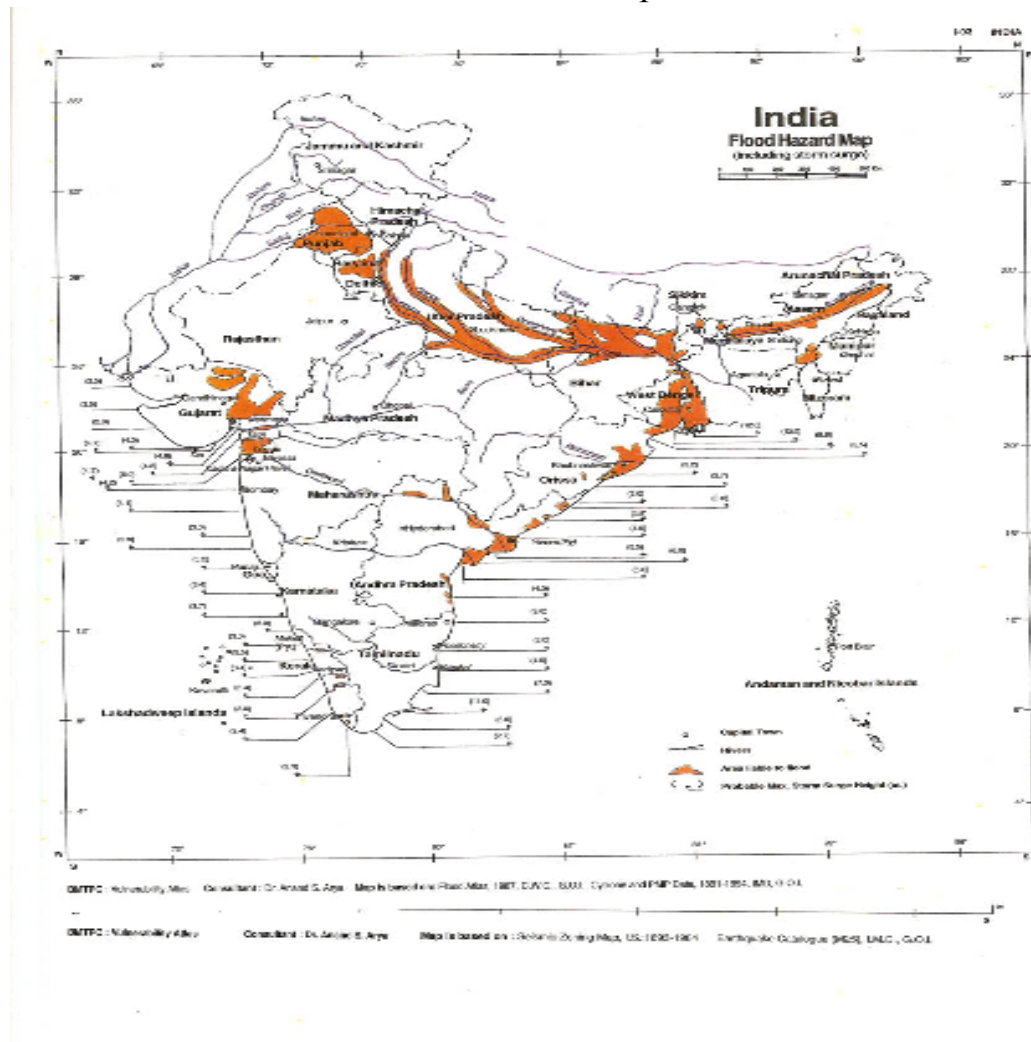
Causes of Floods

Flooding is caused by the inadequate capacity within the banks of the rivers to contain the high flows brought down from the upper catchments due to heavy rainfall. Areas having poor drainage characteristic get flooded by accumulation of water from heavy rainfall. Flooding is accentuated by erosion and silting of the river beds resulting in reduction of carrying capacity of river channel. earthquakes and landslides leading to changes in river courses, obstructions to flow, synchronization of floods in the main and tributary rivers and retardation due to tidal effects. Some parts of the country

mainly coastal areas of Andhra Pradesh, Assam, Orissa, Tamilnadu and West Bengal experience cyclones which often are accompanied by heavy rainfall leading to flooding.

Another cause for flooding has been the water logging in the irrigated area. This is due to excess irrigation water applied to command area and increase in ground water level due to seepage from canals and irrigated field. It has been assessed that an area of 2.46 m. ha. is suffering from problem of water logging under irrigation commands in India.

Effects of Flood

Physical Damag- The structures may damage or collapse by washing waters, landslide triggering on account of water getting saturated. Boats and fishing equipments may be lost or damaged in coastal areas. People and livestock deaths may be caused by drowning, very few serious injuries. Outbreak of epidemics, diarrhea, viral infections, malaria may also be happened. Contamination of water (wells, ground water, piped water supply) is very common during floods. Clean water may be unavailable. Sudden food shortage can be caused due to loss of entire harvest, spoiling of grains when saturated in water along with loss of animal fodder. The crop storage facilities and go-downs may get submerged resulting in immediate food shortage. Floods may also affect the soil characteristics. The land may be rendered infertile due to erosion of top layer or may turn saline if sea water floods the area.

Embankments along the rivers, sea walls along the coasts may keep water away from the flood plains. Water flow can be regularized through

construction of the reservoirs, check dams, alternate drainage channels/routes, increasing vegetation cover and by providing storm drains.

Mitigation Strategies

Mapping of the flood prone areas is a primary step involved in reducing the risk of the region. Historical records give the indication of the flood inundation areas and the period of occurrence and the extent of the coverage. The basic map is combined with other maps and data to form a complete image of the floodplain. Warning can be issued looking into the earlier marked heights of the water levels in case of potential threat. In the coastal areas the tide levels and the land characteristics will determine the submergence areas. Flood hazard mapping will give the proper indication of water flow during floods.

Land use control will reduce danger of life and property when waters inundate the floodplains and the coastal areas. The number of casualties is related to the population in the area at risk. It's better to reduce the densities in areas where neighborhoods are to be developed. In areas where people already have built their settlements, measures should be taken to relocate to better sites so as to reduce vulnerability. No major development should be permitted in the areas which are subjected to high flooding. Important facilities should be built in safe areas. In urban areas, water holding areas can be created in ponds, lakes or low-lying areas. Construction of engineered structures in the flood plains and strengthening of structures to withstand flood forces and seepage is imperative. The buildings should be constructed on a elevated area. If necessary build on stilts or platform.

Flood Control aims to reduce flood damage. This can be done by *Flood Reduction* by decreasing the amount of runoff by treatment like reforestation protection of vegetation, clearing of debris from streams and other water holding areas, conservation of ponds and lakes etc. *Flood Diversion* include levees, embankments, dams and channel improvement. Dams can store water and can release water at a manageable rate. But failure of dams in earthquakes and operation of releasing the water can cause floods in the lower areas. *Flood Proofing* reduces the risk of damage. Measures include use of sand bags to keep flood water away, blocking or sealing of doors and windows of houses etc. Houses may be elevated by building on raised land. Buildings should be constructed away from water bodies.

Flood Management in India, was initiated by systematic planning for flood management commenced with the Five Year Plans, particularly with the launching of National Programme of Flood Management in 1954. During the last 48 years, different methods of flood protection structural as well as non-structural have been adopted in different states depending upon the nature of the problem and local conditions. Structural measures include storage reservoirs, flood embankments, drainage channels, anti-erosion works, channel improvement works, detention basins etc. and non-structural measures include flood forecasting, flood plain zoning, flood proofing, disaster preparedness etc. The flood management measures undertaken so far have provided reasonable degree of protection to an area of 15.81 million hectares through out the country. The various flood management measures undertaken through the successive five year plans (up to 3/2000) are summarized below:

Approaches, Policies and Measures

The approaches to deal with Floods may be any one or more combination of the following available options:

(i)   Attempts to modify the food.

(ii)   Attempts to modify the susceptibility to flood.

(iii)   Attempts to modify the loss burden.

(iv)   Bearing the loss.

Evolution of Policies on Flood Management in India

After the unprecedented floods of 1954, the Government of India took several initiatives and constituted a number of Committees to study the problem of floods in the country. The important steps are,

- Policies Statement- 1954

- High Level Committee on Floods-1957

- Policy Statement of 1958.

- Ministerial Committee on Flood Control-1964.

- Minister's Committee on Flood Control for Five Year Plans.

- Rashtriya Barh Ayog (RBA) - 1980

- National Water Policy (1987).

- National Commission for Integrated Water Resource Development Plan-1996.

- Regional Task Forces-1996.

- National Water Policy (2002).

All the measures for flood management can be classified as under:

Structural measures

(i)   Embankments, flood walls, sea wall.

(ii)   Dams and Reservoirs.

(iii)   Natural detention basin.

(iv)   Channel improvement.

(v)   Drainage improvement.

(vi)   Diversion of flood waters.

Non-structural measures

(i)   Flood Plain Zoning

(ii)   Flood Proofing including Disaster Preparedness and Response Planning.

(iii)   Flood Forecasting and Warning.

(iv)   Disaster Relief.

(v)   Flood Fighting including Public Health Measures.

(vi)   Flood Insurance

Chapter- 7

DROUGHT

Drought is an insidious natural hazard that results from a departure of precipitation from expected or normal that is insufficient to meet the demands of human, plant and animal activities. Almost 35 per cent of the country's area, receiving annual average rainfall of less than 750 mm is prone to drought once in three years. In these areas, almost 200 million people are affected in varying degrees by drought (Table - 7.1). In the arid and the semi arid regions, seasonal periodicities can affect the pattern of livelihood system of farmers.

Table-7.1
Losses Due to Drought in India

S.No.	Year	Districts affected	Villages affected (No)	Population affected (Lakh)	Damage to crops area (Lakh Ha.)	Estimated value of damaged crops (Rs. crore)	Cattle population affected (in lakh)
1	1999	125	-	369.88	134.22	6.44	345.60
2.	2000	110	54,883	378.14	367.00	371.87	541.67
3.	2001	103	22,255	88.19	67.44	NA	34.28
	Total	**338**	**77,138**	**836.21**	**568.66**	**378.31**	**921.55**

Source: Annual Reports, Natural Disaster Management Division, Ministry of Agriculture

Causes of Droughts

Inadequate and improper management of rainfall are the most important factors causing drought. Denuded and sloppy landscapes result in

colossal loss of soil and washes away soil nutrients, which are scarce in drought prone areas creating nutrient stressed conditions. Studies at Solapur in run off plots put the loss of 60-90 tones of soil from one hectare each year due to erosion resulting from different management practices. Proper land treatment for retention of rain water is a part of drought proofing. Division of land amongst family members and extending cultivation to the marginal and sub marginal areas destroys the natural grass cover resulting in erosion and thereby poor production. Fragmentation of land, unchecked cattle population, destruction of grass lands and trees accelerate the land degradation and also encourage soil erosion.

Consequences of Droughts

Indian economy being agriculture oriented any adversely effect on agriculture affects the economy badly. The major kharif crops are rain water dependent and depending upon the rain water crops face stress in different parts of country. In addition to poor crop production and reduced water availability, drought affects rural life in several ways. Drought results in large scale unemployment of the rural population, who migrate to urban and industrially advanced areas, in search of livelihood. This creates large scale problems of environmental pollution and social crimes in cities. A long term objective to manage drought is, therefore, to provide alternate employment in rural areas. We should include agro-based industries in thrust areas for employment of the rural population. Poultry farms, dairy industries, silk worm rearing and handicrafts should be encouraged by various incentives.

Peculiarities of Droughts

Drought has always been listed as a principle-limiting factor for the productivity of the land. The World's climate patterns are so made that the smaller the level of precipitation the larger is the variability. It is not only a question of water shortage but also a problem of uncertainty in the availability of water. Stability of production is finally dependent on stability in water. In Bihar (a high rainfall area) the coefficient of variation is 13-14 percent, whereas in drought prone areas it could be as high as 32 percent. Drought prone areas will have to make special efforts to overcome their natural handicap on account of shortage of water and also on account of uncertainties in the availability of their share of scarce water.

Elements at Risk

Drought impacts mostly rain fed crops to start with and subsequently the irrigated crops. Areas with minimum of alternative water sources to rainfall (ground and canal water supplies), areas subjected to drastic environmental degradation such as denuded forest lands and altered ecosystems, and areas where livelihoods alternative to agriculture are least developed are most vulnerable to drought. The herdsman, landless laborers, subsistence farmers, the women, children, and farm animals are the most vulnerable groups affected by the drought conditions.

Effects of Droughts

Drought, different from other natural disasters, do not cause any structural damages. The typical effects include loss of crop, dairy, timber (forest fires), and fishery production; increase in energy demand for

pumping water; reduced energy production; increased unemployment, loss of biodiversity, reduced water, air, and landscape quality; groundwater depletion, food shortage, health reduction and loss of life, increased poverty, reduced quality of life, and social unrest leading to migration.

Mitigation Strategies

Drought monitoring is continuous observation of rainfall situation, water availability in reservoirs, lakes, rivers and comparing with the existing water needs of various sectors of the society.

Water supply augmentation and conservation through rainwater harvesting in houses and farmers' fields increases the content of water available. Expansion of irrigation facilities reduces the drought vulnerability. Land use based on its capability helps in optimum use of land and water and can avoid the undue demand created due to their misuse.

Livelihood planning identifies those livelihoods which are least affected by the drought. Some of such livelihoods include increased off-farm employment opportunities, collection of non-timber forest produce from the community forests, raising goats, and carpentry etc.

Drought Planning

The basic goal of drought planning is to improve the effectiveness of preparedness and response efforts by enhancing monitoring, mitigation and response measures. Planning would help in

effective coordination among state and national agencies in dealing with the drought. Components of drought plan include establishing drought taskforce which is a team of specialists who can advise the government in taking decision to deal with drought situation, establishing coordination mechanism among various agencies which deal with the droughts, providing crop insurance schemes to the farmers to cope with the drought related crop losses, and public awareness generation.

Public Awareness and Education

Educating the masses on various strategies would help in effective drought mitigation. This includes organizing drought information meetings for the public and media, implementing water conservation awareness programs in the mass media like television, publishing and distributing pamphlets on water conservation techniques and agricultural drought management strategies like crop contingency plans and rainwater harvesting and establishing drought information centers for easy access to the farmers.

Watersheds

Watersheds are the geographic areas where the water flows to a common point. To mitigate the drought impact, all kinds of soil and water conservation measures are taken up with the involvement of the local communities. This approach helped these areas to manage efficiently the soil, vegetation, water and other resources. By conserving scarce water

sources and improving the management of soil and vegetation, watersheds have the potential to create conditions conducive to higher agricultural productivity while conserving natural resources.

Check dams

These are check dams or diversion weirs built across rivers. A traditional system found in Maharashtra, their presence raises the water level of the rivers so that it begins to flow into channels. They are also used to impound water and form a large reservoir. Where a bandhara was built across a small stream, the water supply would usually last for a few months after the rains.

Following measures are suggested to mitigate drought consequences:

(a) Supply-Oriented Measures are intended to increase the available water supply during drought through:-

- Maximizing surface water storage capacity.
- Maximizing ground water storage capacity.
- Water transfer between river basins or within the same river basin.
- Evaporation and evapotranspiration suppression.
- Reduction of infiltration losses
- Soil conservation practices.
- Utilization of inferior quality water.
- Relaxation of water quality standards
- Increasing ground water use
- weather modification

- Interception of dew and fog

- Long distance transfer of water

- Regional interconnection of water supply networks.

- Water transportation by vehicles or boats

- Desalination of salt or blackish waters

(b)   Demand-Oriented Measures are intended to decrease the water demand during drought through:-

- Appeals to consumers to reduce water use

- Water reuse

- Restrictions on water use

- Adjustment of patterns of water consumption by users

- Economic incentives for reducing water consumption

- Regional and local support for water demand reducing strategies.

(c)   Impact-Minimization Measures are intended to minimize drought impacts occurring in spite of increased water supply and decrease demands through:-

- Drought forecast

- Drought warnings

- Drought insurance

- Disaster aid programmes

Comprehensive Monitoring

Based on the use feedback and their requirements, a comprehensive national drought monitoring system is under implementation. The enhanced system may include:-

(i)   Near real-time drought monitoring with biweekly bulletins disseminated within a week.

(ii)   Coverage of both kharif and rabi seasons.

(iii)   Coverage of 12 drought vulnerable and agriculturally important States (Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Orissa, Tamil Nadu, Haryana, Madhya Pradesh, Rajasthan, Uttar Pradesh, West Bengal and Bihar).

(iv)   Cover meteorological, hydrologic, agricultural and socio economic drought indicators and impacts.

(v)   Technology intensification for near real-time sub-district level monitoring with use of new sensor data and analysis techniques.

Chapter-8

LANDSLIDE

Landslide constitute a major natural hazard in our country, which accounts for considerable loss of life and damage to communication routes, human settlements, agricultural fields and forest lands. The Indian subcontinent, with diverse physiographic, seism tectonic and climatological conditions is subjected to varying degree of landslide hazards; the Himalayas including Northeastern mountains ranges being the worst affected, followed by a section of Western Ghats and the Vindhyas. Removal of vegetation and toe erosion have also triggered slides Torrential monsoon on the vegetation cover removed slopes was the main causative factors in the Peninsular India namely in Western Ghat and Nilgiris. Human intervention by way of slope modification has added to this effect Major landslides are shown in Table 8.1

Table-8.1
Major Landslides in India

October 1990	Nilgiris	36 people killed and several injured. Several buildings and communication network damaged
July 1991	Assam	300 people killed, road and buildings damaged
November 1992	Nilgiris	Road network and buildings damaged, Rs. 5 million damage estimated
July 1993	Itanagar	25 people buried alive 2 km road damaged
August 1993	Kalimpong, West Bengal	200 houses destroyed, 500 people died, about 5 km road stretch was damaged
November 1993	Nilgris	40 people killed, property worth several lakhs damaged
January 1994	Kashmir	National Highway 1A severely damaged

June 1994	Varundh ghat, Konkan Coast	20 people killed, breaching of ghat road damaged to the extent of 1km at several places
May 1995	Aizwal, Mozoram	25 people killed. Road severely damaged
September 1995	Kullu, HP	22 persons killed and several injured. About 1 km road destroyed
14 August 1998	Okhimath	69 people killed
18 August 1998	Malpa, Kali river	205 people killed. Road network to Mansarovar disrupted
August 2003	Uttarkashi	Heavy loss of infrastructure

Source: Natural Hazards and Disaster Management, Text Book in Geography for Class XI CBSE, Delhi

Hazard Zones

The Landslide map needs to be popularized among the architects, engineers and development planners and also to the public so that it is used as a tool for regulating construction or development activities and means of managing or mitigating landslide disasters.

Zone Significance of Landslides

The four point hazard scales of the Landslide Zones are – (1) Severe to Very High, (2) High, (3) Moderate to low, (4) Unlikely, was considered adequate. The zonal significance is given below:

(1) Severe to Very High

The area is well known for the danger of landslides, and for the perennial threat to life and property. Restrictions on all new constructions and adoption of improved land use and management practices deserve to be encouraged. Investments on landslide remediation measures, on public education and on early warning systems are strongly indicated.

(2) High

This is a zone in which landslides have occurred in the past and are already to be expected in the future. New constructions in this zone should be strictly regulated and construction should be done only after proper site investigation and implementation of appropriate remedial package. Before the new construction projects are cleared in this zone, environment impact assessment should be made mandatory.

(3) Moderate to Low

Engineered and well-regulated new construction activities and well-planned agricultural practices could be permitted. All construction activities should however be based on technically evaluated and certified plans by established institutions and authorized consultants.

(4) Unlikely

No visible sign of slope instability are seen in this zone in the present stage of knowledge. No blanket restriction needs to be imposed on various land use practices provided they confirm to the prevailing building regulations and bye-laws. Location specific limitations may become necessary for high-density urban areas. Snow covered areas

Onset Type and Warning

Though they occur gradually, however sudden failure (sliding) can occur without warning. They may take place in combination with earthquakes, floods and volcanoes. There are no clearly established warnings in place indicating occurrence of landslide and hence difficult to predict the

actual occurrence. Areas of high risk can be determined by use of information on geology, hydrology, vegetation cover, past occurrence and consequences in the region.

Causes of Landslides

Geological weak material weathered materials, jointed or fissured materials, contrast in permeability and contrast in stiffness (stiff, dense material over plastic materials) may cause landslides.

Wave erosion of slope toe, glacial erosion of slope toe, subterranean erosion Deposition loading slope or its crest, vegetation removal etc also cause landslides.

Storms that produce intense rainfall for periods as short as several hours or have a more moderate intensity lasting several days have triggered abundant landslides. Human excavation *of slope* and its toe, loading of slope/toe, draw down in reservoir, mining, deforestation, irrigation, vibration/blast, water leakage from services may result in landsliding. Earthquake shaking has triggered landslides in many different topographic and geologic settings. Rock falls, soil slides and rockslides from steep slopes involving relatively thin or shallow dis-aggregated soils or rock, or both have been the most abundant types of landslides triggered by historical earthquakes. Deposition of loose volcanic ash on hillsides commonly is followed by accelerated erosion and frequent mud or debris flows triggered by intense rainfall.

Elements at Risk

The most common elements at risk are the settlements built on the steep slopes, built at the toe and those built at the mouth of the streams emerging from the mountain valley. All those buildings constructed without appropriate foundation for a given soil and in sloppy areas are also at risk. Roads, communication line and buried utilities are vulnerable.

The damage intensity related of landslides is shown in chart-8.1

Chart-8.1
Damage Intensity of Landslides

Damage classification	Damage level	Movement Rate	Typical Effect on Roadway and Related Activities
1.	Imperceptible	Extremely slow	Routine and periodic maintenance, Movement cannot be detected without instruments.
2.	Negligible	Very slow	Maintenance keeps road open with only infrequent road closures; drainage structures generally not damaged. Repair work is generally not urgent.
3.	Slight	Slow	Road closures probable for short time periods. Repair work can be safely done during movement.
4.	Moderate	Moderate	Overall roadway stability may be affected unless remedial work is undertaken immediately. Worker safety must be monitored.
5.	Serious	Rapid	Roadways are closed and immediate areas evacuated. Unsafe to undertake remedial work while movement continues.
6.	Very serious	Very Rapid	Roadway destroyed. Escape difficult for motorists and pedestrians. Repair questionable.
7.	Catastro-phic	Extremely Rapid	Total destruction of roadway and adjoining areas. Escape unlikely for motorists, pedestrians, structures and inhabitants. Repair possibilities unlikely.

Effects of Landslides

Landslides destroy anything that comes in their path. They block or bury roads, lines of communication, settlements, river flow, agricultural land, etc. It also includes loss to agricultural production and land area. In addition physical effects such as flooding may also occur. They cause maximum fatalities depending on the place and time of occurrence. Catastrophic landsides have killed many thousands of persons, such as the debris slide on the slopes of Huascaran in Peru triggered by an earthquake in 1970, which killed over 18,000 people.

Mitigation Strategies

Hazard mapping will locate areas prone to slope failures. This will permit to identify avoidance of areas for building settlements. These maps will serve as a tool for mitigation planning.

Proper land use practices may mitigated the landsliding. The land use practices are discussed below:

- Areas covered by degraded natural vegetation in upper slopes are to be afforested with suitable species. Existing patches of natural vegetation (forest and natural grass land) in good condition should be preserved.

- Any developmental activity initiated in the area should be taken up only after a detailed study of the region and slope protection should be carried out if necessary.

- In construction of roads, irrigation canals etc. proper care is to be taken to avoid blockage of natural drainage

- Total avoidance of settlement in the risk zone should be made mandatory.

- Relocate settlements and infrastructure that fall in the possible path of the landslide

- No construction of buildings in areas beyond a certain degree of slope.

Retaining Walls can be built to stop land from slipping. It's constructed to prevent smaller sized and secondary landslides that often occur along the toe portion of the larger landslides. The surface drainage control works are implemented to control the movement of landslides accompanied by infiltration of rain water and spring flows. Engineered structures with strong foundations can withstand or take the ground movement forces. Underground installations (pipes, cables, etc.) should be made flexible to move in order to withstand forces caused by the landslide.

Increasing vegetation cover is the cheapest and most effective way of arresting landslides. This helps to bind the top layer of the soil with layers below, while preventing excessive run-off and soil erosion. Insurance will assist individuals whose homes are likely to be damaged by landslides or by any other natural hazards. For new constructions it should include standards for selection of the site as well as construction technique.

Landslide and Debris Flow

Landslides are a serious geologic hazard very common in northern part of India. Globally, landslides cause billions of dollars in damage and thousands of deaths and injuries each year.

(i)   How to Protect Property

(a)   If your property is in a landslide-prone area, contract with a consulting company specializing in earth movement for opinions and advice on landslides problems and on corrective measures you can take. Such companies would likely be those specializing in geotechnical or structural engineering. Taking steps without consulting a professional could make your situation worse.

(b)   Install flexible pipe fittings to avoid gas or water leaks. Flexible fittings will be less likely to break.

(ii)   What to Do Before Intense Storms

(a)   Become familiar with the land around. Learn whether landslides and debris flows have occurred in the area by contacting local officials. Knowing the land can help to assess the risk for danger.

(b)   Watch the patterns of storm-water drainage on slopes near to home, and especially the places where runoff water converges, increasing flow over soil-covered slopes. Watch the hillsides around the home for any signs of land movement, such as small landslides or debris flows, or progressively tilting trees. Watching small changes could alert to the potential of a greater landslide threat.

