



Ministry of Housing and Urban Affairs
Government of India



Disaster Resilience

TRAINING MANUAL

nua | **c³**
Climate Centre for Cities

giz Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

Supported by:



based on a decision of the German Bundestag

ClimateSmart Cities Assessment Framework
Urban Planning, Green Cover & Biodiversity



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Training module

Developed by:

Climate Centre for Cities, NIUA in association with Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) A

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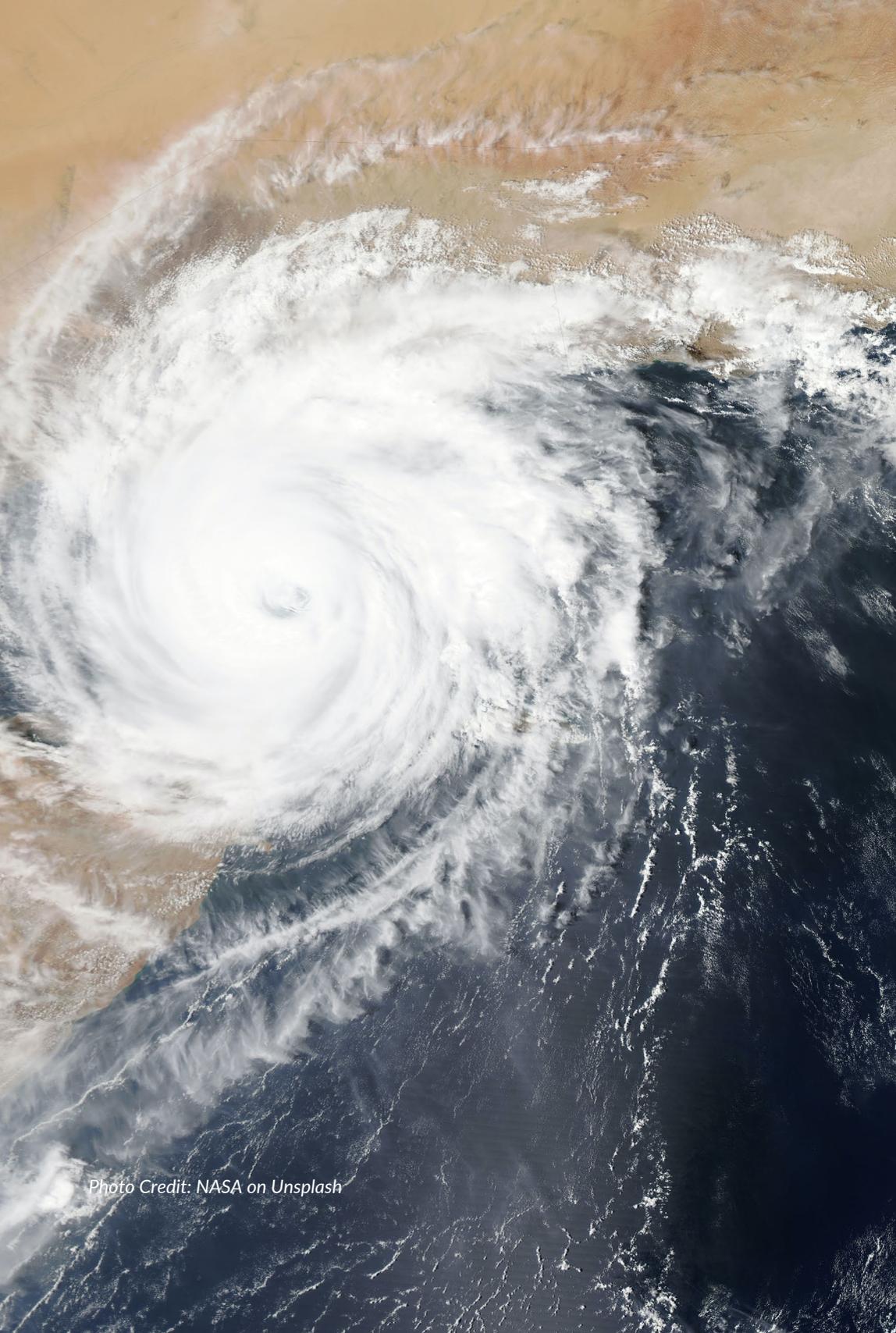


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Executive Summary

On one hand, cities are a significant contributor of carbon emissions aggravating climate change and on the other, cities are considerably impacted by climate disasters. The recently released Global Climate Risk Index 2021 ranks India as the 7th most-affected country from climate-related extreme weather events (storms, floods, heat waves etc.). Further, studies indicate that poor planning and urban management are expected to cost Indian cities somewhere between \$2.6 and \$13 billion annually.¹ Cities are increasingly at the forefront of addressing both urbanization and climate change and to strengthen climate-sensitive urban development, a holistic understanding of urban development from a climate lens is crucial. The ClimateSmart Cities Assessment Framework (CSCAF) launched in 2019 by the Ministry of Housing and Urban Affairs (MoHUA), the Government of India aimed to address this gap. This first-of-its-kind assessment with 28 progressive indicators across 5 thematic areas helps cities to benchmark their development, understand the gaps and further prioritize climate-relevant development.