(iii)   What to Do During Intense Storms

(a)   Stay alert and awake. Many debris-flow fatalities occur when people are sleeping. Listen to a Radio or television for warnings of intense rainfall. Be aware that intense, short bursts of rain may

be particularly dangerous, especially after longer periods of heavy rainfall and damp weather.

(b) If one is in areas susceptible to landslides and debris flows, consider leaving if it is safe to do so. Remember that driving during an intense storm can be hazardous. If one remains at home, move to a second story. If possible. Staying out of the path of a landslide or debris flow saves lives.

(c) Listen for any unusual sounds that might indicate moving debris, such as trees cracking or boulders knocking together. A trickle of flowing or falling mud or debris may precede larger landslides. Moving debris can flow quickly and sometimes without warning.

(d) If someone is near a stream or channel, be alert for any sudden increase or decrease in water flow and for a change from clear to muddy water. Such changes may indicate landslide activity upstream, so be prepared to move quickly. Don't delay! Save oneself, not the belongings.

(e) Be especially alert when driving. Embankments along roadsides are particularly susceptible to landslides. Watch the road for collapsed pavement, mud, fallen rocks, and other indications of possible debris flows.

(iv) What to Do If Suspect Imminent Landslide Danger

(a) Contact local fire, police, or public works department. Local officials are the best persons able to assess potential danger.

(b) Inform affected neighbors. The neighbors may not be aware of potential hazards. Advising them of a potential threat may help save lives. Help neighbors who may need assistance to evacuate.

(c) Evacuate. Getting out of the path of a landslide or debris flow is the best protection.

(v) What to Do During a Landslide

(a) Quickly move out of the path of the landslide or debris flow. Moving away from the path of the flow to a stable area will reduce the risk.

(b) If escape is not possible, curl into a tight ball and protect the head. A tight ball will provide the best protection for the body.

(vi) What to Do After a Landslide

(a) Stay away from the slide area. There may be danger of additional slides.

(b) Check for injured and trapped persons near the slide, without entering the direct slide area. Direct rescuers to their locations.

Chapter-9

HUMAN INDUCED DISASTERS

In a society where gender, caste, religion, region, and class differentials are extremely predominated human made disasters tend to occur more frequently and often with great intensity. Communal riots, terrorism, militancy, ethnic conflicts, plight of refugees, internally displaced persons, road and train accidents, forest and buildings fire, epidemics and industrial accidents etc. cause heavy toll of human lives and property. The natural disasters cannot be properly predicted and controlled while manmade disasters may be controlled through proper planning and preparedness.

Forest fires are a major cause of degradation of India's forests. About 90 per cent of the forest fires in India are created by humans. India witnessed the most severe forest fire in during the summer of 1945 in the hills of Uttarakhand and Himachal Pradesh. The fires were very severe and attracted the attention of whole nation. These affected 6.78 million hectares of forest land. About 3.75 million hectares of forests are affected by fire annually, as per Forest Protection Division, Ministry of Forests and Environment, Government of India.

Fires in Urban Structure - houses, buildings, and other structure also cause destruction to property and human lives. Heating sources, cooking accidents, electric short, combustible and hazardous materials etc. cause the fire in urban structures. In the event of fires, chemical leakages, or explosions occurring in industrial facilities, people are exposed to risks and hazards. Bhopal chemical gas leak disaster (1984) was the worst industrial

disasters of India. The tragedy was a technological accident in which highly poisonous methyl iso-cyanide gas along with hydrogen cyanide and other reaction products leaked out of the pesticide factory of Union Carbide into the night air of Bhopal. The official death toll reached to 3,598 in 1989 and thousands still face a fate worse than death.

The nature and impact of disasters are changing. They need to be placed in the larger context of present day realities. Most experts refuse to include epidemics in their short list of disasters, costing the world dearly in terms of morbidity, mortality, and hence, the human capital. Today, aid and relief go largely to non-biological disasters while increasingly treatment immune and mutagenic bio-systems wreck havoc in the developing countries. The Surat plague outbreak in 1994 killed 56 people nationwide. This outbreak served as a chilling reminder of how rapid urbanization and deterioration of the urban environment can bring people into contact with forgotten disease factors. The scientific studies show that an increase in the temperature viz. 1-2 degrees would enable mosquitoes to extent their range to low geographical areas, leading to an increase in cases of malaria and several other infectious diseases especially in populations living at the periphery of the areas currently prone to these diseases. Tuberculosis, Malaria, Kalajar Dengue, plague, Japanese encephalitis, diarrhea diseases, including cholera, poliomyelitis, HIV/AIDS, etc. are some of the chronic diseases which have caused concern today.

India has one of the largest populations of people living with HIV/AIDS, second only to South Africa. An estimated 5.1 million individuals currently live with the HIV infection, across all states. The HIV prevalence rate among the adult population is 0.8 per cent, but the absolute

number of people living with HIV/AIDS is very high and growing gradually. The endemic is challenging the development achievements of recent years and raising fundamental issues of human rights. In India, HIV/AIDS epidemic is characterized by heterogeneity; it seems to be following the type 4 pattern, where the epidemic shifts from the most vulnerable populations (including sex workers, injecting drug users, men who have sex with man) to bridge populations (client of sex workers, STD patients, partners of drug users) and then to the general population. The epidemic continues to shift towards woman and young people. Migrates both within and between states is a major source of transmission of infection. Srivastava and Sasikumar (2003) estimated that migrants account for 26.6 per cent of the country's population. This shows a declining trend, however, the absolute number of migrants grew from 67.7 million in 1971 to 231.9 million in 1991. Migration of semi skilled and unskilled labours to West Asia and OECD countries started in mid 1970; the growth in demand for foreign labour was triggered by the oil price boom. South Arabia and UAE were the principal destinations for Indian migrants during the past two decades State-wise distribution of emigration clearances granted during the period 1993-2001 shows that 16 states contributed to the process of emigration to the OECD countries. Three states - Kerala, Tamil Nadu, and Andhra Pradesh-together accounted for 60 per cent of those who obtained emigration clearance. The returning migrant is often unaware of whichever has been infected with HIV and the potential risk of infection that his spouse and urban children face.

Trans-border migrants in India- especially Nepali, and Bangladesh migrants also face the high risk of HIV infection. Nepalese women migrants are highly vulnerable to commercial and sexual exploitation. Those who are

engaged in commercial sex line in unhygienic and inhuman conditions, even those who work as domestic help are at risk of being physically and sexually abused by their employers. Bangladesh migrants are less vulnerable them Nepalese migrants however, their number in India is rapidly increasing which causes severe stress on civic services.

The illegal immigration from Bangladesh has become a serious problem; it has changed the demographic landscape and affected Delhi, Rajasthan, Gujarat, Maharastra. In India, the quantum of immigration is small in relation to the total population of the country. There are about 8 to 10 million Bangladeshis nationals in India who are spread all over north India from West Bengal to Rajasthan. The illegal immigration from Bangladesh has caused concern in Mizoram, Tripura, Assam, and West Bengal. Even, it caused to some extent the emergence of militancy and ethnic unrest-ness in North East region of India. The militancy in North East region has caused concuss to the policy makers and development activists.he increasing trend of violence and destruction of property in the region has caused setback to development efforts (Table - **9**.1).

Table - 9.1
Militancy in North East Region (2003)

Head	Assam	Tripura	Nagaland	Manipur	Meghalaya	Arunachal Pradesh	Mozoram
Incidents	358	394	199	243	85	50	03
Extremists Killed	207	50	70	128	37	31	-
Extremists Arrested	215	336	90	232	103	32	-
Security Forces killed	12	39	03	27	07	01	01
Arms Looted	02	36	15	03	02	02	-
Arms Recovered	186	76	64	29	53	34	-

Arms Surrendered	-	-	-	-	-	-	-
Extremists Surrendered	328	268	29	05	20	18	01
Civilians killed	182	207	13	50	35	07	-
No. of Persons Kidnapped	89	221	163	81	51	42	

Though, scheme of rehabilitation of surrendered extremists in North East has checked insurgency, however, a large number of districts in Tripura, Mizoram, Assam, Manipur and Nagaland are affected with militancy. Similarly, the terrorism in Jammu & Kashmir and Punjab has derailed the development efforts for a long time. However, terrorism activities in Jammu & Kashmir, supported by neighbouring countries are causing tremendous loss to human lives and public property (Table - **9**.2).

Table - 9.2
Terrorists Activities in Jammu & Kashmir

Year	No. of Incidents	Civilians killed	SFs killed	Terrorists killed	Foreign Terrorist killed
1990	4158	461	155	550	14
1991	3765	382	173	844	12
1992	4817	634	189	819	14
1993	5247	747	198	1310	90
1994	5829	820	200	1596	122
1995	5938	1031	237	1332	85
1997	3420	971	193	1075	197
1998	2932	889	236	999	319
1999	3071	873	355	1002	305
2000	3074	847	397	1520	436
2001	4522	996	536	2020	625
2002	4038	1008	453	1707	508
2003	3401	795	314	1494	470
2004 (upto March)	638	150	62	263	60
Total	**59864**	**11945**	**3882**	**17820**	**3396**

The increasing influence and incidence of violence by Naxalism in India is also causing concern. Naxalite extremism is spread over 9 states (Table- **9**.3)

Table - 9.3
Incidents of Violence by Naxalite – Extremists

State	2001	2002	2003	2004 (upto March)	2006 (upto June)
Andhra Pradesh	461(180)	346 (96)	575 (139)	155 (50)	104 (18)
Bihar	169 (111)	239 (117)	249 (127)	79 (32)	63 (30)
Chhatisgarh	105 (37)	304 (55)	254 (74)	61 (14)	360 (244)
Jharkhand	355 (200)	353 (157)	341 (117)	80 (18)	169 (58)
Madhya Pradesh	21 (92)	17 (3)	13 (1)	2 (1)	6 (-)
Maharastra	34 (7)	83 (29)	74 (31)	10 (10)	56 (25)
Orissa	30 (11)	68 (11)	49 (15)	19 (4)	21 (4)
Uttar Pradesh	22 (12)	20 (6)	13 (8)	3 (3)	6 (2)
West Bengal	9 (4)	17 (7)	6 (1)	4 (8)	14 (11)
Other States	2 (-)	18 (1)	16 (-)	2 (1)	5 (-)
Total	1208 (564)	1465 (482)	1590 (513)	415 (132)	806 (392)

Source: Annual Report, 2003-04, Ministry of Home, Government of India, Rastriya Sahara, 6 March 2007, Lucknow

The extremism has its root cause in socio-economic backwardness of the region and development deprivation of weaker sections of society. The terrorist activities are being supported by neighbouring countries. These are being operated from Territory of Bangladesh, Pakistan, Myanmar, Bhutan and Nepal. There is marked increase in attacks on government and private properties by naxilites displacing a growing penchant for attacking railway property.

Communal Violence

The communal violence in India is causing concern. The social disharmony, socio cultural factors and political mostilization of communal

groups may cause out standing communal violence. Some of the major incidents are discussed below:

The following points may be helpful in managing communal riots and terrorism related incidents:

(i)   If Disaster Strikes

➢ Remain calm and be patient.

➢ Follow the advice of local emergency officials.

➢ Listen to your radio or television for news and instructions.

➢ If the disaster occurs near you, check for injuries. Give first aid and get help for serious injured people.

➢ Shut off any other damaged utilities.

➢ Confine or secure your pets.

➢ Check on your neighbors, especially those who are elderly or disabled.

(ii)   A Word on What Could Happen

➢ There can be significant numbers of causalities and / or damage to buildings and the infrastructure. So, employers need up-to-date information on how to contact your designated beneficiaries.

➢ Heavy law enforcement involvement follows a terrorist attack due to the event's criminal nature.

➢ Health and mental health resources in the affected communities can be strained to their limits.

- Extensive media coverage, strong public fear and international implications and consequences can continue for a prolonged period.
- Workplaces and schools may be closed, and there may be restrictions on domestic and international travel.
- You and your family or household may have to evacuate an area, avoiding roads blocked for your safety.
- Clean-up may take many months.

(iii) Evacuation

If local authorities ask you to leave home, they have a good reason to make this request, and you should need to advice immediately. Keep these simple tips in mind-

- Wear long-sleeved shirts, long pants and sturdy shoes so you can be protected as much as possible.
- Take your disaster supplies kit.
- Lock your home.
- Use travel routes specified by local authorities don't use shortcuts because certain areas may be impassable or dangerous.
- Shut off water & electricity before leaving.

(iv) Shelter-in-place

If you are advised by local officials to remain inside your home or office and protect yourself there, close and lock all windows and exterior doors. Get your disaster supplies kit, and make sure the radio is working.

(v) First Aid Primer

If you encounter someone who is injured, apply the emergency action steps. Check the scene to make sure it is safe for you to approach. Then check the victim for unconsciousness and life-threatening condition, such as not breathing or severe bleeding, requires immediate care by trained responders and may require treatment by medical professionals. Call out for help. There are some steps that you can take, however, to care for someone who is hurt, but whose injuries are not life threatening.

(a) Control Bleeding

Cover the wound with a dressing, and press firmly against the wound (direct pressure). Elevate the injured area above the level of the heart if you do not suspect that the victim has a broken bone. Cover the dressing with a roller bandage. If the bleeding does not stop,

(i) Apply additional dressing and bandage.

(ii) Use a pressure point to squeeze the artery against the bone. Provide care for shock.

(b) Care for Shock

Keep the victim from getting chilled or overheated. Elevate the legs about 12 inches (if broken bones are not suspected). Do not give food to the victim.

(c) Tend Burns

Stop the burning by cooling the burn with large amounts of water. Cover the burn with dry, clean dressings or cloth.

(d)   Care for Injuries to Muscles, Bones

Rest the injured part. Apply ice or a cold pack to control swelling and reduce pain. Avoid any movement or activity that causes pain. If you must move the victim because the scene is becoming unsafe, try to immobilize the injured part to keep it from moving.

(e)   Reduce Any Care Risk

The risk of getting a disease while giving first aid is extremely rare. However, to reduce the risk even further;

(i)   Avoid direct contact with blood and other body fluids.

(ii)   Use protective equipment, such as disposable gloves and breathing barriers.

(iii)   Wash your hands with soap and water immediately giving care.

Road Accidents

India like many other developing countries, is witnessing a spiraling increase in the number of vehicles clogging its roads. Between 1970 and 2003, number of registered vehicles increased by about 48 times. During 2003, registered vehicles were reported to be 67.03 million. By 2050, there will be over 267 million vehicles on Indian roads. Of the world wide annual average of 0.7 million road accidents, 10 per cent occur in India. In 2003, number of road accidents was reported to be 406.73 million in which 85.99 million persons were killed. Number of accidents per ten thousand vehicles was reported to be 60.68 while number of persons killed per ten thousand vehicles was 12.88. Most of the road fatalities were reported in Andhra Pradesh, Mahrashtra, Rajasthan, Uttar Pradesh, Tamil Nadu, and Karnataka.

The economic cost of road accidents is equivalent to about one per cent of Gross National Product.

A large number of deaths in developing world are due to road accidents. Apart from humanitarian aspect of the problem, road accidents cost countries of developing world at least one percentage of their GNP each year. The proportion of commercial and public service vehicles involved in road accidents are often much greater. Pedestrians and cyclist are often the most vulnerable. During the year 2002, nearly 85,000 people died due to road accidents in India. Fatality risk (defined as, road accidental deaths per million population) in India is increasing over the years, from 64 in 1990 to 80 in 2002. During the same period, road accidental deaths have increased at a rate of 3.8 percent per annum while the population of the country has increased by only 1.8 percent per annum. Although fatality rate (defined as, number of fatalities per 10,000 vehicles) in India is declining over the years, it is still quite high in comparison to developed world.

It is alarming to note that more than 38 people die per week due to road accidents in Delhi alone. Between the year 1990 and 2000, number of road accidental casualties has increased in almost all the metropolitan cities in India. Analysis shows that except Kolkata, Mumbai, and Nagpur all cities are showing very high growth rate in fatalities over the period. Accident severity index (defined as, number of fatalities per 100 accidents) is also very high for all the cities other than Ahmedabad, Bangalore, Kolkata, and Mumbai.

Road traffic clashes and injuries are increasing in India due to increase in vehicle population and traffic density. Road accidents in India are shown in Table 9.4. There has been phenomena increase in the number of road accidents during 1997-2007. Similarly, there has been significant

increase in the road accident injuries increased over the period. The burden of road traffic injuries in India is relatively high in its metropolitan cities. In 2007, fatality risk in 21 out of 35 metropolitan cities was higher than the all India average. On an average, the fatality risk in metropolitan cities is 11.7 fatalities per 1 lakh population, which is higher than the national average of 10.1 per 1 lakh population.

Table: 9.4
Road Accidents in India (1997-2007)

Year	No. of Road Accidents (in '000)	No. of Road Accidental Injuries (in '000')	No. of Road Accidental Deaths (in '000')	Accident Risk (No. of Accidents Per 1,00,000 People)	Accident Severity Index (No. of Fatalities Per 100Accidents)	Fatality Risk (No. of Fatalities Per 1,00,000 People)	Fatality Rate (No. of Fatalities Per 10,000 Vehicles)
1997	290.9	309.5	74.2	30.5	25.5	7.8	19.9
1998	300.0	320.5	76.7	30.9	25.6	7.9	18.5
1999	306.4	324.5	81.0	31.1	26.4	8.2	18.1
2000	308.3	340.2	80.0	30.8	25.9	8.0	16.4
2001	323.7	353.1	80.3	31.5	24.8	7.8	14.6
2002	329.4	382.9	81.9	31.4	24.9	7.8	13.9
2003	336.4	398.2	84.4	31.5	25.1	7.9	12.6
2004	361.3	413.9	91.4	33.3	25.3	8.4	12.6
2005	390.4	447.9	98.3	35.4	25.2	8.9	12.3
2006	394.4	452.9	105.7	35.2	26.8	9.4	12.0
2007	418.6	465.3	114.6	36.8	27.4	10.1	11.8

Source: Accidental Deaths and Suicides in India, 1997-2007, published by the National Crime Records Bureau, Ministry of Home Affairs, Government of India, New Delhi

There has been increasing trend in the road fatalities and accidents in metropolitan cities during 1990 to 2005. Maximum number of road accidents are recorded in Mumbai followed by Delhi. During 2005, road accidents per 1 lakh population was reported high in the cities of Panji,

Raipur, Bhuneshwar, Trivandrum, Bhopal, Kocchi, Pondicherry, Mumbai, and Jaipur (Table 9.5).

Table: 9.5
Road Accidental Casualties in Selected Metropolitan Cities in India

Metropolitan Cities	1990		1997		2005	
	Fatalities	**Accidents**	**Fatalities**	**Accidents**	**Fatalities**	**Accidents**
Ahmedabad	195	2873	239	3229	467	2460
Bangalore	562	7629	704	8722	833	7575
Chennai	507	5877	749	5171	1055	4499
Delhi	1670	7697	2342	10957	2023	9351
Hyderabad	276	1412	377	2108	1196	6149
Jaipur	235	1062	303	2022	495	2681
Kolkata	463	10911	471	10260	484	3751
Mumbai	400	25331	401	27421	787	21678
Nagpur	166	1139	387	1496	246	1628
Pune	275	1387	320	2687	216	1477

Source: Road Safety Cell, State Transport Authority, Cuttack, Orissa, India, March, 2003. Compendium on Road Accidents-2003

Traffic crashes in Indian cities pose a severe public health problem resulting each year in about 20000 deaths, 1.2 million serious injuries and 5.6 million minor injuries. The number of traffic fatalities has increased more than 5 times since 1971. Even the population growth in India is reported to be low than the road accident rate. Fatalities per million populations were reported to be 77.89 during 2001 while it was only 27.36 during 1971. However, fatalities per 1000 vehicles have come down from 8.04 in 1971 to 1.45 in 2001 (Table 9.6).

Table: 9.6
Number of Vehicles, Population and Road Facilities in India

Year	Vehicles (millions)	Population	Fatalities (1000s)	Fatalities per 1000 vehicles	Fatalities per million population
1971	1,865	548,159,652	15	8.04	27.30
1975	2,472	625,246,123	16.9	6.84	27.03
1981	5,391	683,329,097	28.4	5.27	41.56
1985	9,17	772,196,737	39.2	4.27	50.76
1991	21,374	843,930,861	56.6	2.65	67.07
1992	23,507	861,693,859	59.7	2.54	69.28
1993	25,505	879,279,448	60.6	2.38	68.92
1994	27,66	897,223,927	64	2.31	71.33
1995	30,295	915,534,620	70.7	2.33	77.22
1996	33,551	934,219,000	71.9	2.14	76.96
1997	37,231	949,200,000	75	2.01	79.01
1998	41,361	965,600,000	80	1.93	82.85
1999	44,857	1,000,848,550	82	1.82	82
2000	48,857	1,016,118,000	78.9	1.61	77.65
2001	54,991	1,027,015,247	80	1.45	77.89

Source: Ministry of Road Transport and Highway (2003)

Road accidents are caused by several factors, viz., human, automobile, geographical, Infrastructure, information and legal. It is generally acknowledged that human error is an underlined cause of almost all accidents. It is involved over 90 per cent of road accidents while a small proportion of accidents may be directly attributed vehicle defects or faults in road design or maintenance.

The vehicle factors responsible for road accidents include worn tyres, poor breaks and non-functional light, overloading of public service vehicles and tracks, use of unsuitable vehicles like picups for transport of passengers and poor praiseworthiness design.

Road factors responsible for road accidents are related with high or no speed limits and poor visual guidance, poorly controlled intersections and uncontrolled access, narrow roads, poor alignment standards and poor maintenance of pavements and shoulders and steep ditches and hard objects near the road.

Traffic and environmental factors include mix of motorized and non-motorized vehicles, pedestrians, poor traffic management and enforcement of traffic codes, darkness and inclement weather conditions and inadequate emergency medical services.

Economic pressure factors have also become more important following the liberalization of road transport services, as intense competition for passengers have resulted more speeding and reckless driving of the public service vehicles. Moreover, with the globalization and economic liberalization, there is increasing trend of automobiles having speedy pickups with high speed suitability of vehicles, though conditions of roads do not support it. Thus, there will be increasing demand for financial resources for catering to the imperatives of road safety measures.

Road safety measures in India vary from state to state and within the state from district to district and within a district from one department to another department. The states like Karnataka, Kerala, Tamil Nadu have performed well in road safety measures while states like Delhi, Tamil Nadu, Rajasthan and Haryana mobilized substantial amount of resources for road safety measures.

Road safety being a multi-sectoral activity, its functional responsibility lies with many key sectors associated with the road safety, structural conditions of roads and their maintenance, emergency medical care and rehabilitation, justice, finance, information, education and training,

law enforcement and traffic regulations. In the State of Uttar Pradesh, there are six departments/agencies which have identified as the agencies delivering road safety related sub tasks. These are PWD, Home (Traffic), Transport, Urban Development, Medical and Public Health & Education.

PWD is responsible for formulation of road network projects, construction, maintenance, physical marking of extent of encroachment of road space, etc. Home (Traffic) Department is entrusted with the task of enforcement of intra city, intercity, inter-district, inter-state traffic on roads and highways; checking of vehicles and drivers for compliance of Motor Vehicle Acts, & Rules; road safety regulations; rescue, first aid and transport of accident victims to emergency and trauma care facility; filing of FIR, accident investigation and pursuing prostitution in road accident cases.

Transport Department is responsible for registration of different types of vehicles, licensing of different categories of drivers, collection of road tax and fee, passengers of goods transport, issuing of permits for special purpose and specific destinations commercial vehicles; checking of compliance of rules and regulations on Motor Vehicle Act and road worthiness of vehicles; planning and operation of road transport system; road safety education.

Urban Development is supposed to prevent and remove encroachment; planning of construction of new roads and maintenance of roads within their respective areas of jurisdictions; provisions and maintenance of parking, pavement and pedestrians space; planning, installation and maintenance of traffic signaling, infrastructure and traffic regulation, etc. Medical & Health Department is entrusted with post-accident emergency and trauma care of the accident victims. Education Department is supposed to provide road safety education to school and college going students.

Measures related to road safety in the state are mainly concern with education, awareness creation of road users and installing road safety signs on sensitive places. There is lack of coordination among the different organizations, departments and officials. There is also lack of mechanism for creating data base related to road accidents, deaths and persons injured. The task of road safety measures among the different stakeholders is highly fragmented with responsibilities defused amongst constituting sub-sectors viz., ambulances, pre-hospital care, transport authority, driver and vehicle licensing, enforcement of traffic laws and regulations, compliance of Motor Vehicle Acts, etc. Post-accident critical cares of accident victims are highly inadequate in the state. The budgetary provision for road safety financing is grossly inadequate and therefore, resource mobilization for financing of road safety measures is imperative.

India's Ariel skies and airports seem relatively safe an average of two accidents and 10 deaths a year, however, India's skies are a battleground of bad policies, civil military and technological obsolescence. The increased aircraft movement and number of private air lines have increased density with more vulnerability of air accidents.

Rail Accidents

India has the largest rail system which played by ad-hoc modernization, a bureaucratic outlook on some of the worst global accidents and an inadequately trained work force. The increasing incidence of bomb blasts and explosions in trains has caused concern. There has been fluctuating trend in rail accidents and fatalities. During 1997-98, 420 rail accidents caused 316 fatalities (Table - **IX**.5). During 2001-02, 413 rail accidents occurred in India. Number of train accidents per million km. has

been reported to be 0.55 while number of casualties per million passengers carried was reported just 0.02 (Table - **9**.7).

Table - 9.7
Railway Accidents in India

Year	Total Railway Accidents	Total Fatalities in Railway Accidents	Accidents at Level Crossing	Fatalities in Level Crossing	Total in injuries in Railway Accidents	Injuries in level crossing accidents
1988-89	545	231	55	52	736	134
1989-90	541	239	42	51	992	192
1990-91	532	322	37	75	88	175
1991-92	742	235	48	104	896	302
1992-93	746	282	71	116	908	222
1993-94	675	369	71	168	906	312
1994-95	604	296	74	187	676	159
1995-96	440	589	69	138	934	191
1996-97	426	353	66	221	610	264
1997-98	420	316	65	134	977	179

Source: Annual Report Indian Railways, New Delhi, 1998

Table- 9.8
Details of Railway Accidents in India

Particulars	1997-98	1998-99	1999-2000	2000-2001	2001-2002
Collisions	35	24	20	20	30
Derailments	285	292	325	344	279
Level crossing accidents	66	67	93	83	88
Fire in trains	6	5	21	15	8
Misc. accidents	-	-	-	2	8
Total	392	388	459	464	413
Train accidents per million kilometre	0.58	0.56	0.64	0.64	0.55
No. of persons killed	171	280	338	55	85
No. of passengers injured	747	615	716	281	565
Casualties per million passengers carried	0.20	0.06	0.22	0.01	0.02
Compensation paid (Rs. lakhs)	240.89	489.65	110.95	88.07	482.46

Source: Year Book 2001, Indian Railways.

Thus it is clear that a number of human induced disasters cause concern and call for strategic planning to mitigate and manage them. Moreover, manmade disasters may be checked and the adverse effects may be drastically reduced through proper planning and management.

DISASTER MITIGATION

Disaster Preparedness Measures

It is a broad concept that describes a set of measures that minimizes the adverse effects of a hazard including loss of life and poverty and disruption of livelihoods. Disaster preparedness is achieved through readiness measures that expedite emergency response, rehabilitation and recovery and result in rapid, timely and targeted assistance. Most important factor is to increase capacities of people and communities to cope with and minimize the effects of a disaster on their lives. It must be done with their active participation.

Risk Assessment: All planning and implementation of disaster preparedness measures is passed on an assessment of the hazards and risks, as well as the ability or inability of the people to withstand the effects of those hazards. It is based on identification of-

(a) Characteristics, frequency and potential severity of the hazards a community faces.

(b) Geographical areas and communities that is most susceptible and vulnerable to those hazards.

(c) Main sectors of a community (population infrastructure, housing, services, etc.) that would be affected by a specific type of hazard and anticipate how they might be affected.

(d) The ability of those sectors to withstand and cope with effects of hazardous phenomena.

Response Strategies: To increase the effectiveness of the emergency response, strategies and mechanisms are to be strengthened. They include,

➢ Evacuation procedure,

➢ Search and rescue teams,

➢ Assessment teams,

➢ An assessment process and information priorities for an emergency response.

➢ Procedures for activating distribution systems,

➢ Preparations for emergency reception centers and shelters,

➢ Procedures for activating emergency programs for airports, harbors and land transport,

➢ Preparations for storing or making arrangements for rapid acquisition of emergency relief supplies and equipment,

➢ Measures to activate special installations, such as emergency or mobile hospital facilities.

Preparedness Plan: Emergency requires an immediate response. It depends upon the existence and implementation of the plan. The plan is not site specific, nor does it contain the details of the disaster. However it contains the methodology of emergency response. The response team is trained on the basis of this plan. It involves identification of resources, roles and responsibilities of the team, policy development, procedures and whatever is required for the effective and timely emergency response. All of these measures will go a long way to improving the quality, timing and

effectiveness of the response to a disaster. The aim of the preparedness planning is to build, equip, train and organize disaster response team that will function effectively in the emergency.

Coordination: The emergency response demands a variety of skills, which are provided by different specialist teams and agencies. Coordination of these various teams and the agencies, to prevent duplication of work is the single most critical task of the project director. It is very common in our country to see the Service Organizations and Government machinery replicating the food distribution to the disaster affected people. The most important issue involved in the coordination is the mutual trust and the confidence amongst the various components of the disaster response teams.

Information Management: Disaster preparedness and response depend on gathering, analyzing and acting on timely and accurate information before (hazard and early warning information), during (disaster needs assessment) and after disasters (process of post-disaster recovery). Once a disaster strike, relief agency must conduct initial assessments that are timely and that inform emergency responders about critical and immediate life-saving needs. Disaster needs assessments should develop a picture of location, condition, activity, needs and the resources of the affected people.

Early Warning Systems: The purpose of early warning system is to detect, forecast, and when necessary, issue alerts related to impending hazard events. Early warning systems have to be supported by information about the actual and potential risks that a hazard poses, as well as the safety measures people can take. To achieve the best results early warning information has to be communicated to the potential victims of the disaster.

The people too often ignore early warnings. Credibility of the source is one of the main reasons.

Resource Mobilization: A preparedness plan should spell out the policies for acquisition and disbursement of funds use of outside equipment and services, and emergency funding strategies well before a disaster occurs. The disaster management agency must have certain emergency funds at their disposal. If procedural sanctions and clearances are required before their availability, the response will be delayed. Large numbers of organizations are giving funds for specific functions in disaster-affected region. Some agencies are providing funds for reconstruction only, while others are making the funds available for rescue and relief work only. Some agencies are funding through the government, or government agencies while others are funding through the NGOs only. Thus with such a wide spectrum of fund distribution methods and functions, the disaster planners must be fully conversant with the different lending agencies as well as their methodology of funding. The planners must have full list of donors and their conditions. Similarly a definite arrangement must be available for the accessing the funds from the International Agencies.

Public Awareness, Education and Training: Disaster preparedness must have sizable contribution from the affected people. As the major stakeholders they have right to know about the proposed preparedness plan, and the rescue, relief rehabilitation and construction measures. The awareness measures will be supported by public education campaigns, training of response teams and rehearsals of emergency response scenarios.

Community Based Disaster Preparedness: Disaster preparedness and response are not solely the work of experts and emergency responders from national Societies and government disaster organizations. Local volunteers, citizens, organizations, and businesses have an active and important role to play before, during and after major emergencies and disasters. Local populations in disaster-stricken areas are the first to respond to a disaster. They are usually involved in search and rescue activities as well as in providing emergency treatment and relief to their families, friends and neighbor.

State Level Plan: In our country, the actual execution of the various schemes, relief etc is done by the state machinery. Therefore the organizational plans which cover the role and responsibilities of various authorities and organization required for its execution. State level plans are confirmed mitigation and after disaster recovery. They will provide backing to the local level plans for immediate relief.

Local Bodies: They are the third level of Governance in our country. They are the ones who are in actual contact with the disaster location. Naturally the planning at their level will be confined to the preparedness, local operations, and immediate relief, whereas other aspects such as mitigation and recovery measures are normally directed from state level.

Community Based Plan: At the community or village level the capabilities and limitations will obviously vary considerably between different circumstances, and this point must be taken into account in disaster preparedness measures generally. On first reflection, it may be felt that little disaster preparedness capability exists at community of village level; and

that, when disaster strikes it is largely a question of government sending in assistance mostly in the form of equipment, supplies, and specialist manpower. This is not necessarily true. All communities and villages have some vitally important assets when it comes to dealing with disaster. These include local knowledge and experience. Clearly, these assets need to be organized and utilized to optimum effect. This local knowledge contains.

➢ Traditional capability for reading disaster-warning signs,

➢ Knowledge of local safe and vulnerable areas,

➢ Experience and lore concerning disaster impact,

➢ Survival experience in face of disaster loss,

➢ Understanding of the hierarchical local system which may be essential in disaster circumstances,

➢ They have inherent capability to utilize the extended family system, which is often vitally important in withstanding crisis.

Basic Skills Required

The modern day disaster mitigation and management requires a high level of professional skill, while volunteers will always be important in disaster response operations, staff involved in planning, situation evaluation, needs assessment or service delivery have to be equipped with the technical and management skill required to participate in increasingly complex programs. It is an establishment fact that the disasters of different types will require different types of trained rescue workers, and the equipments. The skills required for rescue work cannot be dealt in isolation. They have to dovetail into the holistic picture of the disaster management plan as stated earlier. The post disaster management can be divided into four distinct

phases. First phase is the rescue work, which involves saving the victims of the disaster. Second phase is the relief, which involves comforting the victims and establishment of order at the disaster location. The third is the rehabilitation of the victims. The fourth and the last phase is Reconstruction. It also takes the longest time. The first phase is the most critical from the point of view of saving human lives. It also has a very short duration when the victims can be saved. This makes rescue work the most critical so far as the disaster management is concerned. Thus the rescue workers must be trained and equipped to deal with the ground realities. Then and only then they can be effective in saving the human lives. The skills required in the disaster management include those required for (1) Rescue Work, (2) Relief, (3) Rehabilitation, and (4) Reconstruction. The skills can be disaster specific for Rescue and the relief works. Rehabilitation and Reconstruction are more or less similar in the different types of disasters. The most common natural disasters affecting our country are, (1) Earthquakes, (2) Floods, (3) Landslides, (4) Hurricanes, (5) Drought and Desertification. The different types of skills required for the management of these disasters is comprehensive and a can be listed under different categories.

Basic Search and Rescue: Emergency response is one of the most demanding forms of activity worldwide because it operates in conditions of uncertainty, often in remote locations and within severe time constraints. It therefore tests the management and logistic capabilities of the agencies involved to the limit. These teams are the first to reach the disaster locations. Their basic function is to provide First Aid to the disaster affected and organize Rescue operation. These tasks require certain basic skills. These include-

- ➢ Civil Defense to organize rescue operations,
- ➢ Fire protection in case of fire hazard,
- ➢ Ground and a serial first-aid service,
- ➢ Medical help in disasters,
- ➢ Environmental protection,
- ➢ Emergency supplies and provision of food,
- ➢ Labor safety and occupational hygiene,
- ➢ Water and food protection and treatment,
- ➢ Rescue operations in traffic crashes,
- ➢ Rescue and first-aid service in mining and mountaineering,
- ➢ Protection of material values and property rescue operations in natural disasters.

The disasters victims in these categories are affected more severely than the other victims. They required specialist treatment. The medical team should have trained persons to deal with these categories of patients. In case of severe disasters like Earthquakes or Major floods the mass fatalities are common phenomena. To deal with the ground situation, it requires skill of the highest order. Disposal or cremation of the dead bodies becomes a serious problem and places a heavy strain on the resources of the organization. This situation is further complicated by the problem of identification of the dead.

Technical skills are the specialized engineering skills in various fields. The specialists in these fields are professionals and required very little training before inducting them into rescue work.

Communication is one of the most important part of the disaster management work. The biggest problem faced by the planners is the level of dependence of the existing communication network, either in the form of landlines, or cell phones. Both the forms of communication are susceptible to damage in the event of disaster. The only reliable link can be wireless network. Unfortunately it requires specialist knowledge for operation and maintenance. Satellite linked phones can be a better option but it is exorbitantly expensive.

The disaster affected areas might contain a number of utility services like electricity, water supply, telephones, and gas lines for domestic or industrial supply petrol oil and lubricant storage at the petrol pumps. The live electric lines, gas lines and water lines can pose a serious threat to life. They have to be effectively disabled to prevent accidents. It requires technical as well as the local knowledge.

Like any large scale project the disaster mitigation and management project is a multidisciplinary and multi specialty project. To conduct such an operation a variety of organizational skills and the best of the project management skills are required.

Every project throws up a variety of problems during the execution stage. Despite of the care taken at the planning stage to avoid such situation, these emergencies are increasing. The emergency planners are required to take care of this situation and find away to by pass the emergencies and permit the project to run smoothly.

The manpower requirement in the disaster management is very large. To mobilize and organize such a large force of volunteers is a Herculean task. The volunteers are invariably untrained or at best semi-trained persons. To motivate such a force requires very high level of commitment and organization skill. The decision-making capability is a gift and very few people have this capability. It is more so in case of a crisis situation. The decision has to be made at that point of time. Correctness of the decision can only be judged by subsequent results. The project Managers is the specialists who oversee the project execution. Their main functions are to ensure that-

➢ Resources are deployed at right time,

➢ Adequate resources are available,

➢ Coordination between different agencies or Groups,

➢ Monitoring the progress of the project.

Finance or the Money forms an important part of resources. The main sources of funds are the Government departments, Voluntary Organizations, Public and Private sectors. All of them have their own rules, regulations and other conditions for the release of funds. These conditions have to be fulfilled. The funds have to be deployed for productive work. All this process requires specialist knowledge and skills.

(a)   Strategic Planning,

(b)   Leadership,

(c)   Decision Making

In any emergency, people will generally suffer from varying degrees of anxiety. Any emotional support will help to reduce excessive stress reactions. Possible source for emotional support skills may include

following categories of persons who have experience in counseling and providing emotional support.

- ➢ Teachers,
- ➢ Counselors,
- ➢ Nurses,
- ➢ First responder,
- ➢ Social Workers,
- ➢ Religious Workers,
- ➢ Persons with crisis management skills,
- ➢ Volunteers

Integration of the skills in Disaster management plan-All the skills listed above are integral part of disaster management, Most of the skills are part of some Medical, Technical Management sciences. There are qualified specialists working in these fields. To integrate these skills into the disaster management plan will mean bringing in all these specialists into the action plan. Then only these skills can be utilized in the execution of the action plan. The plan has to be prepared by professional planners.

Manpower Mobilisation and Training

The requirement of manpower for disaster management is very high. The mobilizing such a huge force is itself is a formidable job. It a common practice all over the world to look for the manpower from various organized and disciplined groups like armed forces, civil defense fire brigade etc. There is another big source of manpower that has not been paid adequate

attention. These are the local population who are the biggest stakeholders. The various sources of manpower are:

> Government Departments,
> Use of Armed Forces,
> Non-Governmental organizations, (NGOs)
> Peoples Participation as main Stakeholders,
> Community Based Volunteer force for Relief and Rescue work.

The basic requirement of the rescue volunteers is that they must be properly organized, should have discipline, adequate resources to operate on their own if necessary and last but not the least they must have some basic rescue and or disaster management training.

Armed Forces: Referring to the above list, we find armed forces are the only group coming closet to the requirements. Unfortunately their main training and responsibility is National defense. The deployment of armed forces for disaster management or counter insurgency is not a good practice. It affects their training as well as their moral. This point has been stressed by the Armed forces high command as well as various high-powered committees. Unfortunately we lack an organized, disciplined and trained force to counter the disasters as well as the insurgency.

Government Departments: The Government departments have very little training and organization to combat any disaster. Their best use will be for organizing the back end of the project execution like inventory management, supply and logistics, emergency centers management.

Non-Government Organizations (NGOs): Some of the organizations like Red Cross, St. John Ambulance Brigade are reasonably organized and adequately trained for disaster management. Their limitations are their limited authority to undertake the disaster management on their own. They have to tie up with government officials.

Community based Volunteer Force: This is one area where India as a nation has not done any effort to form such a force. Our thrust has always been on Government doing everything themselves. It resulted in chaos. Number of Government appointed committees have recommended formation of a disaster management agency on the lines on the lines of FEMA of USA. They have recommended formation of an independent ministry for this work. Formation of community based response teams (CRT) in disaster prone area is a necessity. These teams can then become the first respondents in case of emergency. At the moment no such facility is available anywhere in the country. We are totally dependant on the Government machinery. The volunteer force can be raised on the lines of Territorial Army where the participants are part time service personnel. They are paid partial wages during peace postings and full pay when on active duty. The deployment of ex-servicemen in this force would be a good option. The National Social service group, which forms the chunk of university students, would be another source of volunteers. They can be easily trained in disaster management. As it is they are in contact with the local population an account of their social work, their contact can be further utilized for disaster management through public awareness programmes.

People's Participation: It is extremely important that the main stakeholders be involved in this process of disaster management. The biggest stumbling block in this process is the mistrust the people have against the officialdom. An average person does not want to have anything to do with the departments like Police, Revenue, RTO or the Health departments. Under the give situation Government machinery must win the trust of the stakeholder population and bring about the disaster awareness and the participation.

The second problem in dealing with the Government machinery is their obsession with secrecy and the lack of transparency. All plans, programmes, schemes are kept within the four walls of the offices. Even with the right to information bill, having passed, the information is not easily available. One of the best examples is the disaster map of India. This document is available on CD costing Rs. 3000. In fact it should be freely available on line. Unless this system is drastically altered, peoples' participation will remain only on paper like so many other things.

Different Levels of Responsibility: The manpower mobilized for the disaster management has to clearly deployed, depending on their training, skill levels, and equipment available with them. FEMA has classified the levels depending on the above factors. In an earthquake the classification is a follows.

➢ The most skilled and trained teams are the Urban Search and Rescue. It is their responsibility to look for the victims who are entombed and whose rescue requires specialized equipment and trained rescue teams to rescue them.

- Second level of rescue is for the victims trapped under collapsed structures but is visible and accessible to the rescue teams they are to be attended by the emergency service providers.
- Third level of rescue work is by the community response teams who will attend to the victims entrapped under minor obstruction that do not need specialists equipment and expertise as in the first two cases.
- Fourth level of rescue is by the rescuers from the disaster location and has preliminary knowledge of first aid and can attend the injured victims.

Disaster Relief Equipments and Tools

Heavy Moving Machinery / Equipment

- JCB / Excavators.
- Cranes
- Skit Steer Loader (Escorts)
- Crawler Tractor Size II
- Portable Power Pack (Escorts)
- Power Cutters
- Hand held pneumatic cutters
- RCC Cutters
- Air Bags High Pressure Kevlar
- Jacks Hydraulic 20 T and 5 T
- Hydraulic wedge lifter 24 T
- Hydraulic Breaker
- Hydraulic Bolt Cutter
- Air Chisel

- Air Hammer
- Collapsible Ladders
- Ropes 2"
- Face Masks
- Synthetic Gloves
- Life Detection Endoscope Cameras
- Radar Based Life Detection Equipment
- Acoustic Life Detection Equipment
- Heat Sensing Life Detection Equipment

Rescue and Relief Equipment

- Synthetic tents (10'x10'x8') (living)
- Synthetic tents (4'x4'x6') (Toilet)
- Blankets, bed sheets and pillows
- Ground sheets
- Water Tanks Fabric (230 lit)
- Water Tanks Fabric (6140 lt.)
- Cooking Gas Stove/Cylinder (100 strength)
- Cooking/Serving utensils (100 strength)
- Buckets and Mug aluminium
- Emergency lights
- Generating Sets (3.5 KVA), electrical accessories and fuel
- Cover Waterproof (5.5mx4.5m)
- Cover Waterproof (9.1mx9.1m)
- Water purification kit
- Portable Hand held DC Light beam

- Collapsible Ladders
- Splinter proof Helmets with mounted torch
- Orange Colored uniform complete
- Inmarsat Mini M Terminals
- Cellular Mobile Phone with national roaming facility
- Hand held Radio Sets
- Rations (Two days)
- Meals ready to eat (One day)
- HQ/Office requisites & computers
- Personal ruck sack
- Sleeping Bags
- Lifting harness/blocks & tackles
- Sniffer Dogs
- Vibraphone/Acoustic life detection equipment
- Heat Sensing equipment to pick up human life from background
- Hand held pneumatic concrete cutters
- Portable Compressors.

Shelter Pack

- Extendable Tents (20 men)
- Canvas Tarpaulins (30'x3')
- PVC Tarpaulins (12'x12';)
- Blankets, Bed sheets, Pillows.
- Ground sheets.
- Modified Geodesic dome (Dia 5.25m, centre height 3.4m)

Water Supply Pack

➢ Water Bowsers / Tankers

➢ Rubberized Tanks (50,000 Lit.)

➢ Water Purification Plant.

➢ Well boring Equipments.

➢ Pumping sets (various capacities)

➢ HDPE pipe/Victaulic pipes

Power Supply Pack

➢ Generator Set. 63 KVA & Accessories

➢ Generator Sets 30 KVA & Accessories

➢ Enervator Sets 7.5 KVA & Accessories

➢ Electrical Repair kits

➢ Emergency Lighting System

Communication Pack

➢ Inmarsat Mini M terminal

➢ VSAT Terminals in KU Band

➢ Radio set HX

➢ VHF System

➢ Hand held Radio Set

➢ VHF Bases Stn

➢ VHF Repeater Stn

➢ Containerized 100 line EPABX and Integrated WLL System with 20 remote telephones

➢ Telephones

- Cable
- Portable Generators 2 KVA
- Portable Generators 4 KVA

Food Pack

- Dry rations to include ATTA, Rice, Dal, Sugar, Tea, Powder milk, Salt, Masalas, Fuel etc. and hard variety of vegetable.
- Pre cooked food/survival rations.

Medical Equipment

- Stretchers Light Weight folding (serving as a cot)
- Cardiopulmonary monitor
- Oxygen Cylinder 623 liters with mask
- Inflatable pneumatic (set of 4) splints
- Ventilator Portable
- Portable electrical
- Portable mechanical foot
- OT Packs
- OT general stores like gowns, masks scrub brushes, slippers etc.
- X-ray Machine Portable
- X-ray films all sizes
- Sprayer Hand
- Sprayer Shoulder 16 Liters
- Operation Theatre on wheels. (Mobile Theatre)
- Medical Equipment Scale Complete of TSP of Field Ambulance (operational theatre grounded)

- Medical Equipment Scale Complete of Medical Platoon of field Ambulance. (Store for hospital Grounded).

Medicine/Fluids Pack

- Hygiene Chemicals
- Bayon Liquid
- Bayon Granules
- Malathion (conc.)
- Vaccines
- Cholera Amp.
- Tetnus Amp.
- TAB Amp.
- Others as applicable
- Resuscitation Fluids
- 5% Isotonic
- Ringers
- Normal Saline
- Haemaccel

Functional Equipment and Patient Comfort Pack

- Water Bowser 3000 Liter
- Lighting set mobile operating theatre.
- Generating set 5.5 KVA
- Charging set ED 500 W 30V 4A
- Batteries lead acid portable 12A 75 AH.
- Generating Set 30 KVA

- Electrical wire with 20 points set @ 500.
- Ice box 20 liters. (For preservation of vaccines).
- Patients Blankets (all types)
- Pillows & Bed sheets.
- Emergency Lights and Torches.
- Gypsy Ambulance Vans
- Emergency First Aid Pack.

Chapter-11

DISASTER MANAGEMENT

India has been traditionally vulnerable to natural disasters on account of its unique geo-climate conditions. Floods, droughts, cyclones, earthquakes and landslides are regular phenomena in India. The multi-hazard scenario depicted in the Vulnerability Atlas of India (produced by Building Materials and Technology Promotion Council (BMTPC), New Delhi, India), shows that out of the total geographical area of 32, 87, 263 sq. km, about 60% of the landmass is prone to earthquakes of various intensities; over 40 million hectares is prone to floods; about 8% of the total area is prone to cyclone and 68% of the area is susceptible to drought. During 1990-2000, on an average of about 4344 people lost their lives, about 30 million people were affected by various disasters every year and average annual damage has been estimated to be approximately 2700 million rupees. As per the World Bank estimates, during 1996-2001 the total losses due to disasters, including the super cyclone of Orissa in October 1999 and the Bhuj earthquake in Gujarat in January, 2001, amounts to US$ 13.8 billion.

Over the past two decades, there has been an increase in disaster occurrences costing human and economic losses. This is due to the ever increasing vulnerabilities of people to natural disasters. The need is felt to reduce disaster risks by improving capabilities of people and ensuring preparedness, mitigation and response planning processes at various levels. The objective is to look at the entire cycle of disaster management in reducing risk and linking it to developmental planning process. In the past, disasters were viewed as isolated events, responded to by the Governments

and various agencies without taking into account the social and economic causes and long term implication of these events. In short, disasters were considered as emergencies.

The recent disasters and its socio-economic impact on the country at large, and in particular the communities has underscored the need to adopt a multi dimensional approach involving diverse scientific, engineering, financial and social processes to reduce vulnerability in multi-hazard prone areas. in view of this, the Government of India has brought about a paradigm shift in its approach to disaster management. The change is from "relief and emergency response" to a balanced approach covering all phases of the Disaster Management Cycle. The approach acknowledges disaster management as a part of the development process, and investments in mitigation are perceived to be much more cost effective than relief and rehabilitation expenditure. In this regard, Government of India has taken various initiatives in area of disaster preparedness, mitigation and response through networking of various institutions, institutional capacity building, and policy interventions at all levels.

Community participation and community ownership risk reduction is one of the key factors in reducing vulnerabilities of people and minimizing the loss. The Government of India's focus Community Based Disaster Preparedness (CBDP) approach promotes community involvement and strengthening of their capacities for vulnerability reduction through decentralized planning process. This document deals with the concept, component and some of the best practices in India.

Institutional Arrangements

India has integrated administrative machinery for management of disasters at national, state, district and sub-district levels. However, the basic responsibility of undertaking rescue, relief and rehabilitation measures is that of state government concerned. The Central Government supplements the efforts of the states by providing financial and logistic support.

The Contingency Action Plan identifies initiatives required to be taken by various Central Ministries and Public Departments in the wake of natural disasters. Ministry of Home Affairs is the nodal Ministry for coordination of relief and response and overall natural disaster management, and the Department of Agriculture and Cooperation is the nodal Ministry for drought management. Other Ministries are assigned the responsibility of providing emergency support in case of disasters that fall in their purview as indicated in the Table 11.1

Table - 11.1
Ministries Responsive For Various Categories of Disasters

Disaster Type	Nodal Ministry
Natural Disaster & Management (Other than Drought)	Ministry of Home Affairs
Drought Relief	Ministry of Agriculture
Air Accidents	Ministry of Civil Aviation
Railway Accidents	Ministry of Railways
Chemical Disasters	Ministry of Environment & Forests
Biological Disasters	Ministry of Health
Nuclear Disasters	Department of Atomic Energy

The responsibility to cope with natural disasters is essentially that of the state Government. The Chief Secretary of the state heads a state level Committee which is in overall charge of the relief operations in the state and the Relief Commissioners who are in charge of the relief and rehabilitation measures in the wake of natural disasters in their states function under the overall direction and control of the state level Committee. In many states, Secretary, Department of Revenue is also in charge of relief.