With a focus on building local capacities to develop and adopt climate measures, the Climate Centre for Cities (C-Cube) at the National Institute of Urban Affairs (NIUA) initiated a series of training aligned to the thematic areas of CSCAF - Energy and Green Buildings, Urban Planning, Green Cover & Biodiversity, Mobility and Air Quality, Water Management, Waste Management. The focus of the training is to provide a step-by-step approach to conducting studies, assessments and stakeholder consultations, establishing committees, developing action plans and implementing relevant measures that not only make the cities climate-resilient but also help them progress across the assessment of CSCAF.



¹Mani, M. et al., 2018. *South Asia's Hotspots: The Impact of Temperature and Precipitation Changes on Living Standards*, WashingtonD.C.: World Bank Group.

This training module is on the 'Disaster Resilience' indicator under the thematic area of Urban Planning Green Cover and Biodiversity in the CSCAF. The training highlights the fundamentals of Disaster Risk Reduction (DRR), the global and national policy frameworks and institutional arrangements as well as the strategies to build disaster resilience in cities. Hence, the training module is directed at city officials to improve the disaster resilience capacities in their respective cities by initiating incremental actions, which include establishing an emergency operations centre, conducting risk assessments, documenting losses and damages data, developing a city disaster management plan and early warning systems, along with harnessing the potential of Integrated Command and Control Centres to disseminate early warnings. Further, through an interactive exercise, the training provides insights on key weather-related hazards, their warning levels, associated impacts and response actions to be undertaken by the cities.





Who is the training manual designed for?



What is the focus of the training manual?



How to make use of this manual?



What are the Learning outcomes of the training?



Scope and limitations of the training

This training manual is designed for the various ULB departments concerning disaster preparedness, response, relief and recovery measures, such as the Health, Revenue, Transport, Public Works departments etc. It is targeted at engineers, planners, city managers and policymakers of the various government departments and agencies responsible for disaster management.

The focus of this manual is to sensitize the city officials towards the need and relevance of city-level disaster management. The manual lays down a set of strategies and their implementation steps. In doing so, it aims to help cities to prepare, respond and recover from disasters more efficiently and effectively. The manual also provides several reading materials, including handbooks, SoPs, planning and policy documents for a detailed understanding of the concepts of disaster risk reduction.

The manual can be utilised as a guide for building disaster resilience in the city. The chapters focus on incremental levels of planning and implementation of disaster resilience strategies, which can be used while carrying out the said activities in the city. The manual also equips the users with simple tools, manuals and handbooks that can be used at different stages of implementing strategies.

- Understanding the fundamentals of disaster resilience
- Understanding various disaster resilience strategies
- Understanding how to implement the said strategies
- Knowledge-sharing on city-level disaster management planning through case studies.
- Interactive exercise on tackling key weather-related hazards in cities

The training largely focuses on sharing knowledge on how to implement city level disaster resilience strategies only. This has to be aligned with the district and state-level disaster management plans.



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Abbreviations

CDMP	City Disaster Management Plan
CRED	Centre for Research on Epidemiology of Disaster
CSCAF	Climate Smart Cities Assessment Framework
DDMA	District Disaster Management Authority
DMP	Disaster Management Plan
DRR	Disaster Risk Reduction
EM-DAT	Emergency Events Database
EOC	Emergency Operations Centre
ESF	Emergency Support Function
EWS	Early Warning System
GDP	Gross domestic product
GHG	Greenhouse Gases
GVMC	Greater Visakhapatnam Municipal Corporation
HFA	Hyogo Framework for Action
HRV	Hazard, Risk, and Vulnerability
HVRA	Hazard, Vulnerability and Risk Assessment
ICCC	Integrated Command Control Centre
IEC	Information, Education & Communication
IMD	Indian Meteorological Department
IPCC	Intergovernmental Panel on Climate Change
IRADe	Integrated Research and Action for Development
NDMA	National Disaster Management Authority of India
NDRF	National Disaster Response Force
NIDM	National Institute of Disaster Management
PM	Prime Minister
PWD	Public Works Department
QRE	Quick Risk Estimation
SDMA	State Disaster Management Authority
SDG	Sustainable Development Goal
SDRF	State Disaster Response Force
SoP	Standard Operating Procedure
TA/DA	Travelling Allowance and Dearness Allowance
TVC	Town Vending Committee
ULB	Urban Local Bodies
UNDRR	United Nations Office for Disaster Risk Reduction
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations Office for Disaster Risk Reduction
VMC	Vijayawada Municipal Corporation



1

Introduction

Disaster resilience is about anticipating, planning and reducing disaster risk to effectively protect persons, communities and countries, their livelihoods, health, cultural heritage, socio-economic assets and ecosystems (UNDRR, Prevention Web, n.d.). The ideas of 'bounce back', 'spring forward' and 'build back better' are often used in the context of resilience.

Disaster resilience is increasingly becoming relevant as it is expected that both the frequency and intensity of disasters will continue to increase as a result of climate change, urban migration, population growth and increased scarcity of natural resources. The Centre for Research on Epidemiology of Disaster (CRED) reports that over the last two decades, the world has witnessed 7,348 disaster events, recorded by EM-DAT, one of the foremost international databases of such events. The highest number of disaster events reported were floods, followed by storms. Comparing the data from 2000-2019 with that of 1980-1999, it was found that both of these disaster event types recorded a substantial growth in numbers, while other event types, such as earthquake, extreme heat, drought and wildfire also witnessed a spike in numbers (see Figure 1). Figure 2 below highlights that 1.23 million lives were lost and over 4 billion people were affected between 2000 and 2019 due to the impact of disasters. Additionally, the economic loss due to these disasters was US\$ 2.97 trillion worldwide. Between 1980 and 1999, EM-DAT recorded 4,212 disasters linked to natural hazards worldwide, claiming around 1.19 million lives and impacting over 3 billion people (Figure 2).