The district administration is the focal point for implementation of all governmental plans and activities. The administration of relief is the responsibility of the Collector/District Magistrate who exercises coordinating and supervising powers over all departments at the district level.

The 73rd and 74th constitutional amendments gave the status of 'Institutions of self government' to Panchayati Raj Institutions. The constitutional amendments also laid down necessary guidelines for the structure of their composition, powers, functions, devolution of finances, regular holding of elections and reservation of seats for weaker sections and women. These local bodies may be effective instruments in tackling disasters through early warming system, relief distribution, providing shelter to the victims, medical assistant etc. The Eleventh Finance Commission too paid detailed attention to the issue of disaster management and came out with a number of recommendations, including expenditure on restoration of infrastructure and other capital assets as well as capacity building. Training and education are crucial for mitigating disasters and also for disaster response. Training is an integral part of the capacity building as trained

personnel respond much better to different disasters. The multi sectoral and multi hazard prevention based approach to disaster management requires specific professional inputs. Similarly, preventive disaster management and development of a national ethos of prevention calls for awareness generation at all levels. Again, capacity building should not be limited to professionals and personnel involved in disaster management but should also focus on building the knowledge, attitude and skills of a community to cope with the effects of disasters.

The Yokohama Convention in May 1994 underlined the need for an emphatic shift in the strategy for disaster management. It was inter alia stressed that disaster prevention mitigation, preparedness and relief are four elements which contribute to and gain from the implementation of sustainable development policies. The Government of India has adopted mitigation and prevention as essential components of development strategy. In order to respond affectively to flood, Ministry of Home Affairs has initiated National Disaster Risk Management Programme in all the flood prone states. Elected representatives and officials of local bodies are being trained in flood disaster management under the programme. Bihar, Orissa, West Bengal, Assam and Uttar Pradesh are among 17 multi hazards prone states where this programme is being implemented with assistance from UNDP, USAID and European Commission.

A comprehensive programme has been taken up for earth quake risk mitigation. The building construction in urban and sub-urban areas is regulated by Town Country Planning Acts and Building Regulations. A National Core Group for Earthquake Risk Mitigation has been constituted

consisting of experts in earthquake engineering and administration. Review of Building Bye-Laws and Adoption is being insured by the various state Governments. A National Programme for Capacity Building of Engineers and Architects in Earthquake Risk Mitigation has been implemented by the Central Government. Training for rural masons for construction of earthquake resistance buildings and houses is being provided under UNDP - Government of India, Disaster Management Programme in various States. Retrofitting of lifeline buildings is also been insured by the State Governments. An Earthquake Mitigation Project has been drawn with an estimated cost of Rs. 1132 crores. The programme includes training of masons in earthquake resistance constructions and adopting techno-legal regimes by state governments. Accelerated Urban Earthquake Vulnerability Reduction Programme has been taken in 38 cities in Seismic Zone III, IV and V in a population of half a million and above. Training Programmes have been organized for engineers and architects to impart knowledge about seismically safe construction and implementation of Bureau of Indian Standards Norms. A National Cyclone Mitigation Project with cost of Rs. 1050 crores has been drawn up in cyclone prone states. The project envisages construction of cyclone shelters, coastal shelter belt plantation, strengthening of warning systems, training and education etc. A Disaster Risk Management Programme has been taken in 169 districts in 17 multi hazards state prone with assistance from UNDP, USAID and European Union. Importantly, Disaster Management Faculties have already been created in Administrative Training Institutes located in 28 districts. Disaster Management as a subject in social sciences has been introduced in school curriculum for classes VIII and IX. Besides, 8 battalions of Disaster Risk Response have been created for providing prompt response during disasters.

In order to provide training and knowledge for prevention, mitigation, response of disaster as well as rehabilitation and reconstruction of affected persons and areas, academic institutions have been established with financial assistance from government. However, disaster management required multi disciplinary and pro active approach.

Disaster Management

1. Preparedness

This protective process embraces measures which enable governments, communities and individuals to respond rapidly to disaster situations to cope with them effectively. Preparedness includes the formulation of viable emergency plans, the development of warning systems, the maintenance of inventories and the training of personnel. It may also embrace search and rescue measures as well as evacuation plans for areas that may be at risk from a recurring disaster.

Preparedness therefore encompasses those measures taken before a disaster event which are aimed at minimizing loss of life, disruption of critical services, and damage when the disaster occurs. All preparedness planning need to be supported by appropriate legislation with clear allocation of responsibilities and budgetary provisions.

2. Mitigation

Mitigation embraces all measures taken to reduce both the effect of the hazard itself and the vulnerable conditions to it in order to reduce the scale of a future disaster. Therefore mitigation activities can be focused on the hazard itself or the elements exposed to the threat. Examples of

mitigation measures which are hazard specific include modifying the occurrence of the hazard, e.g. water management in drought prone areas, avoiding the hazard by sitting people away from the hazard and by strengthening structures to reduce damage when a hazard occurs.

In addition to these physical measures, mitigation should also be aimed at reducing the physical, economic and social vulnerability to threats and the underlying causes for this vulnerability.

Human Capacity: Human capacities are the qualities are resources of an individual or community to anticipate, cope with, resist and recover from the impact of a hazard. Human Capacities and Human vulnerability are inversely related. Higher the Human capacity lower will be the vulnerability and vice versa.

Approaches of Disaster Management

Disaster risk management can be addressed in three ways: structural measures, non-structural measures and establishing communication networks. Structural measures would reduce the impact of disasters and non-structural measures would enhance the management skills and improve capacities of the community, local self governments, urban local bodies and the state authorities to prepare, prevent and respond effectively to disasters. Non-structural measures are more important and include vulnerability mapping, risk assessment analysis, hazard zoning, inventory of resources to meet the emergency etc. The approaches of disaster management are shown in chart 11.1

Chart 11.1

Approaches of Disaster Management

Type of approach	Proponents	Viewpoint
1. Geographical approach	Harland Barrows Gilbert F. White	Focus on chorological and chronological distribution of disasters, their impact and vulnerability. Based on this understanding of spatio-temporal factors, choices are made among various kinds of adjusting to such disasters.
2. Anthropological approach		A community oriented approaches with focus on role of disasters in guides the socio-economic evolution of population of civilization. They also search for threshold points for local communities beyond which they no longer provide the basic requirements for survival of their members.
3. Sociological approach	Russel R. Dyness Enrico L. Quarantelli	Focus is on vulnerability and its impact on human behaviour and psychologically determined defensive reaction pattern. Impact of disasters on community is major area of study.
4. Developmental studies approach	Davis (1978)	Major areas of interest are aid, relief measures, refugee management, health care and avoidance of starvation. Line of thinking holds developing countries as most disaster prone and poverty responsible for increased human vulnerability.

5. Disaster medicine and epidemiology approach		Focus is on mass casualty management, trauma treatment and epidemiological surveillance of communicable diseases.
6. Technical approach		Focus is on scientific and technical aspects of disasters. Major areas of interest are seismology, volcano logy, geomorphology and geophysical approaches to disasters.
7. Human ecology approach	Meleti (1980)	Focus is on determinants of human behaviour and the process that facilitates human adjustments to disasters through social organizations.

The dynamics and machinery of urban development is complex. Therefore, careful attention is needed to find the best opportunities and effective routes to introduce safety measures. Many authorities fail to recognize the rich range of measures that need to be adopted and integrated into a viable and affordable programme. The expanding scale of urban pressures, problems, and risks in India is a daunting challenge. However, India has certain assets that many countries envy when it comes to reducing urban risks. There is strong and increasing government commitment to disaster protection, a vibrant civil society's network which provides base of community participation and high share of private sector in humanitarian aid to disaster's victims and reconstructions of disaster affected areas. However, there is lack of coordination and integrated approach for disaster response.

Chart - 11.2 denotes elements of disaster management. There are mainly three elements of disaster mitigation viz. risk management,

prevention and preparedness. Chart - 11.2 shows functional structure of natural disaster mitigation. The main three elements are rehabilitation, prevention and response. In responsive measures, relief, medical aid, shelter, food rescue, warning, evacuation, assessment of vulnerability and risks, public awareness, capacity building for livelihoods restoration etc. are included.
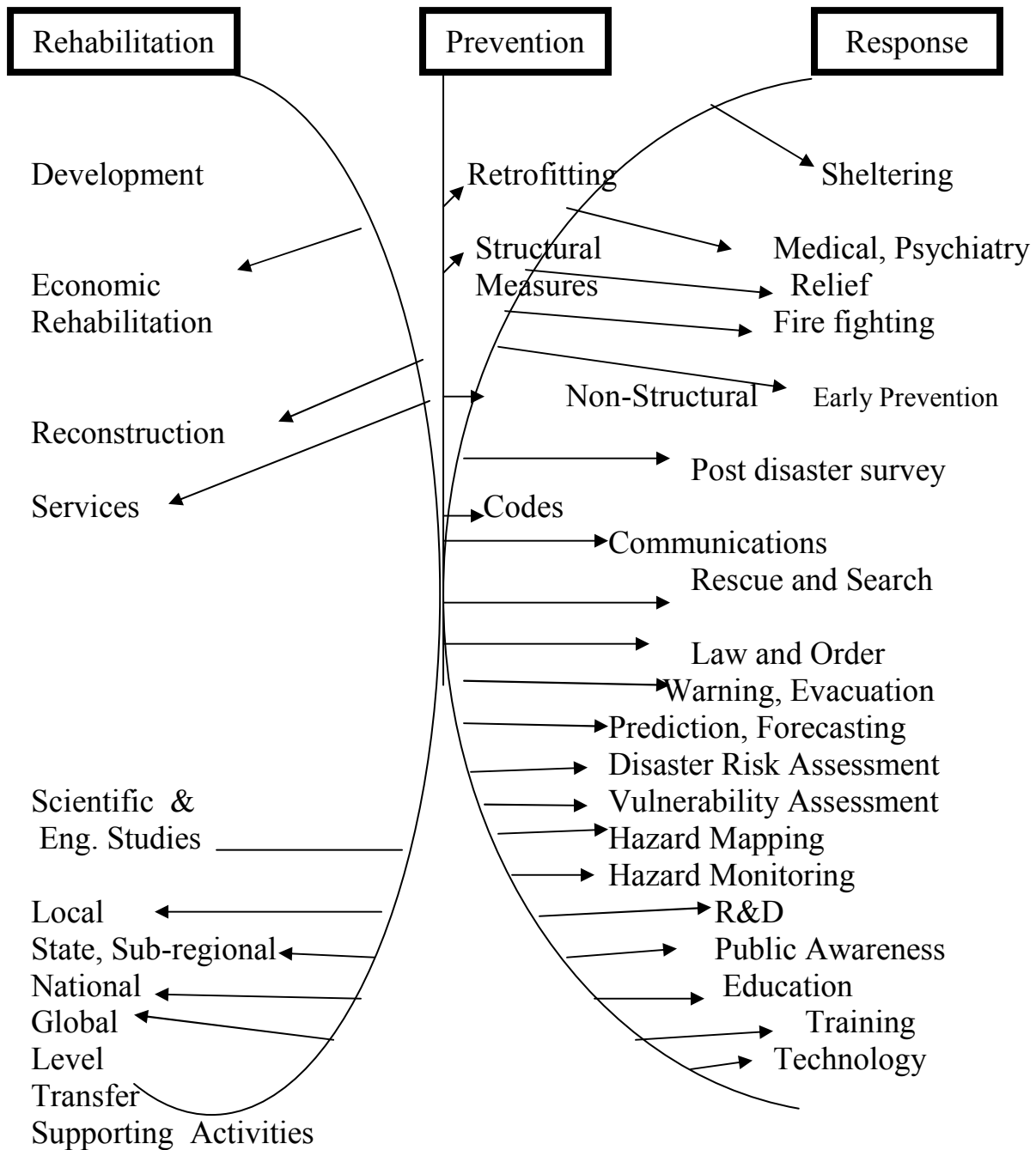
Chart - 11.2

Main Elements of Disaster Management
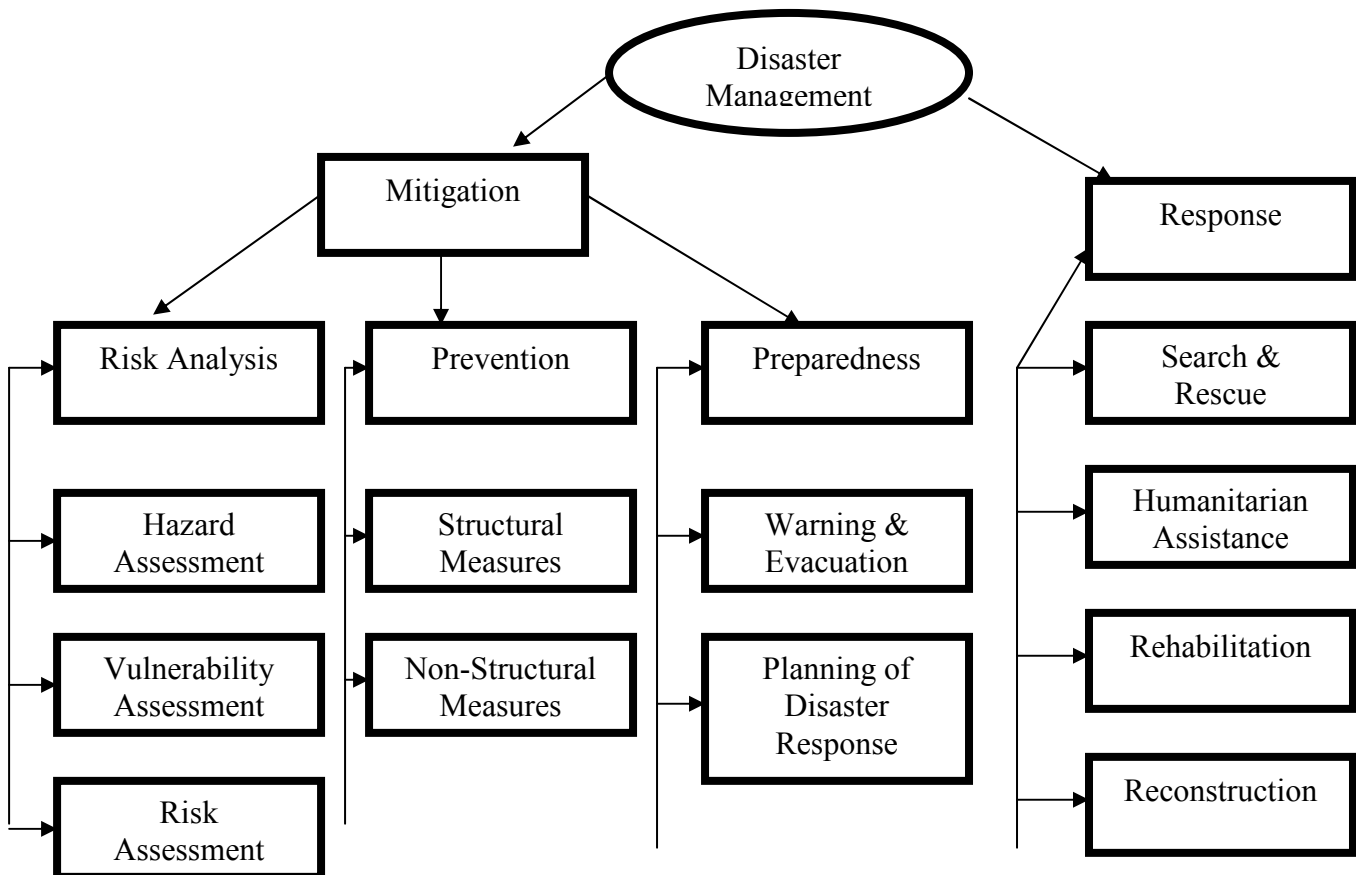
Source: Arya, A.S. (2004)

Chart - 11.3

Functional Structure of Natural Disaster Mitigation

| Rehabilitation | Prevention | Response |

Development

Economic
Rehabilitation

Reconstruction

Services

Scientific &
 Eng. Studies

Local
State, Sub-regional
National
Global
Level
Transfer
Supporting Activities

Retrofitting

Structural
Measures

Non-Structural

Codes

Sheltering

Medical, Psychiatry
Relief
Fire fighting

Early Prevention

Post disaster survey

Communications
Rescue and Search

Law and Order
Warning, Evacuation
Prediction, Forecasting
Disaster Risk Assessment
Vulnerability Assessment
Hazard Mapping
Hazard Monitoring
R&D
Public Awareness
Education
Training
Technology

Source: Arya, A.S. (2004)

Disasters are the ultimate test of emergency response capability. The ability to effectively deal with disasters is becoming relevant because of the increasing risk factors. Increase in population density population shifts and increasing technology are some of the important factors for increasing risks, leading to disasters. As areas become more densely populated, there are more potential victims when a disaster strikes. National disasters such as earthquakes, hurricanes, cyclones, Tsunami, and floods tend to result in greater losses due to densely populated areas in India. Another reason for increasing disaster losses are that population density in disaster prone areas is increasing. The increasing settlements development in high risk areas is the cause of concern. The pattern of settlement in high risk areas is reflected in the increasing mortality ratio in India. In the process of setting high risk areas, natural protection against environmental threats is removed. In India, the vegetative coverage and forests were destroyed in coastal areas for promoting shrimp farming, business, and tourism and housing colonies. This lead to damage of natural protection against hurricanes, and Tsunami and ultimately Tsunami affected to the large population in coastal areas in southern states recently. The vulnerability of people living in high risk areas is increasing because the habitations are often unaware of potential risks and how to deal with them. Even, the prices of land for house construction in high risk areas are lower which attract people for housing construction, even without proper approval of housing structures. People are living in structures that are not designed to resist the forces of local hazards. In India, earthquakes have affected severely due to lack of good design technology and inadequate earthquake resistance housing and building structures. The new technology is also adding to the list of disaster agents at an ever increasing rate. A large quantity of hazardous chemicals, wastes, bio-

medical wastes, and dumping adds proliferation of high risk office buildings and hotels that subject their inhabitants to fire threats not experienced before. The society is also becoming more dependent on technology and specialization, making more vulnerable to disaster. Our dependence on computers is introducing a new form of disaster vulnerability.

In the context of ever increasing risks of disaster losses, it is imperative to deal with these catastrophes with full preparedness and planning. In disasters there are often conditions that may make the traditional division of labour and resources, characteristics of routine emergency management, unsuitable for disaster response. These are as follows:

➤ Disaster may put demands on organizations, requiring them to make internal changes in structure and delegation of responsibilities;

➤ Disasters may create demands that exceed the capacities of single organizations, requiring them to share tasks and resources with other organizations that use unfamiliar procedures;

➤ Disaster may attract the participation of organization and individual volunteers who usually do not respond to emergencies;

➤ Disasters may cross jurisdictional boundaries, resulting in multiple organizations being faced with overlapping responsibilities;

➤ Disasters may create new tasks for which no organization has traditional responsibility;

➤ Disasters may render unusable the normal tools and facilities used in emergency response;

➢ Disasters may result in the spontaneous formation of new organizations that did not exist before.

The typical response to a disaster includes multiple independent organizations from the private sector as well as from agencies of city, country, state, region and district governments. Disasters do not need to cover large geographical areas in order to cross multiple levels of government responsibility. However, disaster management is the only responsibility of government. Community based organizations and NGOs have to play a critical role in disaster management. Disasters are characterized by great uncertainty. Often the character and extent of damage and the secondary threats are not immediately apparent and therefore the necessary counter measures not undertaken. Disasters often create the need for different organizations to share resources. Therefore, coordination of multi organizational task accomplishment is required. The needs such as fuel and maintenance for vehicles, sanitary facilities, food, shelter and rest facilities, relief and replacement, personnel and emergency message, contact arrangement also are to be included in the logistic support of an organization responding to a disaster. In contrast to daily emergencies, disasters often call for large scale search and rescue operations. An important security task in disasters is keeping unauthorized persons out of the disaster area in order to prevent looting and decrease congestion hampering rescue efforts, and to prevent persons from being injured in the wreckage. Moreover, mass handling of the dead creates problems that may not have been faced in routine emergencies. Handling the dead poses different problems in disasters. The other tasks that are important in disaster response are:

- Warning and communicating with the public
- Shelter and feeding of displaced persons
- Evacuating neighborhoods
- Evacuating hospitals, prisons, nursing homes and psychiatric facilities
- Coordinating volunteers
- Acquiring and allocating unusual resources
- Dealing with mass arrival carcasses
- Dealing with livestock or family pets that had to be left behind or sheltered
- Procedures for condemning damaged buildings
- Disposing of unclaimed valuable and merchandise found in the rubble at the scene
- Control of air traffic
- Disposing of large amounts of donations
- Controlling emergency vehicle traffic in order to avoid blockage of routes by emergency vehicles
- Checking the hospitals, nursing homes and day care centers that may need assistance
- Prioritizing of utility sources delivery

Adequate communication is a recurring challenge in disaster response. The importance of communication is its ability to get people to work together on a common task or toward a common goal to coordinate. It is the process by which each person understands that how his individual efforts intermesh with those of others. The information is required for need assessment and rescue operations. The most crucial types of information that need to be shared are related to:

- An ongoing assessment of what the disaster situation is and what disaster counter measures need to be undertaken;

- An ongoing determination of what resources are needed to undertake the counters measure. What resources are presently available and how they can be obtained;

- A determination of the priority of needed disaster counter measures;

- A determination of what persons and organizations will be responsible for the various tasks necessary to accomplish the counter measures

Computers are not only useful for sharing and analyzing disaster information, but also for sharing it. The internet facility may provide strong base for efficient communications in the following measures:

- Sharing and collecting information about what agencies have responded and what resources they have dispatched.

- Locating and specifying procedures for obtaining special disaster resources;

- Sharing information about the location, scope, and character of the disaster and damage that has resulted;

- Sharing information about the status of transportation routes facilities, docking and landing sites;

- Generating and sharing predictions about weather and other expected conditions;

- Obtaining information on how to deal with a specific hazardous chemical;

- General electronic mail.

Thus, it is clear that the communication and equipments and procedures used by most emergency agencies are established primarily to deal with information flow within the organization. Disasters care for inter agency communication also. To some extent, it can be facilitated by the availability of inter-agency radio networks. However, the critical information requirements of the various organizations involved in disaster response need to be mutually understood and the responsibility for gathering and disseminating it needs to be made clear.

Significantly, disasters pose problems for resource management. A prerequisite to effective and efficient resource management is an accurate system for overall analysis of the disaster situation and the available resources. Overall, need, assessment, involves two major processes: (1) situation analysis; and (2) resource analysis. Situation analysis is the collection of information about the extent and character of the disaster itself and problems that have to be tackled. While resource analysis involves the collection of information about the resources needed to be handled. The source allocation of disaster resources depends on the task priorities already decided for the response of disaster.

In contrast to most routine emergencies, efficient response in disaster requires procedures for triage and casualty distribution. Triage has been called the key stone to mass causality management. The technique for assigning priorities for treatment of the injured when resources are limited is called triage. Generally, attention is given first to those with the most urgent conditions and to those who are the most salvageable. The triage is beneficial in disaster response due to the facts: (i) triage separates out those

who need rapid medical care to some life or lives, (ii) by separating out the minor injuries; triage reduces the urgent burden on medical facilities and organizations, (iii) by providing for the equitable and rationale distribution of causalities among the available hospitals. Triage reduces the burden on each to a manageable level, often even to non-disaster level. In order to distribute casualties rationally among the hospitals, capacity assessment of the existing hospitals, dispensaries and clinics need to be examined.

It is to be noted that convincing the public to evacuate areas threatened by impending disaster is often challenging one. In disasters, communication with the public assumes new dimensions not present in routine emergencies. Warning can be one of the most important types of disaster communication allowing the recipients to avoid the threat altogether or to significantly lesson its effects. However, people are often reluctant to evacuate the premises stricken by disaster. There are a number of reasons why persons hesitate to evacuate in the face of threatening disaster. They may not be convinced that they are actually at risk, they may wish to stay and protect their property, or they may want to assure the safety of other family members and property before leaving. Those living in disaster threatened areas are more likely to evacuate if they are encouraged by invitations from relatives and friends outside.

In the impact area people prefer to seek shelter with friends or relatives rather than at public shelters. Importantly, the process of warning is complicated since it requires the accomplishment of a number of tasks. Jammed telephone lines and circuits as well as traffic congestion, make the process more difficult.

Disaster response and preparedness is most effective when it is built in to development programmes. In long run, disaster mitigation could be implemented at nominal cost by incorporating them into development programmes. The expenditure on disaster mitigation would reduce the potential losses that disaster cause. Significantly, urban planning urgently begs fundamental conceptual change, with a need for locating urban disaster management strategies in a holistic framework embracing issues like poverty, provision of institutional support for informal sector activities, over urbanization, environmental degradation and unchecked consumerism etc. A sound, effective and people centric urban disaster management strategy can emerge only in the context of a truly sustainable, and people centric development paradigm. Disaster management and mitigation be organized around local recovery efforts. In an integrated disaster risk management approach, activities from structural interventions to community based disaster management, which reduces hazard and vulnerability, should be coordinated. It is imperative to orient and train development agencies to integrate disaster risk management into the national and local planning process, thus mainstreaming disaster reduction into development collaboration among the stakeholders is a critical strategy in disaster reduction. It enhances complements the respective capabilities of concerned sectors and organizations in the pursuit of development objectives.

2. Community Based Disaster Preparedness

Analyses of response to past disasters have highlighted reaching out to the victims within the critical period during an emergency as a major requirement to protect people and assets. This has resulted in developing mechanisms to mitigate disasters at the grassroots level through participation

of communities. Communities being the first responder and having more contextual familiarity with hazards and available resources are in better position in planning and executing immediate rescue and relief actions. In areas that have experienced repeated disasters, the communities are realizing that they need to work out a plan to prevent losses and at the same time enable faster recovery in the event of an emergency situation. To convert this realization into an effective plan, they need guidelines which will help them to prepare their own Community Based Disaster Management plans to safeguard lives, livelihood and property.

The **Community Based Disaster Preparedness (CBDP)** planning referred to in the following sections pertains to preparedness, mitigation and response plans. The primary goal of CBDP is to reduce vulnerability of the concerned community and strengthen its existing capacity to cope with disasters. The approach of preparing the CBDP plans considers people's participation a necessary pre-requisite for disaster management. By involving the community in the preparedness phase, it not only increases the likelihood of coordinated-action by the communities to help in mitigation disasters but also brings the community together to address the issue collectively. There are evidence of collective and coordinated action yielding good results and to a great extent it has been effective in lessening the impact of disaster.

In view of the above, the Government of India and United Nations Development Programme reviewed various models of CBDP being conducted in the country. Several entities have been supporting communities in developing CBDP. The concept varies; for some, CBDP is getting the

communities organized to maintain a cyclone structure and having a well developed evacuation plan. Similarly, the process followed also differs-some organizations have been developing the plan and explaining the components to the communities; other preferred to develop the plan with the involvement of the communities. Most of these process remained outside the Government system and it has the inherent danger of communities forgetting the roles and responsibilities, especially if they did not have to use the plan over a period of time.

Preparation of CBDP plans are being promoted under the GOI-UNDP Disaster Risk Management programme in 169 districts in 17 states by institutionalizing the process within the Government system, with the local authorities playing a dominant role in partnership with other key stakeholders. It is a scientific approach, tested in some pilot states and covers all aspects of disaster management through a process involving communities at risk. Recently the Government of India has decided to launch a project in the remaining multi-hazard regions of the country.

3. Components of CBDP

(a) Disaster Management Committee: Village Disaster Management Committee (VDMC) is formed in each village and it is responsible for initiating disaster preparedness activities. It consists of local elected representatives, grass root level Government functionaries, local Non-Government Organizations (NGOs)/Community Based Organizations (CBOs), members of youth groups such as the National Service Scheme (NSS) and Nehru Yuva Kendra Sangatan (NYKS), women groups, youth

club members, grass root level Government functionaries, etc. The size of VDMC is based on the population and need of the villagers. The head of the VDMC takes a lead in mobilizing the community for the preparation of the CBDP plans.

(b) Review & Analysis of Past Disasters: It refers to prioritizing disasters based on its frequency and analysis of the estimated losses. This is an important activity as it forms the basis for preparedness and mitigation plans.

(c) Seasonality Calendar of Disasters: While analyzing the past experience pertaining to various natural disasters, communities develop the seasonality calendar based on the occurrence of disaster events. In the calendar below prepared by the community show the month of occurrence of the disaster and month for preparedness and mock drill.

(d) Mapping Exercise: One of the most important activities of the CBDP is the mapping of risk, vulnerabilities and capacities of the village by the community itself because it is considered to be a very simple and cost effective tool to collect ground level data. This is done through Participatory Rural Appraisal (PRA) exercise. Before the mapping exercise starts, the community members first discuss among themselves, about the experience of previous disasters they have faced or the disasters they may face in future. It aims to provide a pictorial base to the planning process especially for the semi- literate populace and ensures maximum community involvement across gender, caste and other divides. It has also been found to be very effective in raising awareness among the community and thereby enhancing

participation of the community in problem identification. The maps generate awareness among the community about the avenues for smooth evacuation during any imminent disaster. The strategy adopted is to use locally available resources rather than depending on the external agencies for helps and support. The villagers/community members are encouraged to draw the maps on the ground using locally available materials such as stone, stand and various colour powders for different items and indicators. The maps drawn need not be to scale. The types of maps are as follows:

- **Resource Map:** Resource mapping focuses on identifying locally available assets and resources that can be utilized for building the capacities of the community during and after disasters. Apart from infrastructure and funds, this could be individuals with specific skills, local institutions and people's knowledge as all these have the capacity to create awareness and bring about changes in the community. A resource map is therefore not limited to a map depicting the available resources but also plotting of the distribution, access and its use by taking into consideration prevailing sensitiveness within the village.

- **Risk and Vulnerability Map:** In the vulnerability map the community members have to identity the hazards that the village is prone to and the possible areas that would be affected. They also demarcate the low lying areas, areas near the water bodies such as the sea and river, direction of wind, etc. Through this mapping exercise the community members identify the location of groups at risk and the assets that require protection from various hazards.

- **Safe and Alternate Route Map:** In a similar exercise, the villagers identify safe areas such as strong houses/buildings, raised platforms

etc. These act as a shelter place for the people in the event of an evacuation. It would be useful to identify the alternate approach routes which could be used during the time of an emergency.

(e) Disaster Management Team

Village level Disaster Management Team (DMT)/Task Forces are formed to outline coordinated response during crisis situations. DMTs have sectoral focus such as early warning, shelter management, evacuation & rescue, medical and first aid, water and sanitation, carcass disposal, counseling, damage assessment and relief and coordination. Based on a needs assessment of the teams, specialized training could be provided to the members. DMT members would be linked to the existing service providers for continuous training and discharging of their responsibilities effectively. The roles and responsibilities of the DMTs are the following:

1. **Early Warning Team**: The members of this team are responsible for providing latest warning information to the villager so that the villagers get ample time to get prepared for the advent of the hazard. At the time of the disaster the members of this team keep a track of the developments. Emergency contact telephone numbers are collected well in advance of the hazard season, tools such as radio, television etc. are to be kept in working condition prior to the hazard period. During the occurrence of the event, the team would be responsible to inform every household of the latest position. They would also keep a track of the situation and listen to the de-warning messages to decide on the timing for calling off the emergency state.

2.   **Evacuation, Search and Rescue Team:** Members of this task force are mainly responsible to evacuate and carry out search and rescue operation during the time of emergency. The members of this team are mainly young men and women of the village, ex-service men; swimmers, etc. Rescue kits necessary to carry out the activities of this team would be ideally made locally with indigenous materials available. These members are trained with the help of Civil Defense, Police, Fire services etc.

3.   **Shelter Management Team:** Members of this team takes care of the identified shelter buildings in pre, during and post disaster scenario. Care needs to be taken to stock necessary material such as food, drinking water, medicines, bleaching powder, firewood, lantern, etc. Special care needs to be taken for the animal stock during any disaster. The team needs to ensure hygiene in and around the shelter place. Women are generally active members of the shelter team as they are well acquainted with house management, and are able to manage shelter during emergency. The team leader or any other team member should have the keys of the safe shelters so that prior to the disaster they will clean up the place and make available the necessary materials like food, water, medicines, bleaching powder, firewood, lantern, etc. required for the evacuees during disaster period.

4.   **Water & Sanitation Team:** Members of this team ensures availability of safe drinking water and the cleanliness of the village so that there is no danger of epidemics even after the event. They will

make arrangements for storing drinking water and water for cooking and other chores.

5. **Medical & First Aid Team:** This specialized team is responsible for preparing and updating the list of vulnerable population like old and ailing people, pregnant ladies, children etc. They also have to procure the necessary medicines before the hazard season and conduct a routine check-up of the ailing people in the village. They have to collect health related information and make the community aware of the health measures to be taken up. Women and existing health practitioners of the village are the members of this team. This team would receive periodic training from the local medical (local health centre) personnel.

6. **Relief and Coordination Team:** This team maintains the list of all household members so that they can arrange or procure sufficient quantity of food materials for each category of people. They are also responsible for the distribution of relief materials. And in the post disaster period they will make arrangements for getting relief materials from the Block office. They should have the list of shops/ wholesale dealerships where food grains are available for use during the time of emergency.

7. **Carcasses Disposal Team:** The team is responsible for the clearing of carcasses (if any) after the disaster. They are exposed to different types of carcasses disposal methods. The team should put in all their effort to check spread of diseases by disposing of the carcasses at the earliest and in the right manner.

8. **Trauma Counseling Team:** The existing relief system does not have any provision for treatment of mental health, which enhances suicidal cases after any major disaster. It has been seen that most of the community members are traumatized due to loss of family members and assets. After the large scale damages, it becomes difficult for some of the victims to get back to normalcy. In such a situation, the counseling team is responsible for counseling the victims to ease them of their trauma.

9. **Damage Assessment Team:** With things getting better after the disaster, the damage assessment team carries out an assessment of the damaged houses, livelihood assets and crops etc. Usually a Govt. functionary from the state Revenue Department carries out such assessment after a particular period. During this exercise, the damage assessment team helps him/her in making a timely and useful assessment.

(f) Mock Drill: Mock drill is an integral part of the village CBDP plan, as it is a preparedness drill to keep the community alert. Keeping this in view, mock drills are organized in all villages to activate the DMTs and modification of the DM plan based on the gaps identified during such exercises. Basically this is a simulation exercise, which if practiced several times, would help in improving the cohesiveness of the community during an emergency.

(g) Identification of Hazard Specific Mitigation Activities: While developing the CBDP, the villagers would develop a mitigation plan for

each hazard for long term planning. These could be coastal belt plantation, cyclone shelter in cyclone prone areas, improved drainage system in low lying areas, raising the platform of the community hall or school building etc. All mitigation plans would be forwarded to higher authorities for financial provision. It helps the community to minimize the loss, and prevents the impact of various natural disasters. All community mitigation plans are consolidated at Gram Panchayat (GP) level and become the part of the respective GP developmental plan. The mitigation plans would eventually be funded under the on-going development programmes in the district, for which the District Magistrate/Collector is the nodal officer. Disaster management committee at the district levels and the State Steering Committee (a mechanism established at the state headquarters level) play a major role in ensuring this.

h. Community Contingency Fund (CCF): Availability of resources for various activities to be carried at different phases of the cycle is very crucial. To meet this contingency, each household in the village would be motivated to contribute resources which could be in the form of funds and/or food grains, which becomes the grain bank for the village. A very nominal amount based on the affording capacity of the inhabitants (households) is collected and kept as the Community Contingency Fund or village emergency fund. In the annual meeting they decide how to use this fund as per the need and developmental plan of the village.

4. Preparation of CBDP Plan-Process

In order to ensure ownership by the community and to ensure reflection of local conditions and sensitiveness, preparation of CBDP will have to be

through a participatory approach. Community based organizations and the NGOs who have been working with communities are to be identified to facilitate a PRA exercise. The process followed is listed below:

(a) Awareness Campaign: A massive awareness campaign is necessary to support the community in preparation of the disaster management plans. These campaign are carried out through various means like rallies, street plays, competitions in schools, distribution of IEC materials, wall paintings on do's and don'ts for various hazards. Meetings with key persons of a village such as the village head, health worker, school teachers, elected representatives and members of the youth clubs and women also motivate the villagers to carry forward these plans for a safer living.

(b) Training of Gram Panchayat/Block Members: In several states of India Gram Panchayat is the intermediary administrative unit between block and village level, which has a vital link for disaster management activities. It is the responsibility of the Gram Panchayat Disaster Management Committee to supervise and guide the community in this process. Similarly block is the administrative unit that executes all developmental programmes in the rural areas, and has a very good linkage with upper level of administration. Therefore, both levels of functionaries are very important to ensure risk reduction as a part of the development programme. The district level master trainers are responsible to train the functionaries of GP and blocks before initiation of the activities at the village level.

(c) Identification of Village Volunteers and Training: One of the major objective of CBDP process is to develop a cadre of trained human resources at community level to carry out all disaster management and mitigation

initiatives. An innovative method is used in this programme to train at least two persons as disaster management volunteers who, after being trained are supporting the community in development of the village disaster management plan. These volunteers are selected by the representatives of local self-Government, block functionaries and CBOs. Most of the volunteers are from local youth clubs, women self help groups or from CBOs and belong to the same community.

(d) Training of PRI Members: The three tier Panchayat Raj System (peoples' representatives) existing in India has laid down responsibilities of elected local Government officials at various levels. To mainstream CBDP. It is suggested to involve PRIs in the process to address the vulnerability reduction initiatives through the developmental programme because they are responsible for the local area's development. All PRIs are oriented by the master trainers on disaster risk management initiatives and encouraged to be involved to reduce the disaster impact. These oriented PRIs would help the trained volunteers and community on disaster preparedness and management. They are vital players in the disaster reduction programme and help to sustain the same.

(e) Sensitization Meeting at Village/ Community Level: Village sensitization meetings are organized with help of the representative of local self-Government, trained volunteers, local NGOs etc. for the implementation of disaster preparedness and mitigation initiatives. In some villages the communities are ready for disaster management planning and other activities in one meeting or in some places they require more efforts.

(f) Women Participation in Community Based Disaster Preparedness:
Women, children and old age people are the most vulnerable groups in any emergency situation and need special attention and support. While preparing the preparedness and response plan of a village, importance is laid on the vulnerability of women and children. It gives equal opportunity to women groups to participate in the preparedness and mitigation initiatives of the village. Women are encouraged to be the members of shelter management, search & rescue and first aid and water and sanitation DMTs. Special trainings such as swimming, first aid etc. are organized to enhance the skills of women DMTs to perform their duties better during the time of an emergency. In formation of DMCs/DMTs, efforts are being given to ensure 30 percent membership for women to improve the local level planning and response process. This would also provide equal opportunities to show their capability, sincerity and dedication.

5. Linkages with Development Programmes:

The GOI-UNDP Disaster Risk Management programme primarily focuses institutionalization of the CBDP process. While external support is being provided to facilitate the plan preparation, the plans become an integral part of the Government's development agenda. At the village level, the disaster seasonality calendar prepared by the communities indicates the appropriate timing for conducting mock drills, which helps the community and authorities to remind various groups their roles and responsibilities. Some of the measures that are being promoted to ensure sustainability and institutionalization are as follow:

- Approval of DM plan by the Development Committee at district level to mainstream the vulnerability reduction activities. All DM plans are the integral part of the developmental plan of villages as per the Government instruction.

- DM plan, DMC and DMTs are recognized by the Government institutions as an integral part of the disaster preparedness and mitigation process.

- Priority is given to the need of the area while developing the development plan of the Gram Panchayat by the community. Utilisation of GP fund for mitigation activities and capacity building of DMTs is encouraged. Special provision for disaster preparedness activities is being made in fund allocation by the Government at various levels.

- It is the Gram Panchayats' responsibility to guide the villagers on development of disaster preparedness plan and after its completion on the compilation of all village plans at the GP level. In a similar way GP Mitigation Plans are consolidated at block level, which ultimately become the block mitigation plan. Now Gram Panchayats are responsible for development programme as well as disaster management progrmme. Thus the govt. has decentralized the process of disaster preparedness and mitigation.

- The existing government service providers are used for up grading the knowledge and skills of GP DMTs and village DMTs. Training institutions are strengthened for a comprehensive training programme of DMCs and DMTs before the hazard season.

- Trained volunteers, CBOs and NGOs are based at grass root level and make the process sustainable.

The process of preparation of CBDP plans through a participatory process, institutionalization of risk management as well as linking it to the overall developmental planning process could be ensured only with capacity enhancement of the stakeholders. Simultaneously, there is a need to create large scale awareness about various options of development process which reduces risks. These cannot be a one-time activity. The chart below outlines some of the essential tools at various stages that would ensure sustainability of community based disaster management.

CHAPTER-12

DISASTER MANAGEMENT IN UTTAR PRADESH

Uttar Pradesh is the most populous state in the country which accounts for 16.4 per cent of the country's population. It is also the fourth largest state in geographical area covering 9 per cent of the country's geographical area. The pace of urbanization has been lower in the state. The level of urbanization has been reported lower than most of the other states. In 2001, 20.78 per cent population of the state was found living in urban areas. During 1991-2001, urban population grew by 2.84 per cent per annum (Table 12.1).

Table – 12.1
Trends of Urbanization in Uttar Pradesh

Census year	No. of UA's and Towns	Total Urban Population	Percentage of Urban Population	Decadal Growth	Annual Growth
1901	349	5223025	11.20	-	-
1911	350	4720939	10.26	-9.61	-1.01
1921	367	4728727	10.61	0.16	0.02
1931	375	5354962	11.28	13.24	1.24
1941	385	6749767	12.52	26.06	2.31
1951	410	8225068	13.65	21.86	2.31
1961	215	8983900	12.81	9.23	0.88
1971	256	11653740	13.90	29.72	2.60
1981	598	18749979	17.83	60.89	4.76
1991	631	25971891	19.68	38.52	3.26
2001	670	34512624	20.78	32.88	2.84

Source: Census of India, 2001, Uttar Pradesh

As per census, there are 670 towns and cities in the state. Most of the towns and cities are categorized as class IVth and Class IIIrd having

population in between 10,000 to 50,000. However, urban population is concentrated in large towns and cities (Table 12.2).

Table – 12.2
Class-wise Population of Towns in U.P. (2001)

Class	No. of Towns/UA's	Population
Class I (100,000+)	55	21452407
Class II (50,000-99,999)	51	3434532
Class III (20,000-49,999)	171	4970212
Class IV (10,000-19,999)	253	3585898
Class V (5,000-9,999)	130	1025967
Class VI (Less than 5,000)	10	43613
Total	**670**	**34512629**

Source: Census of India, 2001, Uttar Pradesh

There are 628 local bodies, as per information available. There are 12 Municipal Corporations, 194 Nagar Palika Parishads, and 422 Nagar Panchayats. However, the details of these local bodies are not available. As per information available for 623 local bodies in U.P. about 40 per cent urban population is found concentrated in Nagar Palika Parishad while Municipal Corporations comprises of about 37 per cent population. There are about 34162 officials and 9159 elected representatives (Table 12.3).

Table – 12.3
Urban Local Bodies in U.P.

Local Body	Number	Geographical Area (sq. km.)	Population (2001)	Officials	Elected Representatives
Municipal Corporations	11	138.24 (26.86)	128245 (36.83)	16086	820
Nagar Palika Parisad	195	2017.65 (39.26)	13867538 (39.86)	14406	4881
Nagar Panchayat	417	1741.40 (33.88)	8009423 (23.21)	3670	3458
Total	623	5139.29 (100.00)	34729411 (100.00)	34162	9159

Source: Directorate of Urban Local Bodies, U.P.

The 74th Amendment Act of the Constitution opened a new chapter in the process of decentralized governance. The Uttar Pradesh Local Self Government Laws (Amendment) Act, 1994 was passed in May, 1994. The changes in relation to the Conformity Act were mainly in composition of municipalities, reservation, election process, functional domain, and devolution of powers and finances. Besides the civic services functions, municipalities being local governments also perform several statutory and regulatory roles which strictly do not fall within their own functional domain but fall within the functional domain of state government. In the state all the functions as envisaged by the Twelfth Schedule are being performed by urban local bodies except the functions as enurmated at item No.1, 2, 3 and 7 of twelfth Schedule. Significantly, the state has formulated a strategy of introducing innovative Policy and legislative changes and implementing multifaceted institutional and financial capability building reforms for urban local bodies.

In the state of Uttar Pradesh flood damages have been heavy and increasing, both dimensionally and impact wise. The eastern Uttar Pradesh is flood prone area and witnesses' regular floods, causing severe losses to crops, cattle, human lives and properties (Table 12.4 & 12.5).

Table – 12.4
Average and Maximum Flood Impacts and Losses in Uttar Pradesh
(1953-1990)

Particular	Yearly Average	Maximum Impact/Loss	Year
Area Affected (M.ha.)	2.33	7.34	**1978**
Population Affected (Million)	8.73	30.35	**1980**
Damage to crops (mna)	1.34	5.20	**1979**
Value of Crops Damaged (Rs. Crore)	149.39	967	**1985**
Houses Damaged (000')	316	1923	**1980**
Value of Houses Damaged (Rs. Crore)	37	255	**1982**
Cattle Lost (No.)	1746	7430	**1978**
Human Lives Lost (No.)	275	1309	**1980**
Damage to Crops, Houses and Public Utilities (Rs. Crore)	256	2401	**1985**

Source: Dameja, M.D. Director PCC, CWC, New Delhi

Table– 12.5
Damage by Floods/Landslides in U.P.

Year	Villages Affected	Population Affected (Lakhs)	Area Affected (Lakh hac.)	Cropped Area Affected (Lakh ha.)	Houses Destroyed or Damaged (No.)	Human Lives Lost	Animal Lives Lost
1997	2248	10.21	3.85	1.55	5000	102	114
1998	15617	122.67	25.23	14.12	384896	1356	3385
1999	629	1.84	0.38	0.37	1023	17	9
2000	5802	63.9	7.84	4.72	40706	453	997

Source: Relief Commission, U.P.

Even droughts adversely affect to the farmers in Bundelkhand and eastern Uttar Pradesh. The typical courses of floods are well known viz. heavy precipitation, rising river bed levels, inadequate capacity of water courses to contain high flood flows the cutting of hill sides for development works, reckless construction of buildings and settlements in vulnerable areas, landslides, poor drainage etc.

On the basis of the Vulnerability Atlas prepared by Building Materials Promotion and Technology Council (BMPTC), Government of India, UNDP and Ministry of Home Affairs have identified 199 multi hazard prone districts in the country. These districts fall mainly in Gujarat, Orissa, Bihar, Tamil Nadu, West Bengal, Maharashtra, Delhi, Uttar Pradesh, Uttaranchal, Assam, Meghalaya and Sikkim. However, there are 125 most vulnerable districts falling in Gujarat, Orissa, Bihar, Tamil Nadu, West Bengal, Maharastra, Delhi, Uttar Pradesh, Uttaranchal, Assam, Meghalaya and Sikkim. Out of 125 hazard prone districts of India, 13 districts fall in Uttar Pradesh. These districts are Bahraich, Balrampur, Bijnor, Badaun, Deoria, Ghazipur, Gonda, Gorakhpur, Rampur, Saharanpur, Santkabir Nagar, Sidharth Nagar and Sitapur (Government of India, Vulnerability Atlas).

In the state of Uttar Pradesh, 17879 road accidents were reported in 2004 in which 9463 persons were killed and 12456 persons were injured. It is expected that by the year end of 2011, there will be 19250 road accidents. The economic loss due to road accidents in the state of Uttar Pradesh was estimated Rs. 8939.5 million in 2004 which is likely to increase in the coming years (Table 12.6).

Table: 12.6
Road Accidents in Uttar Pradesh

Year	Registered Vehicles ('000')	Road Accidents	Persons Killed	No. of Injured	Economic Loss (Rs. Million)
1995	2544	--	--	--	--
1996	2977	16475	8111	--	8237.5
1997	3164	16648	8741	--	8324.0
1998	3775	17631	8201	--	8815.5
1999	4027	18116	9984	--	9058.0
2000	4627	16644	8187	12055	8322.0
2001	4921	20473	9654	13256	10236.5

2002	5171	20684	9726	13152	10342.0
2003	5928	14286	7845	9348	7143.0
2004*	6423*	17879	9463	12546	8939.5
2011	9079	19250	--	--	9625.0
2021	13213	20668	--	--	10334.0

Source: PWD, Uttar Pradesh Government, Lucknow

The share of road accidents in total accidental fatalities in Agra (82 per cent), Lucknow (78 per cent), Varanasi (53 per cent), Meerut (47 per cent) and Kanpur (42 per cent) is far higher than the all India average (33 per cent). Road accident fatality risk has been reported much higher in the cities of Agra, Meerut, Faridabad, Vijayawada, Jaipur, Lucknow, Vishakhapatnam, Kanpur and Coimbatoor. Fatality risk in U.P. metropolitan cities during 2007 was reported 23.1 which is much higher than the national average of 10.6 (Table 12.7).

Table: 12.7
Fatality Risk in UP's Metropolitan Cities in 2007

	Population (In Million)	Number of Fatalities	Fatality Risk (No. of Fatalities Per 1,00,000People)
Agra	1.32	510	38.6
Allahabad	1.05	104	9.9
Kanpur	2.69	545	20.2
Lucknow	2.27	517	22.8
Meerut	1.17	354	30.3
Varanasi	1.21	218	18.0
Metropolitan Cities of U.P.	9.71	2247	23.1
Metropolitan Cities of India	107.88	12664	23.1
Metropolitan Cities of Rest of India	98.17	10417	10.6
Uttar Pradesh	188.54	12555	6.7
India	**1136.55**	**114590**	**10.1**

Source: Accidental Deaths and Suicides in India, 2007, published by the National Crime Records Bureau of Home Affairs, Government of India, New Delhi.

Involvement of bicycles and pedestrians in road accidents for some of the selected cities for the year 2005 is shown in Table 22. Pedestrian related accidents are higher compared to bicycles related accidents across all cities. Pedestrian involvement on road accidents range average 20 per cent while bicycles are involved in 5 per cent of the road accidents (Table 12.8).