While better recording and reporting has certainly contributed to the increase in these numbers, it is also due to a rise in the number of climate-related disasters. Between 2000 and 2019, there were 510,837 deaths and 3.9 billion people affected by 6,681 climate-related disasters (EM-DAT Team, 2020). This compares with 3,656 climate-related events which accounted for 995,330 deaths (47% due to drought/famine) and 3.2 billion affected in the period 1980-1999 (EM-DAT Team, 2020).

Figure 1.1. Total Disaster Events by Type | 1980-1999 vs 2000-2019¹

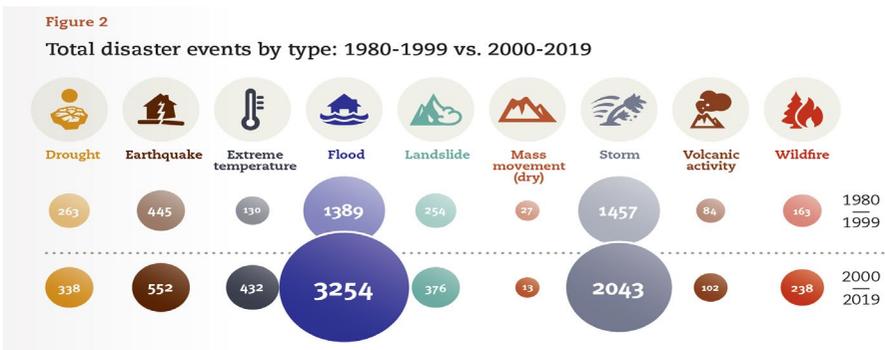
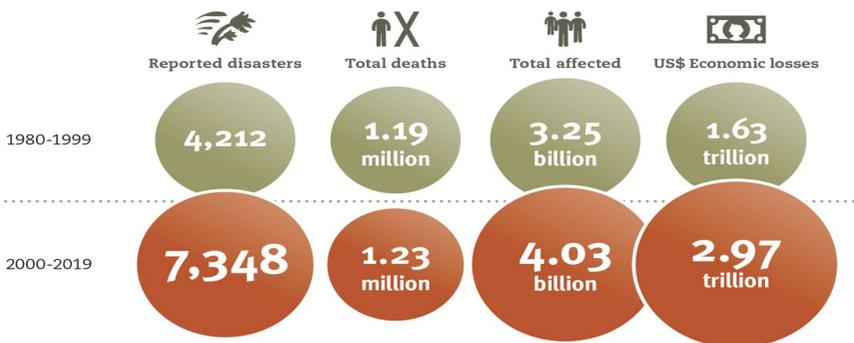


Figure 1.2. Disaster Impacts: 1980-1999 vs 2000-2019²

Disaster Impacts:
1980-1999 vs. 2000-2019

the associated economic damage are growing in contrast to the decrease in mortality.



^{1,2}Source: Human Cost of Disasters, an overview of the last 20 years 2000-2019 (CRED, UNDRR)

Figure 1.3. Number of disasters reported per country/territory (2000-2019)²

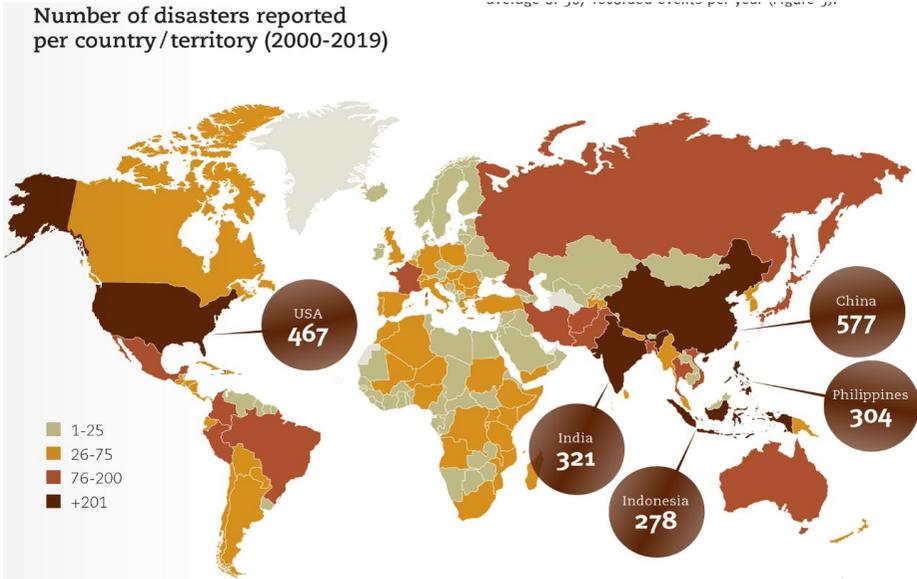
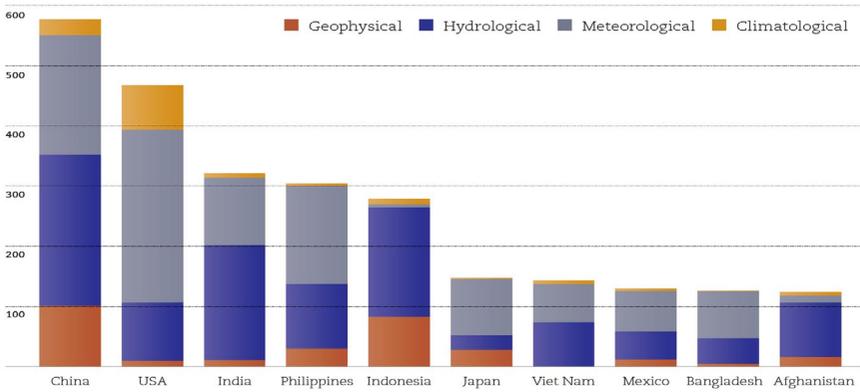


Figure 1.4. Top countries by the occurrence of disaster sub-groups (2000-2019)³

Top 10 countries by occurrence of disaster sub-groups (2000-2019)



^{2,3}Source: Human Cost of Disasters, an overview of the last 20 years 2000-2019 (CRED, UNDRR)

1.1. What is Disaster Management?

Disaster Management means a continuous and integrated process of planning, organizing, coordinating and implementing measures that are necessary or expedient for implementing the following actions (Ministry of Law and Justice, 2005):

1. Prevention of danger or threat of any disaster
2. Building capacities within governments and citizens.
3. Mitigation or reduction of risk of any disaster or its severity or consequences
4. Prompt response to any threatening disaster situation or disaster
5. Preparedness to deal with any disaster
6. Assessing the severity or magnitude of effects of any disaster
7. Evacuation, rescue and relief
8. Rehabilitation and reconstruction

1.2. Components of Disaster Management

The following are the key components of Disaster Management (NDMA, 2022):

Preparedness

Preparing to protect lives and items of great importance in the event an emergency/ disaster occurs.

Response

When there is an actual occurrence, administering first aid or getting medical attention for victims if necessary. Attending other emergency procedures that must take place to lessen the impact.

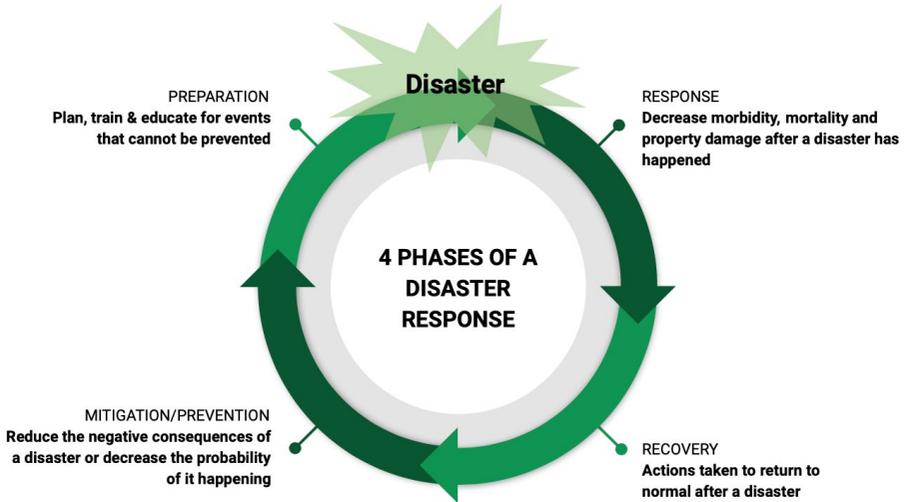
Recovery

After things are under control, beginning the cleanup or repairing the damages to bring back normalcy.

Mitigation

Finally, asking how did the disaster, accident or emergency happen and how can any problems that occurred in handling the incident be lessened.

Figure 1.5. The Disaster Management Cycle



1.3. What is a Disaster Resilient City?

As per the national institute of disaster management (National Institute of Disaster Management, 2022), a disaster-resilient city:

1. Is one where disasters are minimised because the population lives in homes and neighbourhoods with organized services and infrastructure that adhere to sensible building codes.
2. Has an inclusive, competent and accountable local government that is concerned about sustainable urbanization and that commits the necessary resources to develop capacities to manage and organize itself before, during and after a natural hazard event.
3. Is one where the local authorities and the population understand their risks and develop a shared, local information base on disaster losses, hazards and risks, including who is exposed and who is vulnerable.
4. Is one where people are empowered to participate, decide and plan their city together with local authorities and value local and indigenous knowledge, capacities and resources.
5. Has taken steps to anticipate and mitigate the impact of disasters, incorporating monitoring and early warning technologies to protect infrastructure, community assets and individuals, including their homes and possessions, cultural heritage, environmental and economic capital, and can minimize physical and social losses arising from extreme weather events, earthquakes or other natural or human-induced hazards.

6. Can respond, implement immediate recovery strategies and quickly restore basic services to resume social, institutional and economic activity after such an event.
7. Understands that most of the above are also central to building resilience to adverse environmental changes, including climate change, in addition to reducing greenhouse gas emissions

For further information, please refer to the manual on 'Developing Disaster-Risk Resilience in Cities' by the national institute of disaster management. https://nidm.gov.in/PDF/pubs/capres_DDRRC.pdf

The following are the key concepts for a holistic understanding of disaster management (National Institute of Disaster Management, 2019):

Hazard

A hazard is any potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environment (ISDR, 20073). More simply, any condition, material, process or event having the potential to cause harmful effects is understood as a hazard. India is prone to a wide range of natural hazards, such as cyclones, floods, heatwaves, landslides, earthquakes and wildfires. In addition, Indian cities also face air quality deterioration, flash floods and urban heating.