Table: 12.8
Share of Bicycles and Pedestrians in Road Accidents (2005)

Sl. No	Name of the city	Bicycle (per cent) Accidents	Pedestrian (per cent) Accidents
1	Agra	4	6
2	Bhopal	2	4
3	Kochi	11	14
4	Nagpur	14	25
5	Jaipur	2	7
6	Kanpur	10	7
7	Surat	4	43
8	Pune	3	13
9	Bangalore	5	44
10	Ahmedabad	10	0
11	Chennai	2	5
12	Hyderabad	5	19
13	Kolkata	5	64
14	Delhi	6	24
15	Mumbai	3	35

Source: Ministry of Urban Development, Govt. of India

One of the most crucial needs is the provision of improved rights of way for pedestrians and cyclists. Throughout the world, these non-motorized travelers are among the most vulnerable roadway users. Thus, Western European cities generally provide them with a wide range of separate facilities such as wide sidewalks (pavements), crosswalks, cycle paths, ped/bike traffic signals, intersection modifications (bulb-outs, raised surface, special lighting), car-free zones, and traffic-calmed neighborhoods. By comparison, Indian government officials and planners have largely ignored non-motorists— although they account for about half of all trips made—and thus expose them to intolerably high levels of traffic danger. It is very rare indeed to find any special provisions for pedestrians and Cyclists. While narrow roads, densely built central cities, and lack of funding obviously hinder the allocation of scarce roadway space to cyclists and pedestrians, the real problem is government priorities that favor motorized traffic. Since the powerful elite are more likely to drive private cars, they have strongly favored highway projects over improvements for pedestrians and cyclists. Policy makers rarely consider the needs of the non-motorized urban poor.

Thus, it is clear that the communication and equipments and procedures used by most emergency agencies are established primarily to deal with information flow within the organization. Disasters care for inter agency communication also. To some extent, it can be facilitated by the availability of inter-agency radio networks. However, the critical information requirements of the various organizations involved in disaster response need to be mutually understood and the responsibility for gathering and disseminating it needs to be made clear.

In the impact area people prefer to seek shelter with friends or relatives rather than at public shelters. Importantly, the process of warning is complicated since it requires the accomplishment of a number of tasks. Jammed telephone lines and circuits as well as traffic congestion, make the process more difficult.

HAPTER-13

BUILDING A NEW TECHNO-LEGAL REGIME

Building Regulations/Bye-laws provide the mandatory techno-legal framework for regulating building activity from planning, design to completion of construction. Mainly such laws are State Legislations as the State is competent to legislate and make laws on such subjects. However, where the Central Government is to legislate on such subjects and where Parliament is to make law in this behalf such legislations are applicable in the Union Territories. Central laws are advisory and recommendatory in nature. Taking this legislation as Model, other State Governments formulate the rules and regulations with the help of local bodies, under the various legislations. After the approval, the concerned local bodies enforce these rules and regulations pertaining to development and building standards as building regulations/building bye-laws in their respective areas.

Authorities for Controlling Development

To regulate the growth of urban areas, the State Governments notify areas for planned growth under certain laws. These are notified under relevant Planning and Development Act. State Government formulates the rules and regulations with the help of the local bodies under the various legislations. After the approval, the concerned local bodies enforce these rules and regulations pertaining to development and building standards as building regulations/building bye-laws in their respective areas.

Central Legislation/Guidelines

Model Town and Country Planning Act, 1960

The Town and Country Planning Organization (TCPO), which is an organization of Central Government to deal with the subject of planning (regional, urban and rural) and developmental policies, formulated a Model Town and Country Planning Act in the year 1960. The Model Act provides as follows:

a. Provision for preparation of comprehensive Master Plan for urban areas of various states. The states may adopt the Model legislation with suitable modifications for this purpose.

b. To constitute a Board to advise and to coordinate in the matter of planning and plan formulation by the Local Planning Authorities in the State.

c. Provisions for implementation and enforcement of the Master Plans the miscellaneous provisions to achieve planned urban growth of various urban areas in the state.

National Building Code

National Building Code prepared by the Bureau of Indian Standards in 1970 and subsequent revisions are advisory in nature and not mandatory. The various provisions in the Codes are framed by a panel of experts keeping other standards in view. It lays down a set of minimum provisions designed to protect the safety of the public with regard to structural sufficiency, fire hazards and health aspects in buildings. So long these basic requirements are made, the choice of materials, methods of design and construction is left to the ingenuity of the architect and the engineers and

other experts engaged in such projects. The code also covers aspects of administrative requirements and bye-laws including building services.

State Level Legislation

The planning and development are mainly the State subjects and therefore, the development in the State is based on the legislative support as applicable in that State. The legislative support in the state is applicable to formulate Master Plans, Zonal Plan, Development Plans and Development Schemes and for their implementation and enforcement.

Legislative Support at the Local Level

At the local level, the Municipal Authorities and Panchayat regulate the development/construction of building through the building regulation/building bye-laws as followed in their respective areas. The State Government from time to time issues directions/guidelines for safety against natural hazards, which are followed by local bodies while granting permission for construction of buildings/structures.

Initiative Taken to Strengthen Legislative Framework

The State Government have based their legislation, regulation and bye-laws on the guidelines issued by the Central Government. Post disaster studies of some of the devastating earthquakes like Uttarkashi Earthquake (M-6.6) in October 1991, Killari earthquake (M-6.3) 1993, Chamoli Earthquake (M-6.8) in March 1999 and Kutchch Earthquake (M-6.9) in January 2001 showed the need for planning and engineering intervention in

development plan, design and construction of buildings to make them strong enough to withstand the impact of natural hazards and to impose restrictions on land use so that the exposure of the society to the hazard situation is avoided or minimized. Due to lack of adequate or no land sue restrictions in the hazard prone areas in the town and country planning laws, Master Plan rules or bye-laws, cities tend to expand in all directions, occupying even most vulnerable areas resulting in vulnerability of more and more areas getting threatened by natural hazards. Realizing this urgent need was felt for establishing a proper techno-legal regime through appropriate provisions for safety against natural hazards.

The Expert Committee constituted by the Ministry of Home Affairs studied the existing guidelines Acts, Regulations, Development Control Rules and Bye-laws and prepared a Model Building Regulations to enable the States in Seismic Zones III, IV and V (based on M. M. Intensities VII, VIII and IX or more respectively) to adopt them for safety against natural hazards. Recommendations for amendment in Model Town & Country Planning Act, 1960 and Model Regional & Town Planning and Development law, 1985 cover the following aspects:

➢ Addition of definition of Natural Hazard, Natural Hazard Prone Areas, Natural Disaster and Mitigation

➢ To keep in view natural hazard proneness in preparation of Development Plans by Local Planning Authorities

➢ Due consideration to follow the Regulations pertaining to Land use Zoning and necessary protection measures in perspective and Development Plan of State, district and local planning areas

➢ Existing map(s) to indicate hazard provisions of the areas

Regulations for Land Use Zoning for Natural Hazard Prone Areas

The regulations for land use zoning for natural hazard prone areas are notified under Town and Country Planning Act as applicable in the respective States as and when Master Plan/Development Plan of different cities/towns/areas are formulated. These zoning regulations are implemented through the provisions of Development Control Regulation/Building Bye-laws, wherever the Master Plan are not in existence or not formulated. Classification of urban land use is based on the sequences of various plans as shown below:

Perspective Plan	-	Policy document
Development Plan	-	Comprehensive plan indicating use of each Parcel of land
Layout of Projects	-	For detailed layout of projects/schemes

The main purpose of the land use zoning is to provide regulations for development of a particular area to serve the desired purpose efficiently and to preserve its character. It also provides for the kind of buildings to be constructed. Zoning regulations are legal tools for guiding the use of land and protection of public health, welfare and safety. Such regulations also include provisions for the use of premises/property and limitations upon shape, size and type of buildings that are constructed. or occupy the land. These provide both horizontal as well as vertical use of land and also improve the quality of life in urban areas.

This includes:

- Definition of natural hazard, natural hazard prone areas, natural disaster, mitigation.

- Identification of natural hazard prone areas with respect to earthquakes, cyclones, floods and landslides

- Specific recommendations for land use zoning for earthquake, landslide, cyclones and flood areas

- Protection measures of building of essential services and installations from natural hazards in hazard prone areas

- Prioritization of types of building for land use zoning:

  (i) Defense installation, industries, public utilities, life line structures like hospitals, electricity installations, water supply, telephone exchange, aerodromes and railway stations; commercial centers, libraries, other buildings or installations with contents of high economic value.

  (ii) Public and Semi Public institutions, Government offices, and residential areas.

  (iii) Parks play grounds, wood lands, gardens, green belts, and recreational areas.

- Regulation for land use zoning shall be an over riding effect on any other regulation.

- For any relaxation, adoption of safe guard and protective measures to the satisfaction of the Competent Authority will be incumbent on the part of user.

- Additional provisions with regard to land use zoning for natural hazard areas are suggested in Model Planning Legislation.

State Governments have been advised to suitably incorporate the modification in their respective Planning Legislation (s), so that regulation

for land use zoning for natural hazard prone areas may be notified by the competent authority under the above legal provision.

Additional Provisions in Development Control Regulations

Development Control Regulations and Bye-laws

To regulate development within the framework of a development plan regulation, known as development promotion regulation prescribed as a part of the development plan. The basic purpose of such regulations is to promote quality of life of people by organizing the most appropriate development of land in accordance with the developmental policies and the land use proposals contained therein.

- Registration preferred - Registration, qualification and duties of professional defined.
- In order to bring professionalism in all development and construction work, especially with respect to safety against natural hazards, registration of the following professionals have been recommended mandatory requirement.
  - (i) Structural engineer - qualification and experience defined on the   basis of types and importance of structures
  - (ii) Engineers
  - (iii) Construction Engineer (RCE)
  - (iv) Construction Management Agency-owner shall be a RCE
  - (v) Quality Auditor
  - (vi) Architect
  - (vii) Geotechnical Agency
  - (viii) Town Planner

(ix)   Developer

- The owner/developer shall appoint the professionals from the registered professionals from the registered professionals and will submit a list of professionals on Record with the application for development permission to the Competent Authority.

- Indication of designation and registration number of each professional on every plan, document prepared by him/her made compulsory.

- Structural engineer on Record and Architect on Record shall be responsible for adhering to the provision of the relevant and prevailing Indian Standards.

- Procedure for securing Development Permission requires certificate of undertaking in the prescribed form by the Owner, Developer, Structural Engineer on Record and Architect on Record and Construction Engineer on Record regarding the mandatory application of all structural safety regulations including safety from natural hazards in both design and construction of the buildings.

- Adequate protection clause for land liable to liquefaction, storm surge and landslide.

- For adequate record and checking compulsory submission of detailed working drawing/structural drawing along with soil investigation report before the commencement of the work.

- For Structural Design details of various National Standards/Codes relating to structural safety from natural hazards as listed below have been included for guidance of the professionals to design the structures/buildings, keeping in view the provision of such codes against different hazards.

Structural Design Basis Report

To ensure the compliance of various codes, Structural Engineer on Record is required to submit Structural Design Basis Report in prescribed proforma for applicable type of structure. Design Basis Report format for Load Bearing Buildings. Reinforced concrete framed building and structural steel, interalia, include essential elements of design required for safety against hazard. In compliance of the design with the above Indian Standard, the Structural Engineer on Record will submit a Structural Design Basis Report in the prescribed Proforma covering the essential safety requirements specified in the Standard.

Seismic Strengthening of Existing Building

Prior to seismic strengthening/ retrofitting of any existing structure, evaluation of the existing structure as regards structural vulnerability in the specified wind/ seismic hazard zone shall be carried out by a Registered Structural Engineer (RSE) / Registered Structural Design Agency (RSDA). If as per the evaluation of the RSE / RSDA the seismic resistance is assessed to be less than the specified minimum seismic resistance in the note below, action will be initiated to carry out the upgrading of the seismic resistance of the building as per applicable standard guidelines.

Review of Structural Design

Provision for proof checking of design by a Senior Structural Engineer selected from the Structural Design Review Panel registered with the Authority has also been introduced.

Supervision

All construction except load bearing building up to 3 storeys shall be carried out under supervision of Construction Engineer or Construction Management Agency on Record.

Quality Control and Inspection

To ensure proper quality, it is recommended that all the construction for high rise buildings higher than seven storeys, public buildings and special structures shall be carried out under quality inspection programme prepared and implemented under Quality Auditor on Record or Quality Auditor Agency on Record in seismic zone IV and V.

Inspection

The Indian standers/codes relating to structural safety from natural hazards are shown in chart 12.1

Generally all development work for which permission is required shall be subject to inspection by competent Authority as deemed fit.

The applicant shall keep a board at site of development mentioning the survey No, city survey No, Block No, Final Plot No., Sub Plot No., etc. with names of owner, the Architect, the Structural Engineer, the construction Engineer as Recorded with the competent Authority for the project.

Chart-12.1

Indian Standards/ Codes relating to Structural Safety from Natural Hazards for General Structural Safety

- IS: 456:2000 "Code of Practice for Plain and Reinforced Concrete (Fourth Revision
- IS: 800-1984 "Code of Practice for General Construction in Steel (Second Revision)
- IS: 801-1975 "Code of Practice for Use of Cold Format Light Gauge Steel Structural Members in General Building Construction (Second Revision0
- IS: 875 (Part 2): Design loads (other than earthquake) for buildings and structures Part 2 Imposed Loads (Second Revision)
- IS: 875 (Part 3):1987 Design loads (other than earthquake) for buildings and structures Part 3 Wind Loads (Second Revision)
- IS: 875 (Part 4):1987 Design loads (other than earthquake) for buildings and structures Part 4 Snow Loads (Second Revision)
- IS: 875 (Part 5):1987 Design loads (other than earthquake) for buildings and structures Part 5 special Loads and load combination (Second Revision)
- IS: 883:1966 "Code of Practice for Design of Structural Timber in Building (Fourth Revision)
- IS: 1904:1987 "Code of Practice for Structural Safety of Buildings: Foundation" (Third Revision)
- IS: 1905:1987 "Code of Practice for Structural Safety of Building: Masonry Wall (Third Revision)
- IS: 2911 (Part 1): Section 1: 1979 "Code of Practice for Design and Construction of Pile Foundation (First Revision)

    Part 1: Section 2 Based Cast-in-situ Piles

    Part 1: Section 3 Driven Precast Concrete Piles

    Part 1: Section 4 Based Precast Concrete Piles

    Part 2: Timber Piles

    Part 3: Under Reamed Piles

    Part 4: Load Test on Piles

For Cyclone/Wind Storm Protection

➢ IS 875 (3)-1987 "Code of Practice for Design Loads (other than Earthquake) for Buildings and Structures, Part 3, Wind Loads" (Second Revision)
➢ IS 15498 Guidelines for improving the Cyclonic Resistance of Low rise houses and other buildings (Under Print)

For Earthquake Protection

➢ IS: 1893-2002 "Criteria for Earthquake Resistant Design of Structures (fifth Revision)"
➢ IS: 4326 1993 "Earthquake Resistant Design and Construction of Buildings - Code of Practice (Second Division)"
➢ IS: 13828 -1993 "Improving Earthquake Resistance of Low Strength Masonry Buildings - Guidelines"
➢ IS: 13827 -1993 "Improving Earthquake Resistance of earthen Building - Guidelines"
➢ IS: 13820 -1993 "Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces- Code of Practice"
➢ IS: 13835 -1993 "Repair and Seismic Strengthening of Buildings - Guidelines"

For Protection of Landslide Hazard

➢ IS 14458 (Part 1): 1998 Guidelines for retaining wall for hill area: Part 1 Selection of type of wall.
➢ IS 14458 (Part 2): 1997 Guidelines for retaining wall for hill area: Part 2 Design of retaining/breast wall
➢ IS 14458 (Part 3): 1998 Guidelines for retaining wall for hill area: Part 3 Construction of dry stone walls
➢ IS 14496 (Part 2): 1998 Guidelines for preparation of landslide - Hazard zonation maps in mountainous terrains: Part 2 Macro-zonation

Note: Whenever an Indian Standard including those referred in the National Building Code or the National Building Code is referred, the latest revision of the same shall be followed except specific criteria, if any, mentioned above against that code.

CHAPTER-14

AGENCIES INVOLVED IN DISASTER RESPONSE

Bilateral Organizations

The European Union is the world's biggest donor of humanitarian aid, which comprises of assistance, relief and protection operations. Such aid includes operations in preparation for, and the prevention of disasters. The activities of the European Commission (EC) are coordinated through various mechanisms in partnership with NGOs and the specialized agencies of the United Nations.

The three mechanisms through which the EC operates are the European Community Humanitarian Office (ECHO), Food Aid and Food Security support operations, and Rehabilitation and Reconstruction operations. The EC finances disaster prevention, mitigation, and preparedness in response to requests from NGOs and international organizations. Long-term development in areas affected by disasters has also been undertaken.

DFID

The British Government's Development for International Department provided a huge and ponds through Christian Aid for emergency assistance to 10,000 flood-affected families in Northern India. In addition, DFID also

provided support to the International Federation of the Red Cross and Red Crescent Societies for basic emergency assistance to a large number beneficiaries for up to three months. DFID is also funding Oxfam's North-east India flood response proposal, and providing support to a cyclone relief programme in West Bengal.

USAID

In the majority of cases, USAID does not involve itself in disaster relief other than monitoring and reporting on disaster preparedness and response activities. There may, however, be provision through partner NGOs for short-term food aid to disaster victims. In the event of a major disaster, or when the US Government is requested/warranted, it is the duty of the Mission Disaster Relief Office to ensure that there is a adequate pre-disaster preparedness and response plan, to advise the ambassador on the mode of US participation desirable, and to coordinate disaster relief operations as approved by the ambassador.

Multilateral Organizations
World Bank

The World Bank's (WB) Disaster Management Facility (DMF) was established to mainstream disaster prevention and mitigation initiatives into all its activities. The DMF has, therefore, undertaken the Market Incentives for Mitigation Investment project aimed at promoting market incentives for risk reduction. India has been selected for a pilot study for the following:

- Disaster loss experience and vulnerability to sudden and slow onset disasters.

- Institutional and regulatory structure: regulations related to natural for the insurance industry.

- Structure of the insurance sector for casualty insurance: primary and reinsurance.

- Role of the insurance sector in motivating mitigation investment, risk-based premium, and public education.

- Role of public policy to support the insurance industry in mitigation.

- The role of the global reinsurance industry in risk reduction.

- The role of International Financial Institutions (IFIs) in risk reduction.

Between June and December 1996, heavy rains, floods and cyclones killed 1,689 people in the subcontinent and caused an estimate US$ 2 billion in damage. In late November 1996, the State Government of Andhra Pradesh requested the WB's assistance in the recovery efforts. To ensure the sustainability of the State's future development, the focus of the WB's assistance has been to provide long-term disaster mitigation capability across the state. The project has an estimated cost of US$ 220 million. Its objectives are to assist the State Government of Andhra Pradesh in preparing and implementing a hazard management programme in high risk areas; and restoring public infrastructure according to hazard resistance criteria and to enhance the early warning capacity of the Government of India.

Following the 1993 Latur earthquake, the WB undertook a rehabilitation project to assist with reconstruction, increase the earthquake resistance of buildings and infrastructure through the development of

improved standards for design and construction and to develop the ability of the state of Maharastra to plan for and manage disasters. The project's estimated cost is US$ 328 million and its most important focus is the development of long-term disaster management capacity in the state.

WHO

In 1995, an Emergency and Humanitarian Action unit was established at WHO's South East Asia Regional Office in New Delhi. Its goal is to provide assistance to the member states in developing and strengthening their emergency prevention, preparedness, mitigation and response programmes and to promote national self-reliance, The ERA also acts to strengthen the Regional Officer's emergency prevention, preparedness, mitigation and response programmes and to provide emergency assistance upon request from the member states. With each of the member states, the until will focus on:

- National health policy and legislation
- Planning, emergency preparedness and management
- Community-based emergency preparedness and management
- Emergency information system
- Human resource development and institutionalization, based on a multi-sectorial approach.

UNDP

UNDP has been operating in India for 50 years. Its agreement with the Government of India does not allow it to participate in relief operations

unless specially requested. However, development programmes are often initiated following a disaster. The concept of disaster preparedness and management has been incorporated into its development programmes, particularly after the 1993 Latur earthquake.

Although not involved in immediate disaster relief, UNDP receives information on the extent of disaster damage and loss of life. Following the recent floods in West Bengal, UNDP was part of a joint agency mission to the Malda district to assess the damage and the response of UN agencies. The focus on incorporating disaster management training and preparedness into development reflects the newfound awareness that disaster planning has on large-scale development.

To strengthen the national capacity to mitigate, prevent and manage crises, UNDPs Emergency Response Division sponsors activities in two areas. The first is preventive development, which includes:

- Assessing vulnerability to crises and natural disasters
- Establishing early warning systems
- Developing and maintaining a framework of development responses and other contingency disaster plan to be used if a crisis erupts
- Forming and strengthening UN Disaster Management Teams
- Integrating disaster preparedness, mitigation, prevention and response programmes into national development programmes
- Identifying and engaging the services of consultants to be placed at the disposal of the Resident Coordinator/Humanitarian Coordinator in crisis situations

- Preparing National Human Development Reports.

  The Second activity is training in order to contribute to human resources development by improving capabilities in:

- Risk and vulnerability analyses

- Planning for contingencies

- Designing responsive structures

- Implementing prevention and mitigation strategies for disaster and crises.

The training is provided through the Disaster Management Training Programme to personnel from the Government, NGOs, community leaders, and partners in the United Nations. UNDP expects to deliver US$ 200 million in development oriented assistance between 1997 and 2001.

UNICEF

UNDP has a long-term presence in India with a strong field-based structure. Through its state offices, UNICEF is able to respond quickly and flexibly to disaster situations. Its response is subject to being requested by the Government of India (which has not asked for outside help since 1974). Thus, UNICEF can only help by donating funds to the Prime Minister's Relief Fund, an avenue that it feels inappropriate.

However, requests from the state or district levels enable UNICEF to provide disaster assistance. When a disaster occurs, US$ 10,000is immediately made available. In many cases, disaster relief is an extension of an ongoing programme (for instance, drinking water programmes may be altered to incorporate the bleaching of wells contaminated during a flood).

UNICEF produced four flood situation reports and also examined how children were severely traumatized during the floods. The fragmented response of the Government, the United Nations, and NGOs is a major concern of UNICEF. It is, therefore, meeting with the Government in order to facilitate a more coordinated disaster response mechanism.

UNHCR

The two main functions of UNHCR are to provide international protection to refugees, and to seek permanent solutions to refugee problems. UNHCR first established its office in New Delhi in February 1969 to assist the 100,000 Tibetan refugees in India. It has since provided assistance to over 10 million refugees from Bangladesh, 50,000 refugees from Afghanistan, as well as assisted the Government of India to repatriate Sri Lankan refugees from Tamil Nadu. UNHCR provides limited financial assistance, since it would prefer to help refugees become self-reliant. It encourages able-bodied refugees to participate in income generating activities and is further investigating the possibility of micro-credits, cooperatives, and community development activities.

CARE India

CARE India is committed to respond to mitigate human suffering and loss of support systems in disaster situations. CARE works closely with national and state Governments, generally responding to disasters at their request, and its relief and development interventions aim at improving the socioeconomic conditions of the poor. CARE activates its Emergency

Response Unit at its headquarters in Delhi, a State Emergency Response Team at the state level, and an On-Site Emergency Response Coordinator.

Its organizational structural allows it to implement both regular development and emergency work down to the community level. CARE India is also the convener of the Government of India NGO Committee on Emergency Preparedness.

IFRC

The IFRC is the world's largest humanitarian organization. Its mission, broadly speaking, is to improve the situation of the world's most vulnerable people. The IFRC is represented in India through its South Asian Regional Delegation.

Over the past two years, the Federation has actively supported and jointly carried out a series of Regional Disaster Preparedness Workshops with the Indian Red Cross Society (IRCS). Its Regional Progamme Manager has been involved in this training since august 1997 and will continue till the end of 1999, by which time the IRCS is slated to have developed sufficient expertise and ownership to carry on this training with little or no expatriate involvement.

The implementation is being shared by IRCS, the Federation and the International Committee for the Red Cross (ICRC). The Federation will support a three year training initiative to the IRCS staff and to volunteers in disaster preparedness, risk management, hazard identification, vulnerability, and community capacity analysis. These workshops will enable staff to

conduct their own sub-branch and village-based training events and apply the skills to disaster situations. District plans will gradually be developed from the vulnerability and community capacity analyses. This database will provide the foundation for a state level and, eventually, national level, disaster preparedness plan.

ICRC

Although the ICRC has been operating in India for the past 50 years, its South Asian regional office was established in New Delhi in 1982. The ICRC has responded to several conflict in the region, including the Indo-Pakistan conflict (1948), assisting Tibetan refugees (1959), the Indo-Portuguese conflict (1960-1), the Sino-Indian conflict (1962-3), the second Indo-Pakistan conflict (1965-6) and the Indo-Pakistan/Bangladesh conflict (1971).

Recently, the ICRC has become increasingly involved in working with the victims of internecine conflict, such as, in the case of prisoners in Jammu and Kashmir, and violence against Dalits. Here, the ICRC's mandate is to ensure the fair and proper treatment of prisoners, which therefore interdicts its involvement in long-term development projects: natural disaster response is more the responsibility of the Indian Red Cross Society, although the ICRC provides support where necessary. During emergencies priority is given to the treatment and evacuation of the injured, especially those in the more marginalized groups-women and children. In South Asia, the ICRC's 'tracing services' forwarded more than 16 million family messages and opened 20,000 inquiries to trace missing family members. In

this region, the Committee operates on an annual budget of Swiss Franc 8 million.

IRCS

The Indian Red Cross Society was founded in 1920. It follows its own established disaster plan, the most basic being disaster relief. Through some 650 branches, the IRCS provides a well-knit and well-organized network countrywide. In the event of a disaster, the services of the Red Cross become auxiliary and/or complementary to that of the Government. The district committee of the affected area immediately goes into action by initiating disaster relief operations. The state branch reinforces these efforts and informs the national headquarters of the situation, of the services, the quality and type of materials required. There is close cooperation with the Government and other NGOs.