Vulnerability

Vulnerability means the characteristics of a person, group of persons (community) or their resources (property, infrastructure, environment or ecosystems) and the concerned situation that influences their capacity to anticipate, cope with, resist and recover from the impact of a natural or anthropogenic hazard. It involves a combination of factors that determine the degree to which someone's life, livelihood, property, ecosystems and other assets are put at risk by a discrete and identifiable event in nature and society. Social vulnerability enumerates upon the fact that in our society some groups are more prone to damage and losses in context to different hazards. The vulnerability could be divided into four types, viz:

1. Physical vulnerability

Physical vulnerability includes the risk to the tangible things having physical structure or configuration, such as infrastructure, amenities, houses, buildings, bridges, and other assets which can be directly hit by a hazard event. For example, in case of an earthquake, old and structurally weak buildings are vulnerable to damage or collapse.

2. Environmental vulnerability

Environmental vulnerability represents the risk to land and landscape, land-use, existing ecological settings including natural resources and ecosystem services, and

thereby, also referred to as underlying causes of socio-economic vulnerability. For example, urban activities on the coastline of cities like Mumbai make the mangrove vegetation cover recede. This environmental vulnerability increases the chances and impact of urban flooding and causes further socio-economic vulnerability in urban coastal communities and slum areas.

3. Socio-economic vulnerability

Social vulnerability means the threat to life and livelihood based on factors like caste, ethnicity, age, gender, ability, health status, etc due to a hazard. Key variables explaining the variation of impact include class, occupation, caste, ethnicity, gender, disability and health status, age and immigration state and social networks.

4. Systemic vulnerability

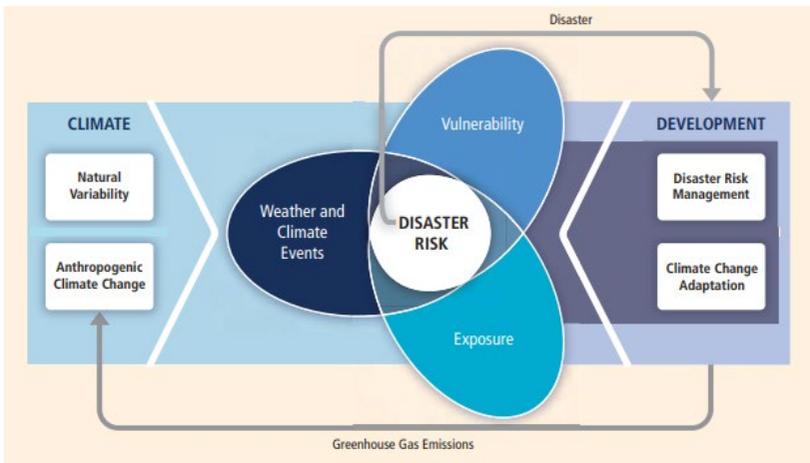
Systemic vulnerability represents the state of intactness in the governance and administration against the risk of disaster incidents. This includes management and inter-relationship between different levels of governments, and within and among organizations, agencies and, thus, represents the effectiveness of coordination even during a disaster situation.

Risk

Risk is an indicator of the probability of occurrence of a hazardous event and the extent of its damage in terms of lives lost, persons injured, damage to property, environment, infrastructure and disruption of economic activity.

The IPCC defines disaster risk as an expression of the likelihood that a particular shock or stress can become a disaster (by causing damage and losses) and may be expressed mathematically as a function of shocks or stresses, vulnerability, exposure and capacity.

Figure 1.6. Key concepts involved in disaster risk management and climate change adaptation, and the interaction of these with sustainable development, IPCC



For detailed insights into disaster risk management, please refer to the special report of the IPCC, 'Managing Risks of Extreme Events and Disasters to Advance Climate Change Adaptation.

Link: https://www.ipcc.ch/site/assets/uploads/2018/03/SREX_Full_Report-1.pdf

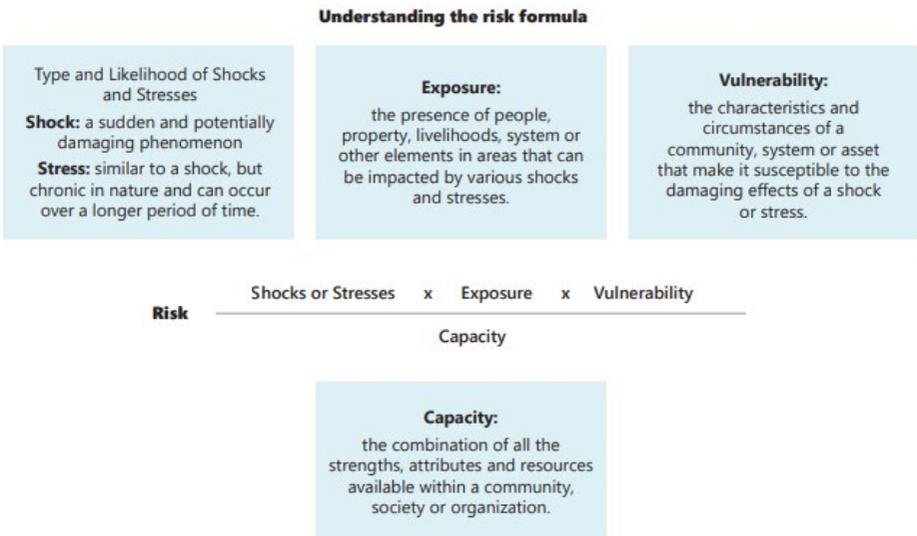
Risk Assessment

Risk assessment is a process to determine the nature and extent of risk by analyzing potential hazards (frequency and intensity) and evaluating existing conditions of vulnerability that could allow a potential threat or harm to people and their property, environment and livelihoods. It serves as the first step towards adopting disaster risk reduction measures.

Disaster

As per the Disaster Management Act, 2005 of India, disaster is defined as a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes, or by accident and negligence which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area.

Figure 1.7. Understanding the relationship between risk, vulnerability and capacity, National Institute of Disaster Management



2

Policy and Institutional Frameworks

The relevance of promoting disaster risk reduction efforts on the international, regional as well as national and local levels has been recognized in recent years in several key multilateral frameworks and declarations as explained below:

2.1. Global Policy Framework

The Hyogo Framework for Action 2005-2015:

Access the detailed document here. <https://www.unisdr.org/2005/wcdr/intergover/official-doc/L-docs/Hyogo-framework-for-action-english.pdf>

The United Nations promoted a 10-year plan (2005-2015) to make the world safer from natural hazards. It has since guided national policy and international organisations in their efforts to substantially reduce losses stemming from natural hazards. The Hyogo Framework for Action addresses the roles of states, regional and international organisations, calling on civil society, academia, volunteer organisations and the private sector to join efforts. It promotes the decentralization of authority and resources to promote local-level disaster risk reduction. The expected outcome of the Hyogo Framework is to substantially reduce disaster losses in terms of lives and the social, economic and environmental assets of communities and countries. The five HFA priorities for action are (United Nations Office for Disaster Risk Reduction, 2005):

1. *Build institutional capacity*: Ensure that disaster risk reduction is a national and local priority with a strong institutional basis for implementation.
2. *Know your risks*: Identify, assess and monitor disaster risks and enhance early warning.
3. *Build understanding and awareness*: Use knowledge, innovation and education to build a culture of safety and resilience at all levels.

4. *Reduce risk*: Reduce the underlying risk factors through land-use planning, environmental, social and economic measures.
5. *Be prepared and ready to act*: Strengthen disaster preparedness for effective response at all levels.

Sendai Framework for Disaster Risk Reduction 2015-2030

Access the detailed document here. <https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030>

The Sendai Framework is developed as the successor instrument to the Hyogo Framework for Action (HFA). It is a non-binding agreement, which the signatory nations, including India, will attempt to comply voluntarily. The HFA was conceived to give a further push to the global work under the International Framework for Action for the International Decade for Natural Disaster Reduction of 1989, and the Yokohama Strategy for a Safer World: Guidelines for Natural Disaster Prevention, Preparedness and Mitigation and its Plan of Action, adopted in 1994 and the International Strategy for Disaster Reduction of 1999. The Sendai Framework is developed on elements that ensure continuity with the work done by states and other stakeholders under the HFA and introduce several innovations. To support the assessment of global progress in achieving the outcome and goal of the present Framework, seven global targets have been created (United Nations Office for Disaster Risk Reduction, 2015).

These seven targets are:

1. Substantially reduce global disaster mortality by 2030, aiming to lower the average per 100,000 global mortality rates in the decade 2020–2030 compared to the period 2005– 2015

2. Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 in the decade 2020–2030 compared to the period 2005–2015
3. Reduce direct disaster economic loss in relation to the global gross domestic product (GDP) by 2030
4. Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030
5. Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020
6. Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of the present framework by 2030
7. Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030.

Priority areas for Disaster Risk Reduction

Taking into account the experience gained through the implementation of the Hyogo Framework for Action, and in pursuance of the expected outcome and goal, the Sendai Framework highlights the need for focused action within and across sectors at local, national, regional and global levels in the following four priority areas:

Priority 1: Understanding disaster risk.

Priority 2: Strengthening disaster risk governance to manage disaster risk.

Priority 3: Investing in disaster risk reduction for resilience.

Priority 4: Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction.

The United Nations Office for Disaster Risk Reduction (UNISDR) has developed a Quick Risk Estimation (QRE) tool for the city authorities to identify and understand current and future risks/stress/shocks and exposure threats to both human and physical assets. The QRE Tool enables a multi-stakeholder engagement process to establish a common understanding. Taking into account the actions or corrective measures already undertaken, the QRE will produce a dashboard-style risk assessment advising the risks and hazards to human and physical assets, impacts of identified main risks and associated hazard events on the specified location and/or a particular asset.

Access the QRE tool here. https://docs.google.com/spreadsheets/d/1_eDrzUIY4oVUIFHcreTYJifUkNQPNxxm/edit?rtf=true&sd=true#gid=1835909528

National Policy and Guidelines for Disaster Risk Reduction

The National Disaster Management Authority (NDMA) is the apex body for Disaster Management in India. Setting up of NDMA and the creation of an enabling environment for institutional mechanisms at the state and district levels is mandated by the Disaster Management Act, 2005 (NDMA, 2022):

The government of India adopted the National Policy on Disaster Management in 2009 with the vision to build a safe and disaster resilient India by developing a holistic, proactive, multi-disaster oriented and technology-driven strategy through a culture of prevention, mitigation, preparedness and response.