CHAI

The Catholic Health Association of India is the world's largest voluntary healthcare organization. Its disaster response is characterized by 'holistic health through people's empowerment'. Following the Latur earthquake in 1993, CHAI not only provided relief but supported an ongoing development process to lead to people's self reliance and liberation'. CHAI's first priority was to provide relief: it established one of the first health camps in the area. It also insured that its activities were not in competition with those of other relief organizations, but rather filled in the gaps.

CHAI's main priorities are to provide medical aid and healthcare; concentrate on physical, social, emotional, and spiritual rehabilitation; attend to hygiene and sanitation; mobilize relief material for villages; and create economic development programmes that assist in returning to normalcy.

VHAI

VHAI links 4,000 health and developmental organizations across India through State Voluntary Health Associations. Its goal is to make health a reality for the people of India'. VHAI's long-term major objectives are the promoting social justice and human rights in health service, building up a people's health movement, and advocating a cost-effective, preventive, promotive and sustainable healthcare system. At the macro level, VHAI acts jointly with health-planners, policymakers, parliamentarians, activists, and other leading health organizations. At the micro level, it maintains grassroots contact through programmes designed to respond to local needs, receiving feedback from the field about its concepts on community health and suggestions about the organization's future direction.

CASA

CASA has been involved in relief and development since 1947, when the Government of India requested the Church to help provide relief to the Partition's refugees. CASA established the Committee on Relief and Gift Supplies (CORAGS), and later extended its relief operations to victims of natural disasters.

In 1972, CASA became independent of the National Council of Churches and re-orientated itself towards development and disaster mitigation. Throughout the 1980s, emergency relief gradually dovetailed with development activity, and disaster preparedness became an integral part of the development progress. This involved community interaction and empowerment, ensuring in times of calamity the community's capacity to help itself, rather than promoting a relief psychology.

Disaster Management Training programmes, a close association with the Government, and a strong network within the Church and among grassroots NGOs has allowed CASA to pool resources and expertise from various sectors to provide a holistic approach to development and disaster mitigation, preparedness and relief.

EFICOR

EFICOR is a Church-based organization that provides relief to all communities during times of calamity and supports long term development programmes. EFICOR's first response was to the 1971 Bihar famine, with its primary role that of a 'welfare organization responding to need'. In the 1980's, a review of the effectiveness of EFLICOR's response reoriented it towards long term development programmes and disaster preparedness. EFICOR still involves itself in disaster relief, responding to 30-35 disaster situations a year, but in a supplemental capacity to the efforts of the Government and other NGOs.

When a disaster occurs, a member from EFICOR's Disaster Management Unit goes to the affected area to assess where it can 'fill the

gaps' of the relief effort. The organization outlays Rs 1.5-2 lakhs for immediate disaster assistance. In workshops held twice a year, participants from partner NGOs are brought to a previously disaster affected area to teach them to assess how relief was administered and to evaluate the redevelopment programme.

Action Aid

Action Aid has been involved in India since 1972 and 'exists to facilitate the empowerment of the poor in the process of social development.' Recognising that long- term development is where its core competence lies, Action Aid, through local NGOs, supports long term (8-12 years) development programmes, with the aim of making the community self-sufficient and improving the life of the marginalized.

Action Aid has also perceived any involvement in disaster-related work as another process perpetuating poverty. However, venturing into the heartland of poverty in India-which is also prone to disasters- it has had to develop strategies to systematically deal with disasters. In this context, Action Aid has recently produced an Emergency Strategy Paper.

NOVIB

NOVIB was founded in the Netherlands in 1956. The devastating floods in Holland in the early 1950s which killed over 2,000 people and the ensuring humanitarian aid from the rest of the world prompted secular philanthropists to found NOVIB.

Country operation is South Asia, particularly in India, began during late 1970s in the form of supporting relief-rehabilitation, basic needs satisfaction, and food security programmes like 'food for work'. NOVIB started the disaster relief-related work in India following the 1977 cyclone along the AP coast.

NOVIB's disaster/emergencies-related work is primarily, but not exclusively, with the direct target group with whom its partner NGOs works. For example, it participated in the Latur earthquake relief work through its partner NGO Manavlok, the flood relief programme in the Tirunelveli and Nagercoil districts through partner NGOs like the Centre for Appropriate Technology (CAT) and the Centre for Rural Technology (CRT), and the AP cyclone relief programme through Oxfam Hyderabad (1997-8). In the past, NOVIB's work has been emergency response rather than preparedness. It seeks to provide immediate relief such as food, cloth, temporary shelter, health resources, compliment the work of Government and other local institutions in long-term rehabilitation, and strengthens the capacities of the communities to have access to local resources, and adopt appropriate technologies and influence policies.

Currently, the disaster /relief programmes are handled by one person in NOVIB's International Bureau in close cooperation with the respective country programme officers. NOVIB and Oxfam are also working to develop a policy framework and protocol regarding emergency relief.

There have been no separate allocations for Indian on the issue of emergencies. NOVIB's annual budget for India for the past three years has been about 8 million Dutch Guilders (roughly Rs 160 million, at the current

exchange rate), with most of it earmarked for direct structural poverty alleviation programmes. Its total for emergency relief/rehabilitation expenditure in India during the past three years is about Rs 25 million.

CARITAS India

CARITAS India, operating in India since 1962, is a development organization of the Catholic Bishops Conference of India. Initially, CARITAS focused on providing relief to the poor and suffering, especially during times of calamity. However, this approach was deemed unsatisfactory and the thrust of its involvement shifted toward developing skills to enable higher income generation. Although effective, this approach was also found wanting as it benefited only those without it were further marginalized. CARITAS, therefore, redeployed itself to target the population as active participants in the development process rather than as passive recipients of aid.

The people's empowerment is the priority, in keeping with its motto of 'building people through building homes and building homes through building houses'. During the past five years, CARITAS has released over Rs 439 lakh for relief, rehabilitation and long-term environmental programmes.

Save the Children

Save the Children began working ink pre-Independence India proving relief during emergencies. The India office was established in 1975 to coordinate the existing relief operations to explore new areas and long-term development programmes incorporating disaster mitigation and

preparedness. Relief operations also under-went a review, leading to better assessment of disasters and the needs of the people affected. Save the Children Fund works through partner NGOs by providing financial and technical resources and training assistance. It is currently involved with six programmes in 12 states, including child sponsorship and Tibetan refugees. Both these programmes are, however, to be phased out.

CRS

CRS has been operating in India for nearly 50 years. It is closely affiliated to USAID and has a working partnership with the Indian Government. When a disaster occurs, CRS is informed of the relief required by one of its local counterparts and has the capacity to immediately release up to 50 metric tones of food relief supplies, as well as other auxiliary relief resources such as blankets, tarpaulins and cash. If the amount required exceeds 50 metric tones, it requests the US Government for additional resources. CRS, which provides about US$ 350,000 a year in food assistance, has an agreement with Indian Government that it be responsible for the transportation of the relief supplies to the affected area.

LWS

LWS has operated in India since 1974, when it responded to the needs of refugees following the Bangladesh war. LWS has since been implementing relief, rehabilitation and integrated development programmes in several Indian states, particularly in West Bengal and Orissa. All

programmes are taken up at the Government's request or on its own initiatives in consultation with Government authorities.

LWS works with disaster response at different levels. Relief operations are short term initiatives in which disaster victims are given temporary shelter, materials and food. Rehabilitation programmes assist affected communities to rebuild damaged houses, construct school-flood shelter, develop safe water sources, as well as repair and strengthen other community assets. Disaster preparedness programmes are long-term initiatives to improve the coping capacity of disaster -prone communities.

An Outlines of
District Disaster Management Plan

Chapter I: Introduction

- **Location**
  - Area
  - Boundaries with other districts/State
- **Administrative Divisions**
  - Subdivision
  - Taluqa / Tehsils
  - Blocks
  - Villages
  - Zila Panchayat
  - Intermediate level Panchayats
  - Gram Panchayats
  - District/Metropolitan Planning Committees
  - Municipal Corporations
  - Municipalities
  - Nagar Panchayats
- **Physical Features**
  - Geology
  - Climate
  - Rainfall
  - Drainage System
  - Economic and Social Conditions

- Population

- Decennial changes

- Composition

- Age-structure

- Sex-ratio

- Rural-urban distribution

- Scheduled Caste/Scheduled/Backward Composition and their locational distribution

- Education and Literacy

- Occupational Distribution

- Poverty Ratio

- Status of agriculture-direct and indirect dependence on it

- Status of Industry; Its nature and direct and indirect dependence on it. Townships developed or developing along with the industry may be specifically stated.

- Status of tertiary sector indicating the extent of dependence on it.

- Health Infrastructure

- Educational Infrastructure

- Non-Government and other voluntary organizations engaged in social work.

Chapter II: Hazard Analysis

o **Status of Disasters in and around the District**

- Water and Climate related disasters

- Floods

- Cyclones

- Tornadoes and Hurricanes

- Hailstorm

- Droughts

- Any other indicated in the HPC list or peculiar to the district and falling in this category.

o **Geologically related disasters**

- Landslides and mudflows

- Earthquakes

- Dam Failures/ Dam Bursts

- Mine Fires

o **Biologically related disasters**

- Biological disasters and epidemics

- Pest Attacks

- Cattle Epidemics

- Food Poisoning

o **Chemical, Industrial and Nuclear disasters**

- Chemical and Industrial disasters

- Nuclear disasters

o **Accident related disasters**

- Forest Fires

- Urban Fires

- Serial Bomb Blasts.

- Air, Rail, and Road Accidents

- Any other disasters mentioned in the HPC list for this category or a type of disaster peculiar to the district falling in this category but including in the list.

- o **Details of the disasters which occurred in the district along with information about the loss- physical, material and human- and the measures taken to meet it.**

Chapter III: Risk Analysis

- o **Identification of Areas likely to be affected by each type of disaster Population and Area to be indicated in the map of the district.**

- o **Vulnerable Groups should be identified.**

- o **Capability assessment be Done. In particular, following aspects is covered:**

  - Level of awareness.

  - Existing prevention and mitigation measures

  - Present level of preparedness

  - Response Capability

  - Community and NGO preparedness, capability, response and participating abilities.

  - Existing Laws and regulations; their analysis and effectiveness for meeting disasters.

Chapter IV: Organizational Structure

- o National Level

  - The nodal Ministry/Department for each disaster to which the district is prone may be indicated. For example, The Ministry of Agriculture is the Ministry for every natural disaster. Similarly, Ministry of Environment and Forests is the nodal Ministry for the management of chemical accidents. The nodal Ministry/Department be ascertained and indicated so that unnecessary time is not wasted in ascertaining it at the time of disaster and furnishing information and getting Support.

Ordinarily, Secretary of the concerned Ministry/Department acts as head of the Crisis Management Group with representatives from other concerned Central Government organizations and Ministries. For each disaster, it should be separately given.

- In the case of serious disasters, The Cabinet Secretary heads the Crisis Management Group with Secretaries of concerned Ministries/ Departments and heads of Central organizations.

o State Level

- The State level organizational structure for disaster management is indicated. Where responsibility for management of different types of disasters is assigned to different departments, the nodal department for each type of disaster should be clearly indicated. While ordinary disasters (difficult to define and therefore intensity and severity to be determined in each case) may be dealt by the secretariat administrative departments, serious may require coordination and action at the Chief Secretary and Chief Minister's level. Provisions of an official Committee at the Chief Secretary's level consisting of Secretaries of relevant departments and a ministerial level Committee at the Chief Ministers level consisting of Ministers of relevant departments for coordination, direction, monitoring action and organizing support be provided in the plan.

o District Level

- At the district level, the Collector is the focal point for disaster response and recovery. A district level Committee consisting of the district level representatives of all the concerned departments. This could be designated as District crisis management Group.

- Sub-division level committees consisting of subdivision level officers for coordination and action.
- Each concerned departmental head to organize his team for carrying out the plan of action for management.
- Involvement of Panchayat raj and municipal institutions with responsibility for disaster management.
- Involvement of District Planning committee and other representatives in disaster management role as may be determined.
- Involvement of NGO's and community in awareness generated management.
- Involving media for collection and dissemination of information.

Chapter V: Prevention and Mitigation Measures

o Emphasis on prevention and mitigation

o Prevention and Mitigation measures be identified for each type of to which the district is prone.

o Preparation of a plan of action with time schedule for implements keeping in view the availability of resources.

o Generating private and institutional support- institutional and other for identified prevention and mitigation measures.

o Exploring financial support for prevention and mitigation plan Government, private, and institutions including financial institutions.

o Review existing legal framework for proper implementation of prevention and mitigation measures and suggest modifications for making the effective where necessary.

Chapter VI: Preparedness Plan

o Inventory of human resources. This may consist of :

- Names and address of principal functionaries all concerned department at the district level to be kept in the District Emergency Committee (DECR).

- Names and addresses of all key functionaries of all concerned department at the district to be kept with the principal functionary of the department

- List of equipment and stores for rescue and relief operations in each by type of disaster and their availability at various places private Government - be prepared and kept in the DECR and with the department at the district level.

- Preparation of list of members of the community, NGOs and the members and elected representatives who could be helpful in management of the disaster.

- Setting of DECR in the Collector's office and due publicity to it.

- Identification of Shelters and other facilities near the hazard prone are for accommodating affected population.

- Identification of sites near the hazard prone areas for setting temporary control rooms for rescue and relief operation.

- Establishing a coordination mechanism for incoming relief material teams from outside at their possible places of disembarkation at deploying them in affected areas in a planned manner.

- Preparation of alternate communication arrangements in case conventional communication channels.

- Inventory of transport-public and private-available for deployment times of emergence including names and address of owners, driver mechanics and repair workshops and fuel depots.

- Preparation of the community especially in the disaster prone areas.
- Identification of manpower for manning the DECR and other control rooms and allocation of duties.
- Arrangement for training of all identified functionaries and period upgrading of their knowledge.
- Periodic simulation exercise as test preparedness for all the functionaries and the community.

Chapter VII: Response Plan

- Alerting and strengthening the various control rooms
- Alerting the community
- Restoring the communication channels
- Organizing Rescue of the affected population
- Organizing medical relief
- Organizing Shelters for population rendered homeless
- Coordinating the relief operations of NGOs and community worker
- Coordinating relief from outside agencies including distribution material
- Assessment of damage
- Organizing post-mortem, death certificates, disposal of dead bodies carcasses
- Maintaining law and order and protecting the property of the population
- Assisting the population towards rehabilitation

Chapter VIII: Recovery

- Physical and Economic rehabilitation of the affected population

- Restoration of community services-street lighting, water supply, schools and medical services
- Restoration of private enterprises including farming activities
- Restoration of private residential buildings
- Helping organizing institutional finance in restoration work
- Medical rehabilitation of people seriously affected by the disasters
- Psychological rehabilitation of persons and families traumatized by the disaster

Chapter IX: Appraisal, Documentation, and Reporting

- Reappraisal of the plan in operation
- Comprehensive documentation on disaster management
- Preparation of report and submitting it to the State Government

Source: HPC at a Glance, 2001, Ministry of Agriculture, Govt. of India.

Emergency Preparedness Checklists

This checklist can be used for developing or evaluation emergency preparedness programmes.

Policy

➢ Have all emergency management parts of relevant legislation been located, and have the implications of this legislation been considered in community emergency preparedness?

➢ Is there power for the following actions during emergencies

- Commandeering of resource?

- Evacuation of people at risk?

- Centralized coordination of emergency work at the national; district and community level?

Vulnerability Assessment

➢ Is a Vulnerability Assessment available for emergency preparedness, as well as for emergency response and recovery work?

➢ Are there procedures for reviewing Vulnerability Assessment in the light of :

- Community change?

- Vulnerability change?

- Hazards change?

- Capacity / capability change?

Planning

➢ Have people - stakeholders, private organizations and NGOs been involved ink the planning process?

➢ Has assistance or guidance in developing emergency plan been provided to government, private organizations and NGOs?

➢ Are there emergency plans that are related to the community emergency plan?

➢ If such plans exist, what are the implications for your plans?

➢ Has contact been made with people in other organizations jurisdictional areas that may be able to assist community?

➢ Has the District Plan been approved by the Disaster Management Community?

➢ Has the plan been endorsed by all relevant organization and copies given?

➢ Has a person or an organization been assigned responsibility for developing the community emergency plan? (Do's, Don'ts during disaster)

➢ Who is responsible for keeping the emergency plan up date and how often is it to be formally reviewed in the month of April & May? Last week of April & May every year nationwide (except for cyclone prone District)

➢ Do people who held existing plans receive amendments?

➢ Is a distributions list of the plan maintained?

➢ Have the community emergency management structure as organizational responsibilities been described?

➢ Who is responsible for the overall management?

➢ Who is responsible for the operations of particular organizations?

➢ Who is responsible for coordinating particular tasks?

➢ Are all the necessary tasks assigned to organizations as personnel?

- ➢ Are the responsibilities of all organizations described?
- ➢ Does the plan contain a summary of the vulnerability assessment?
- ➢ Has the relationship between different levels of planning been described?
- ➢ Have mutual aid and twining agreements with adjacent communities been made?
- ➢ Is the plan consistent with the related district plans?

Training and Education

- ➢ Who is responsible for the various training and education requirements of emergency workers and the public?
- ➢ Has a training needs analysis of emergency workers been performed?
- ➢ Have a number of different public education strategies been implemented in emergency?
- ➢ Has quickly the new personnel in organizations are man capable of working in emergency management?
- ➢ Is institutional memory being preserved? For example, people have to "reinvent the wheel" or are past, practicable lessons learned, documented, and passed on?
- ➢ Do the capabilities and capacities of organizations improve over time during the implementation of preparedness strategies?

Monitoring and Evaluation

- ➢ Is there a procedure for reviewing emergency preparedness on a regular or as- required basis? How is it done and who is responsible?
- ➢ How often is the community plan to be exercised? Who is responsible?
- ➢ How are the lessons learned from exercises to be incorporate into plans?
- ➢ Are multi-organizational (Department) exercise run, as well as single- organizational exercises?

Communication

➢ What forms of communication are available?

➢ Are there backups?

➢ Who is responsible for communications maintenance and planning?

➢ Do people know the relevant radio frequencies and contact numbers?

➢ Are there contact lists updated (containing names, telephone numbers, etc.) for all emergency management organizations?

➢ Do the communications systems allow communication between all relevant organizations?

Search and Rescue

➢ What rescue tasks may need to be performed?

➢ Who is responsible, who coordinates?

➢ Are there procedure for detecting and marking danger areas?

➢ How are search and rescue activities integrated with other emergency functions, particularly in health?

Health and Medical

➢ Have the ambulance and hospital services planned and be trained for the handling of mass casualties?

➢ Are they aware of each other's arrangements?

➢ Are there emergency field medical teams?

➢ Who manages these on-site?

➢ Are there arrangements for counseling the public emergency workers? Who is responsible for providing the service and who pays for it?

Social Welfare

➢ Are the arrangements for feeding and accommodating people linked to the registration and enquiry system and the evacuation procedure ?

- ➢ Is there any arrangement for expediting the assessment damage to private and public property and payment losses ?

- ➢ Do the insurance companies have any cooperative arrangements among themselves?

- ➢ Where, when, and how do people have access to insurance companies?

- ➢ What is insurance company policy on makeshift repairs minimize damage?

Transport and Lifelines

- ➢ Who is responsible for each lifeline?

- ➢ What are the priorities for repairing damaged lifelines?

- ➢ How long should it take to repair each lifeline from the predicted levels of damage?

- ➢ How are alternative lifelines to be arranged if required?

Police and Investigation

- ➢ Are there procedures to ensure that resources are reserve from the emergency response work to enforce law and order?

Alerting

- ➢ Who is responsible for receiving warning from outside the community?

- ➢ Is there a clear system that ensures that all relevant organizations and personnel are alerted?

- ➢ Does this system :

  - Assign responsibility for initiating an alert?

  - Provide for a "cascade" method of alerting, whereby those alerted are responsible for further alerting where appropriate?

  - Describe the first actions required by those alerted?

  - Provide for the cancellation of an alert and the stand down of organizations and personnel?

Command, Control and Coordination

➢ Have all officers and elected officials, civil defense wardens been allocated a task?

➢ To whom do one turn for information?

➢ Are there procedures for ensuring the safety of the Government and administrative records (paper and computerized)?

➢ Have lines of succession been determined to ensure continuity of leadership?

➢ Have alternative sites for Government organizations been identified?

➢ Have locations for emergency coordination centers been designated and promulgated?

➢ Are there alternative centers?

➢ Are they remote from areas likely to be damaged?

➢ Do they have adequate communication, feeding, sleeping, and sanitation facilities?

➢ Do they have backup power?

➢ Is the availability of backup communications equipment known?

➢ Is there adequate water supply?

➢ Is there a designated site manager and alternative and relieving managers?

➢ Do the centers have trained staff?

➢ Are there procedures for development staff rosters?

➢ Are there procedures for activating and operating the centers?

➢ Is there adequate administrative support for the centers?

➢ Are functions of the centers succinctly described?

➢ Is there a procedure method for collecting, verifying analyzing, and disseminating information?

➢ Is there a procedure for recording events, requests for assistance, decisions, and allocating resources?

➤   Are there internal security arrangements for the centers?

➤   Has responsibility for day-to-day maintenance of the centers been assigned?

➤   Are there procedures within and between organizations for the briefing of personnel on an impending or actual emergency?

➤   Are there procedures for conducting single and multi-organizational debriefings followings an emergency or alert?

Information Management

➤   Are maps prepared and available to the community (topographic, demographic, hazard, and vulnerability)?

➤   It a public information centre/ control room designated as the official point of contact by public and the media during an emergency?

➤   Are there provisions for releasing information to the public including appropriate protective actions and devised responses?

➤   Have agreements been reached with the media for disseminating public information and emergency warnings?

➤   Are contact details for all media outlets (radio, television and newspapers) available?

➤   Who is responsible for providing information to the media?

➤   Who is responsible for authorizing information?

➤   Who is responsible for emergency assessment and to whom do they report? How is the information recorded and who relays the information to those concerned?

➤   Who is responsible for issuing public statements about emergencies?

➤   Do they have public credibility and adequate Liaison with other organizations who may also issue warnings?

➤   Who is responsible for providing warnings for each type of emergency?

- To whom is the warning supplied?
- At which warning level is response action initiated?
- What is the purpose of the warnings and what action is required of the public?
- Who will inform the public when the danger has passed?
- Is there a point of contact for members of the public wanting specific information, and is this point of contact public known? (Control room).
- Is there a referral service for directing people to the appropriate sources of information?
- Is there a registration and enquiry system for recording the where about of displaced, injured, or dead persons?
- Is there a system for providing this information to bonafide inquiries?
- Does the community know how to contact the registration and inquiry system?
- Are there plans for establishing public information centers?
- Is the community aware of the existence of these centers?

Resource Management
- Who coordinates resources within each organization?
- Who is responsible for supplying resources beyond the normal capabilities of each organization? Who records the sue and cost of resources?
- Have arrangements been made with State or Military Organizations for assistance in times of emergency?
- Is there agreed access to emergency funds?
- Who records the expenditure for future acquittal/repayment?
- What are the limits of expenditure for personnel?
- What tasks can be safely performed by unskilled volunteers?

- Who coordinates this work?
- Is it likely that some organizations will begin public appeals for donations to emergency-affected persons?
- How can these appeals be coordinated?
- How is equitable disbursement of appeal money to be ensured
- Who coordinate the requests for assistance for the community
- Who sort of assistance is likely to be required?
- Where is the assistance likely to come from?
- Is there an expected form that the request should take
- Is the following information available to help outside assistance:
  - Lists of organizations working in the country, with information on their competence and capability to be involved in emergency response and recovery activities
- Is the following information available :
- Lists of essential response and recovery items, with specifications and average costs? Availability.
- Lists of local manufacturers and regional manufacturers or suppliers of response and recovery items, with information on quality, capacity and capability, delivery times, and reliability?
- information on essential response and recovery resources that will allow a rapid response, e.g. water supply systems, sanitation systems, heath networks, alternative shelter sites and materials, Tarpaulins. Tents, ports and transport networks, warehouses. Communication systems, etc.?

Evacuation

- Does any person or organization have the authority to evacuate people who are threatened?
- Are there designated locations to which evacuees should travel?

- How many people may need to be evacuated?
- In what circumstances should they be evacuated?
- Who will tell people that it is safe to return? Who will trigger this?
- Are staging areas and pick-up points identified for evacuation?
- Are evacuees to be provided with information on where they are going and how they will be cared for?
- Is there security for evacuated?
- How are prisoners to be evacuated?
- How are the cultural and religious requirements of evacuees?
- Who is responsible for traffic control during evacuation?
- How are evacuees to be registered?

Response and Recovery Operations
- Has a community emergency committee been set up?
- Have response teams been organized?
- Is anything being done for isolated families?
- Have arrangements been made to pick up the injured and take them to the health centre or hospital?
- Have people been evacuated from dangerous buildings?
- Have steps been taken to resolve the most urgent problems for the survival of the victims, including water, food, and shelter?
- Has a place been assigned for the dead to be kept while awaiting burial?
- Are steps taken to identify the dead?
- Has an information centre been established?
- Have communications been established with the state headquarters government?