The themes that underpin this policy are (NDMA, 2022):

- Community-based disaster management, including last-mile integration of the policy, plans and execution.
- Capacity development in all related areas.
- Consolidation of past initiatives and best practices.
- Cooperation with agencies at the national, regional and international levels.
- Compliance and coordination to generate a multi-sectoral synergy.

The policy can be accessed here: https://nidm.gov.in/PDF/policies/ndm_policy2009.pdf

The NDMA has developed guidelines for planning and management of disasters, which include urban floods, cyclones, earthquakes and others. The guidelines can be accessed on this link: <https://ndma.gov.in/Governance/Guidelines>

2.2. Institutional Mechanisms at the National, State and District Levels

National Level

Decision making and standing bodies responsible for disaster management at the central level are (NDMA, 2022):

- NDMA, headed by the PM to build a safer and disaster resilient India by a holistic, proactive, technology-driven and sustainable development strategy
- Union cabinet & empowered group of ministries
- National crisis management committee
- Crisis management group
- Technical organisations - Indian Meteorological Department, Central Water Commissions, Building Material and Technology Promotion Council, Defence Research and Development Organisation, Directorate General Civil defence

**Table 2.1. Central Ministries Responsible for
Various Categories of Disasters, National Disaster Management Plan**

Disaster	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 and Climate Change
Biological Disasters	Ministry of Health
Nuclear Disasters	Department of Atomic Energy

National Disaster Management Authority of India (NDMA)

The NDMA was established in 2005, under the Disaster Management Act 2005.

- The objective is to build a safer and disaster resilient India by a holistic, proactive, technology-driven and sustainable development strategy.
- The NDMA is chaired by the PM of India and has a vice chairman with the status of a cabinet minister and 8 members with the status of ministers of state.
- The NDMA secretariat is headed by the secretary and deals with mitigation, preparedness, plans, reconstruction, community awareness and financial and administrative aspects.

State Level

The responsibility to cope with natural disasters is essentially that of the state government (NDMA, 2018).

- The SDMA prepares the state disaster management plan and implements the national disaster management plan.
- The chief secretary of the state heads a state-level committee that is in overall charge of the relief operations in the state.
- The relief commissioners are in charge of the relief and rehabilitation, function under the direction of the state-level committee.
- In many states, the secretary, department of revenue, is also in-charge of relief.

State Disaster Management Authority (SDMA)

- At the state level, the state disaster management authorities are established under the Disaster Management Act 2005.
- SDMA is chaired by the chief minister of the state and has not more than eight members who are appointed by the chief minister.
- The SDMA prepares the state disaster management plan and implements the national disaster management plan.

District Level

Under Disaster Management Act 2005, every state government is responsible to establish a DDMA for every district in the State.

- The district administration is the focal point for the implementation of all governmental plans and activities.
- The actual day-to-day function of administering relief is the responsibility of the collector/district magistrate/deputy commissioner, who exercises coordinating and supervising powers over all departments at the district level.

District Disaster Management Authority (DDMA)

The state governments are mandated to set up a DDMA for every district under the Disaster Management Act 2005. The district disaster management authority consists of:

1. Chairperson - the collector or district magistrate or deputy commissioner acts as chairperson of DDMA.
2. Co-Chairperson - is the elected representative of the local authority.
3. In the tribal areas, the chief executive member of the district council of an autonomous district is the co-chairperson.
4. The DDMA makes a district disaster management plan and implements the state disaster management plan

City level

The constitution of India provides a mandate for democratic decentralisation through the 74th amendment, which sought to create an institutional framework for ushering in democracy at the grassroots level through self-governing local bodies in urban areas of the country. The 74th constitutional amendment provided constitutional status to urban local bodies and sought to empower them to perform 18 functions listed in the 12th schedule.

Per the 74th constitutional amendment, the local bodies can be effective instruments in tackling disasters through early warning systems, relief distribution, providing shelter to the victims, medical assistance etc (Government of Karnataka, 2020).

Figure 2.1. Organisation Tree of National Disaster Management Structure, India (NDMA)