- ➤ Has there been a needs assessment to consider the number of people needing assistance, the type of assistance required, and the resources locally available?
- ➤ Are steps being taken to reunite families?
- ➤ Have safety instructions been issued?
- ➤ Are steps being taken to circulate information on :
    - The consequences of the emergency?
    - The dangers that exist?
    - Facts that may reassure people?
- ➤ Are communications being maintained with the state/central government?
- ➤ Is information on requirements being coordinated?
- ➤ Are local volunteer workers being coordinated?
- ➤ Are volunteer workers from outside being coordinated?
- ➤ Is inappropriate aid being successfully prevented and avoided?
- ➤ Are response and recovery supplies being fairly distributed?
- ➤ Is contact being maintained with all family grouping?
- ➤ Have families who are living in buildings that are damaged but not dangerous been reassured?
- ➤ Has an appropriate site been chosen for temporary shelters?
- ➤ In setting up shelters for emergency victims, have family and neighbourhood relationships and socioeconomic and cultural needs been taken into account?
- ➤ Have the victims been organized in family groupings?
- ➤ Have the essential problems been dealt with:
    - Water supply
    - The provision of clothing, footwear, and blankets?
    - Food supply?

- Facilities for preparing food (Community kitchen)?
- The installation of latrines/sanitation facilities?
- Facilities for washing clothes, pots and pans?
- Collection and disposal of waste?

➢ Have meetings been arranged in the community to discuss the various problems and find solutions to them?

➢ Have steps been taken to encourage solidarity, mutual assistance, and constructive efforts among the people?

➢ Have school activities started up again?

➢ Have measures, been adopted to ensure that there is favoritism in the distribution of response and recovery supplies? (Transparent - relief policy to be announced).

➢ Is care being taken to make certain that volunteer worker from outside to not taken the place of local people but help them to take the situation in hand?

➢ Have the victims been encouraged and helped to resume to work?

Source: Source Book on District Disaster Management, Ministry of Agriculture Govt. of India, & Lal Bahadur Shastri, National Academy of Administration Mussoorie.

Trigger Mechanism

The man has conquered the nature and feels so. The nature on its part shows its fury and takes its tall now and then reminding the mankind to be careful. There are a number of factor, which contribute to the natural disasters in different parts of the world. These can be traced to the process of evolution of the planet earth, impacts of developmental activities without regeneration to meet endless demands of the man, explosion and concentration of population and changing social pattern of life. The effects of the modern culture are reflected in the global warming, excessive generation of heat energy and depletion of the protective environmental layer. Whereas the natural disasters are the manifestation of the nature of trying to maintain equilibrium, the man made disasters are the fall out of modern developmental activities, levels of human inefficiency and the man's intense desire of being the supreme and unchecked.

As and when a disaster takes place, be it natural or man made, the managers struggle to mitigate its effects on human lives and material losses. The immediate response in all disasters has more or less the same parameters. These are to provide rescue and relief and save the precious human life. Thus, the emergency response of the disaster managers is a factor independent of the types of intensity of the disasters.

We already have Contingency Action Plans. The national contingency plan has already been notified. These management plans lay down in detail the activities which are required to be undertaken with reference to the particular disaster. These are very exhaustive management plans. However, these plans can not put into operation immediately, as such as, the functional spontaneous mechanism has not been provided, for example who will do what ?

As and when the disasters strike or take place, the managers are required to swing in action without losing time. Generally, In such situations, the managers start organizing planning and activating the mitigation process. On the other hand, the event had already taken place and the need of that hour is to start the mitigation process and virtually no time can be spared at that stage for the activities like organizing and planning. Time is the essence of the immediate relief and rescue operations to save human lives and mitigate human miseries for the next 48 to 72 hours. Therefore, actually what is required to be done is a part of long term rehabilitation and reconstruction programmes.

The trigger mechanism, therefore, envisages that on receiving signals of a disaster happening or likely happen, all activities required for the mitigation process are energized and activated simultaneously without loss of any time and the management of the event is visible on the ground. The primary objective of the trigger mechanism is to undertake immediate rescue and relief operations and stabilize the mitigation process as quickly as possible.

The trigger mechanism in fact is a preparedness plan which all the participating managers, and actors, know advance the task assigned to them and the manner in which they have to be prepared themselves to respond. As such the organization and planning has already been taken care of. The resources are identified including manpower material and equipment. The performers should have adequate delegation and financial and administrative powers and have the mandate for accomplishing the task.

The success of the trigger mechanism depends on the vision and perception of the planners. They are required to anticipate the likely activities with reference to the nature of the disaster and its impact. In fact the trigger mechanism can also be called the operating standard procedure where the implementations of the efforts on ground are well laid down. Generally, the activities will include

evacuation, search and rescue, temporary shelter, food, drinking water, clothing, health and sanitation, communications, accessibility, and public information. All these major activities which are common in all types of disasters will require sub-division and preparation of sub-action plans by each specified authority. They will be required to list all requirements and their availability within the prescribed response time.

To sum up the trigger mechanism is an emergency quick response mechanism like ignition switch which when energized spontaneously sets the vehicle of management into motion on the road of disaster mitigation process.

The Concept in Nut Shell

- Key to ignition
- Spontaneous response
- Suo motto activation
- Simultaneous energisation
- Command and control

The Parameters

- Signal/warning mechanism
- Activities and their levels
- Sub activities defined
- Authorities specified
- Response time determined
- Sub action plans formulated
- Quick response team
- Alternative plans
- Appropriate delegation

The Preparedness

- Know the tasks in advance
- Have clear mandate and authority
- Identify and earmark resources
- Lay down mechanism to respond
- Network the team
- Undergo preparedness drills
- Coordinate and communicate
- Appraisal and updating

Structural Details

Activities / Authorities

- Listing probable disasters
- Signals / warning mechanism
- Coordination command, control
- Media management
- Rescue and evacuation
- Food and clothing
- Drinking water
- Health and medicine
- Trauma Centers
- Disposal of bodies and carcass
- Shelter camps and sanitation
- Fuel and power
- Transportation
- Communication

Levels of Activities

- Area of operation
- Numbers to be looked after
- Activity quantification
- Three level decision

Sub Activities

- List sub activities
- Entrust to sub authority
- Constitute quick response team
- Delegation - financial and administrative

Quick Response Team

- Procurement
- Distribution
- Mobilization
- Finance

Source: Source Book on District Disaster Management, Ministry of Agriculture, Govt. of India, & Lal Bahadur Shastri National Academy of Administration Mussoorie.

District Control Room

- The District control room is the nerve centre for the disasters management.

- To monitor, coordinate and implement the actions for disaster management.

- Periodic check to ensure that all warning, communication systems and instruments, are in working condition.

- An information system on a routine basis from the district departments on the vulnerability of the various places and villages. (parts of the districts)

- Receive reports on the preparedness of the district level departments and the resources at their disposal to arrange and meet their requirements.

- Upgrade the Disaster Management Action Plan according to the changing scenario.

- Maintain an inventory of all resources.

- Provide information to the Relief Commissioner.

- Furnish information to all those who are seeking and needy.

- Monitor preparedness measures and conduct training programmes.

- Providing information at district level, local level and disaster prone areas through appropriate media.

- Brief the media of the situations and day to day reports during the disasters.

- To report the ground situation and the action taken by the District Administration.

- The District control room would be placed under Senior Officers, who have already been trained adequately to handle disasters.

- Duty chart along with all basic facilities to be provided.

- Control room can have many service divisions with assigned duties, example, infrastructure / health / drinking water / logistics / agriculture / communication / resources etc. According to the need it could be expanded.

- The District Control Room should have all the facilities for effective communication and also to anticipate in case of system failure has alternative, ordinary and mobile phones, e-mail facility etc.

- List of all personnel and trained persons who could be contacted at any time.

- Organize post disaster evaluation.

- Liaise with site operation centre. Site operation centre is the centre in the Disaster site to be set up and an officer earmarked to be in charge. The Officer In charge will conduct the relief, transit camps, feeding centers, cattle camp; salvage operations, disposal of the dead bodies and carcasses of animals, construction of temporary sheds with adequate facilities, medical relief, clearance of debris and repair of damaged infrastructure etc.

- Collect information and activate the District/State Level Department for handling/getting assistance on need basis.

Source: Source Book on District Disaster Management, Ministry of Agriculture, Govt. of India, & Lal Bahadur Shastri National Academy of Administration Mussoorie.

Role of District Collectors in Disaster Management

- Preparation of the Disaster Management action plan for the District with the assistance of the Disaster Management Committee and other experts.
- To implement the disaster management action plan.
- Setting up the district control room and making it function effectively.
- Earmarking and entrusting responsibility to the various departments.
- Coordination with line departments of the state, Central and other agencies.
- To liaise with the Government periodically about the disaster and the action taken.
- Integrating the MARG (Mutual Aid and Response Group) of the industrial belt with the disaster management committee.
- Before the disaster make the district machinery to equip and to be prepared.
- Setting up relief camps and transit camps.
- Conducting relief and rescue operations.
- Corresponding with the Defense Ministry Personnel.
- To interact with the donor agencies for relief and rehabilitation.
- Collector is the central authority exercising emergency powers to issue directives to all the departments and to provide emergency response service.
- Organizing Training and conducting mock drills
- Maintaining the supply of essential commodities.
- Preparing Memoranda for getting resources for Relief.
- Giving adequate and right information to the people.

Source: Source Book on District Disaster Management, Ministry of Agriculture, Govt. of India, & Lal Bahadur Shastri National Academy of Administration Mussoorie.

Further Readings

Arya, A.S., Engineering Role in Earthquake Disaster Reduction in India, paper presented in World Congress on Natural Disaster Mitigation, by World Federation of Engineering Organization, at Delhi, 19-22, February, 2004.

Bahme CW: Fire officer's guide to disaster control, National Fire Protection Association, Quincy, MA, 1978

Baker CW: and Chapman DW, editors: Man and society in disaster, New York, 1962, Basic Books Inc.

Baker FJ: The management of mass casualty disasters, Topics in Emergency Med I (I): 149, May 1979.

Barton A: Communities in disaster: a sociological analysis of collective stress situations, Garden City, NY, 1969, Doubleday & Co.

Barton AH: Social organization under stress: a sociological review of disaster studies, disaster study on 17, publication no 1032, Disaster Research Group, National Academy of Sciences National Research Council, Washington, 1963.

BMTPC, Building A New Techno-Legal Regime for Safer India; Building Materials & Technology Promotion Council, New Delhi.

Bolduc J: Natural disasters in developing countries: myths and the role of the media, Emerg Prepared Digest (Canada) 14(3):12, July-Sept. 1987

Bose (ed), Modern Encyclopedia of Disaster and Hazard Management Vol I-V, Rajat Pub., Delhi, 2006

Bose, B.C., Introductions to Disaster Management, Rajat Publications, Delhi, 2007

Bourque LB, Reeder LG, and Cherlin A: the unpredictable disaster in a metropolis: public response to the Los Angeles earthquake of Februrary 1971, report#SRC-TR1-73 (AD-7655130), (microfilm), University of California at Los Angeles, Survey Research Center, 1973.

Bowers, W.E. et.al., Surgical Philosophy in Mass Casualty Management, Springfield, IL, CC, Tharnao, 1960.

Brunacini, A.V., Fire Command, National Fire Protection Association, Quinty, MA, 1985.

Brunacini, A.V., Phoenix Fire Department Operation and Manual Vol. 2, Standard Operating Procedures, Unpublished, Phoenix, A2, 1998.

Carroll, J.M., Emergency Planning: Proceedings of the Conference or Emergency Planning, January 27-29, 1983, San Diego, CA, Simulation Series, Vol.11(2), Society for Computer Formulation, Lactolla, CA, 1983.

CASA Disaster Management & Mitigation: Perspective in Community Participation, CASA, New Delhi

CBRI, Earthquake Design Manual for Practicing Engineers, Central Building Research Institution, Roorkee, Uttarakhand, 2004

Cigler B: Emergency management and public administration, report 86-12, University of North Carolina at Chapel Hill, 1986

Clary BB: The evolution and structure of natural hazard policies. In petak WJ: Emergency management: a challenge for public administration, special issue, Public Admin Rev 45:20, Jan 1985

Cohen E: Disasters: an emergency care work-book, Instructional Development and Educational Aids, Inc, San Diego, CA, 1982

Committee on Disasters and the Mass Media, Commission on Sociotechnical Systems: Disasters and the mass media, National Research Council-National Academy of Sciences, Washington, DC, 1980

Cowley RA: The use of communications satellite systems in major disaster situations. In Manni C and Magalini SL: Emergency and disaster medicine, New York, 1985, Springer-Verlag.

Dheri S.K and Mishra, G.C., Fire: Blazing Questions, in India Disaster Report, OUP, Delhi, 2000

Drabek TE, et al: Managing the emergency response. In Petak WJ: Emergency management: a challenge for public administration (special issue), Public Admin Rev 45:85, Jan 1985

Drabek TE: Emergency management: the human factor, Federal Emergency Management Agency, National Emergency Training Center, Emmitsburg, MD, 1985

Drabek TE: Human system responses to disaster: an inventory of sociological findings, New York, 1986, Springer-Verlag

Drabek TE: The professional emergency manager: structures and strategy for success, monograph no 44, Institute of Behavioral Science

Drabek, T.E. et.al., Managing Multi Organizational Emergency Responses: Emergent Search and Rescue Networks in Natural Disaster and Remote and Settings, Natural Hazards Information Centre, University of Colorado, Boulder, 1981.

Dynes RR, Quarantelli EL, and Kreps GA: A perspective on disaster planning, ed 3, report series 11, Disaster Research Center, University of Delaware, Newark, 1981

Dynes RR: Organized behavior in disaster, Disaster Research Center, University of Delaware, Newark, 1974

Dynes, R.R. et.al., Organizational Communications and Decision Making in Crises, Disaster Research Centre, University of Delware, New York, 1977.

Elegant, S., Resurrection, Time, April 4, 2005.

Faupel CE: The ecology of disaster, New York, 1985, Irvington Publishers, Inc.

FICCI Chemical (Industrial) Disaster Management, NDMA, New Delhi, 2009

Form W, and Nosow S: Community in disaster, New York, 1958, Harper

Foster HD: Disaster planning: the preservation of life and property, New York, 1980, Springer-Verlag

Fox GG: Disaster planning: a tale of two cities, Public Management 63:7, Jan/Feb 1981

Francis, C.M. et. al., Epidemics: Diseases as Disaster, in India Disaster Report, OUP, Delhi, 2000

Gandhi, P.J., Disaster Mitigates and Management, Deep & Deep Pub., Delhi, 2007

Ghosh, G.K., Disaster Management Vol I-II, APH Pub., Delhi, 2006

Gibson G: Disaster and emergency medical care: methods, theories and a research agenda, Mass Emerg 2:195, 1977

Goel, S.L., Disaster Administration and Management: Text and Case Studies, Deep & Deep Pub., Delhi, 2007

Goel, S.L., Encyclopedia of Disaster Management Vol I-III, Deep & Deep Pub., Delhi, 2006

Government of India - Disaster Management: Development Perspectives, National Disaster Management Division, Ministry of Home Affairs, Government of India, Delhi, 2002

Government of India - Hazards, Disasters and Your Community: Primer for Parliamentarians, NDM Division, Ministry of Home Affairs, Government of India, Delhi

Government of India Tenth Five Year Plan (2002-07), Government of India, Delhi.

Gupta, M.P., Crises Management, Maxford Books, Delhi, 2006

Hamilton, R.V., et. al., Social Psychological Interpretation on the Udaukansas, Tornado, Unpublished Report, University of Wichita, October 1985.

Hazarika S., Ethnic Conflicts in North East, in India Disaster Report, OUP, Delhi, 2000

Heide, Erik Aderfder, Disaster Response: Principles of Preparation and Coordination, Disaster Research Centre, University Delaware, New York.

Husain, A. Natural Disaster, Sumit Enterprises, New Delhi, 2006

Irwin RL: Personal communication, Emergency Management Consultant, Basic Governmental Services, Sonora, CA, 1987

Jain, A.K., Emergency Planning for Natural Disasters, paper presented in World Congress on Nature Disaster Mitigation, organized by World Federation of Engineering Organization, at Delhi, dated 19-22 Feb. 244.

Kallsen, G., Collapse of Coalinga, Journal of Emergency Medical Services 8(7), 1983

Kapur, A. etal., Disasters in India, Studies of Grim Realities, Rawat Publications, Delhi, 2005

Kilijanek TS, et al: The emergency of a post-disaster communications network, a paper presented at the Annual meeting of the American Sociological Association, Boston, MA, Aug, 1979

Kreimer A: The role of the mass media in disaster reporting: a search for relevant issues, in: Disasters and the mass media, Committee on Disasters and the Mass Media, Commission on Sociotechnical Systems, National Research Council-National Academy of Sciences, Washingtion, DC, 1980

Kumar, A. (ed), Disaster Management: Recent Approaches, Anmol Pub., New Delhi, 2006

Larson JF: A review of the state of the art in mass media disaster reporting. In: Disasters and the mass media, Committee on Disasters and the Mass Media, Commission on Sociotechnical Systems, National Research Council-National Academy of Sciences, Washington, DC, 1980

Marshall, Andrao, Healing Hands, Time April 4, 2005.

Mathur, Ranjeet, Railway Accidents, in India Disaster Report, OUP, Delhi, 2000

Mcluckie B: The warning system in disaster situations: a selective analysis, report series no 9, Disaster Research Center, University of Delaware, Newark, 1970

Medury and Dhameja, Rehabilitation of Cyclone in Orissa in Administrative Reforms (ed) Amita Singh in India, Sage Publications Delhi, 2006.

Moore, H.E., Tornadoes Over Texas: A Study of Waco and San Angelo in Disaster University of Texas Press, Austin, 1958.

Murthy D. B. N., Disaster Management: Text and Case Studies, Deep & Deep Pub. Delhi, 2007

Nath Meenakshi, Sarangi S., Industrial Disasters: Working Towards Oblivion Bhopal Gas Tragedy, in India Disaster Report, OUP, Delhi, 2000.

National Interagency Incident Management System: Information and guides, Publication Management System, National Wildfire Coordination Group, Boise Interagency Fire Center, Boise, ID, 1983

Parausraman, S. and Unnikrishnan, P.V. (ed), India Disaster Report, Oxford University Press, Delhi 2000.

Perry, R.W., Comprehensive Emergency Management: Evacuating Threatened Populations, Greenwich, CT, JAI Press, Inc., 1985.

Petak WJ: Emergency management: a challenge for public administration. In Petak WJ: Emergency management: a challenge for public administration special issues, Public Admin. Revisions, International Fire Chief 47:12, Jan 1981. 45:3, Jan 1985

Prasad K. and B.D.Singh, Drought Disaster and Development, Mittal Publications, New Delhi, 1994

Quarantelli EL, and Dynes RR: When disaster strikes (it isn't much like what you've heard or read about), Psychology Today, p 67, Feb 1972,

Quarantelli EL, and Tierney KJ: Disaster preparation planning. In: Office of Public Sector Programs, Fire safety and disaster planning, 263-313, reprint no 118, American Association for the Advancement of Science, Washington DC, Disaster Research Center, University of Delaware, Newark, 1981

Quarantelli EL: Human resources and organizational behaviours in community disasters and their relationship to planning, preliminary paper no 76, Disaster Research Center, University of Delaware, Newark, 1982.

Quarantelli EL: Some basic themes in sociological studies of disasters. In Quarantelli EL: Disasters: theory and research, Beverly Hills, CA, 1978, Sage Publications.

Quarantelli, E.L., Disaster Planning: Small and Large - Past, Present and Future, presented at American Red Cross, EFO Division Disaster Conference, Blacksburg, V.A., February 19-22, 1981, Disaster Research Centre, University of Delaware, New York, 1981.

Quarantelli, E.L., Organizational Behaviour in Disasters and Implications for Disaster Planning Report Series 18, Disaster Research Centre University of Delaware, New York, 1985.

Quarantelli, E.L., Socio-Behavioural Response to Chemical Hazards: Preparations for and Responses to Acute Chemical Emergencies at the Local Community Level, Disaster Research Centre, University of Delaware, New York, 1981.

Quarantelli, EL: Studies in disaster response and planning, final project rep no 24, Disasters Research Center, University of Delaware, Newark, 1979

Rai N. & Singh A.K. (ed), Disaster Management in India, New Royal Book Comp., Lucknow, 2008

Rai, N. and Singh, A.K., Disaster Response in India: With Special Reference to Tsunami Disaster, Urban Panorama, Vol. V (1), January-June, 2006

Roth R: Cross-cultural perspectives on disaster response, Am Behave Sci 13(3): 440, Jan-Feb 1970.

Roy, S., Natural Disaster Management Abhjeet Publications, New Delhi, 2004

S.L. and Kumar, R. (ed), Disaster Management, Deep & Deep Pub. Delhi, 2000

Sahu, B.P. and Mahapatra S., Post Disaster Management of Super Cyclone, Mittal Publications, New Delhi, 2004

Seismic Safety Commission: Public official attitudes toward disaster preparedness in California, publication no SSC 79-05, Sacramento, 1979.

Shaftan GW: Disaster and medical care, J Trauma 2:11, 1962.

Sharma R.K. (ed) Natural Disaster: Institutional Building for Mitigating the Impact of Vulnerable Sections, APH Publishing Corp., New Delhi, 2005

Shashi Kumar S.K., Trends in International Migration from India- 1950-2000, Paper presented at Labour Mobility and Globalizing World, September 18-19, VVGNLI, ISLE, IHD, Noida 2002

Silver Mcein M.E., Triage Decision Trees and Triage Protocols: Changing Strategies for Medical Rescue in Civilian Mass Casualty Situations, U.S. Department of Commerce, Springfield, U.A. 1984.

Singh P.P. and S.Sharma (ed) Modern Dictionary of Natural Disasters, Deep & Deep Publications & Pvt. Ltd., New Delhi, 2005

Singh, K.K., Indian Policy, Legislation and Institutional Arrangements for Urban Risk Mitigation: An Argument for Right Based Approach, paper presented in World Congress on Natural Disaster Mitigation, by

World Federation of Engineering Organization, at Delhi, dated 19-22, February, 2004.

Singh, R.B. (ed), Natural Hazards & Disaster Management, Rawat Publications, Delhi, 2006

Singh, U.B., and Singh A.K., Socio-Economic Dimensions of National Disasters in India: Suggested Strategies for Mitigation, paper presented in World Congress on Natural Disaster Mitigation by World Federation of Engineering Organizations at Delhi, February 19-22, 2004.

Sinha P. (ed) Disaster vulnerabilities and Risks, SBS Publications and Distributions, New Delhi, 2006

Sinha P.C.(ed) Disaster Mitigations, SBS Publications & Distributors Pvt. Ltd. New Delhi, 2006

Sinha P.C.(ed) Disaster Relief, SBS Publication & Distributors Pvt. Ltd. New Delhi, 2006

Sorensen, J.H., et.al., Inter and Intra Organizational Cohesion in Emergencies, Mass Emergencies and Disasters 3(3), November 1989.

Spirgi EH: Disaster management: comprehensive guidelines for disaster relief, Bern, 1979, Hans Huber Publishers.

Srivastava R.S. and Sashikumar S.K., An Overview of Migration in India: Its Implications and Key Issues, JNU, VVGNLI, New Delhi, 2003.

Srivastava, H. N. And Gupta, G.D., (ed), Management of Natural Disasters in Developing countries, Daya Publishing House, Delhi, 2006

Stallings R: Communications in natural disasters, rep no 10, Disaster Research Center, University of Delaware, Newark, 1971.

Subbiah, A.R., Natural Disaster Management, Vol. 21, State of Indian Farmers, Academic Foundation, Delhi, 2004

Super G: START: A triage training module, Hoag Memorial Hospital Presbyterian, Newport Beach, CA, 1984.

Swain, M. etal, Disaster and Gender, Serials Publications, New Delhi, 2006

Taori, K., Disaster Management Through Panchayati Raj, Concept Publication, Delhi, 2005

Thomas, V.J., Road Accidents in India, in India Disaster Report, OUP, Delhi, 2000

Tiwari, B.K. and Singh, A.K., Bangladeshi Issue in Perspective: The Problem of Immigrants in India, Dynamics of Public Administration, Vol. III-IV (1-2), January, December 1998.

UN Recovery Frame Work in Support of government of India for a Post Tsunami Rehabilitation and Reconstruction Programme, United States, March, 2005.

UNAIDS - Innovative Approaches to HIV Prevention, UNAIDS, Geneva, 2001

UNAIDS - Migrants: Right to Health, UNAIDS, Geneva, 2001

UNDP - HIV Vulnerability and Migration: South Asia Perspectives, UNDP, Delhi, 2002

UNDP - Recovery Framework in Support of Government of India for a Post Tsunami Rehabilitation and Reconstruction Programme, UNDP, Delhi, 2005

UNDP Disaster Risk Management Programme, (2002-07) MoHRD, Government of India, Delhi, 2003.

UNDP No Safety Signs Here, UNDP, Delhi 2004

Wallace, W.A., et.al., Decision Support Systems for Disaster Management, IW Petak W.J. Emergency Management: A Challenge for Public Administration, special issue, Public Administration Review, Jan. 1985.

Waugh, W.L., Handbook of Disaster Management, Crest Publishing House, New Delhi, 2005

Wenger D: Mass media and disasters, preliminary paper no 98, Disaster Research Center, University of Delaware, Newark, 1985.

Wenger DE: Community response to disaster: functional and structural alterations. In Quarantelli EL: Disasters: theory and research, Beverly Hills, CA, 1978, Sage Publications.

Wohlworth, N., Putting Computer Technology to Work in Emergency Planning, Emergency Preparedness Digest, 14(2) April-June 1987.

World Bank, World Bank in India, Newsletter, Vol. 4(3), November 2005.