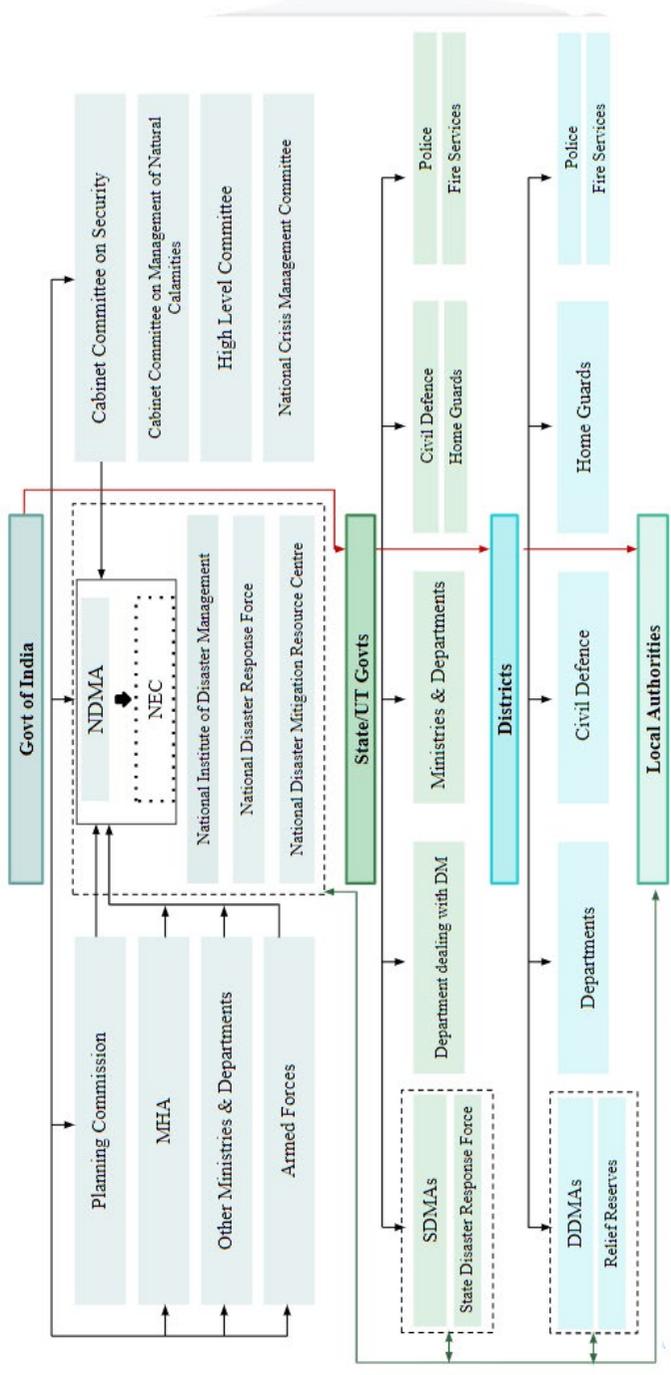




Photo Credit: Saikiran Kesari on Unsplash

3

ClimateSmart Cities Assessment Framework

City-level disaster preparedness, mitigation, response and recovery minimizes the urban risks associated with disasters, such as loss of lives, livelihoods, critical infrastructure and property.

The indicator on 'disaster resilience' CSCAF assesses the readiness of cities/ULBs to tackle disaster events and mitigate the loss and damages by taking actions prescribed in the NDMA guidelines. This includes identifying vulnerable hotspots, developing HRV assessments, developing city disaster management plans aligning to district disaster management plans, establishing end-to-end early warning systems and adopting relevant actions to reduce vulnerability to identified disasters.

Cities are scored based on the progressive steps taken towards building disaster resilience such as institutionalizing a dedicated disaster management cell that can initiate basic disaster response actions, conducting assessments to understand their vulnerability, and taking actions for building resilience, besides establishing communication networks in case of emergency. The Disaster Resilience indicator assesses the performance of the participating cities on 5 levels, with level 5 being the highest.

Figure 3.1. ClimateSmart Cities Assessment Framework



Table 3.1. Performance Evaluation Levels

	1	2	3	4	5
Progression Levels	Disaster and Risk Reduction is yet to be prioritized	Institutional Mechanism Established	Disaster Management Plan	Plan Implementation	Monitoring, Updating Mainstreaming
Evidence/ Data sources	City-level plan not initiated	<ul style="list-style-type: none"> • City level loss and damage data has been collated and documented (last 5 years) • Institutionalizing and establishing of dedicated Disaster Management Cell/ Emergency Operation Centre (EOC) within ULB (based on NDMA Guidelines, 2010) • First responders/ volunteers for disaster response identified. Training and mock drills conducted. 	<ul style="list-style-type: none"> • Ward-level Hazard Risk (hydrometer, geophysical and public health), Vulnerability and Capacity Assessment prepared for the current year in a participatory manner (based on NDMA Guidelines, 2010) • Map of ward wise hazard, vulnerability and capacity information as a .kml file (polygon geometry) • City Level Disaster Management Plan, prepared as per NDMA Guidelines and vetted by State Disaster Management Authority 	<ul style="list-style-type: none"> • Establishment of Early warning systems for priority risks incl. helpline and early warning systems along Weather Forecasting System are linked to Integrated Command and Control Centers (ICCC) for regular monitoring and managing emergency situations • Map of alert systems across the city as a .kml file (point or polygon geometry with attribute: type of alert) 	<ul style="list-style-type: none"> • Regular monitoring and review of City level Disaster Management Plan conducted • Mainstreaming disaster risk reduction in departmental plans within the ULB • The States/ City level Building Bylaws/ Development Controls/ Codes address hazard and vulnerability identified at level 2

	1	2	3	4	5
Responsible Department/ Agency	ULB in coordination with District administration, State Disaster Management Authority, State Revenue Department; State Irrigation Department				
Reference Document	Greater Chennai City Disaster Management Plan, 2018 - https://www.chennaicorporation.gov.in/images/CDMP%20Book%20Wrapper%20Full%20Book%20(%20English).pdf Ahmedabad Heat Action Plan, 2019 - https://www.nrdc.org/sites/default/files/ahmedabad-heat-action-plan-2018.pdf NDMA Guidelines, 2010, 2014, 2019 (https://ndma.gov.in/en/ndma-guidelines.html) SOP on Urban Flooding, 2017 (https://smartnet.niua.org/content/55ad7139-2d37-4831-a74a-d228720ce584)				
Score	0	25	50	75	100

4

Implementation Strategies

This chapter highlights the strategies to implement the city level disaster resilience measures, which include establishing an emergency operation centre and early warning systems, developing a city disaster management plan, conducting HVRA and mock drills, assessing loss and damage and having mechanisms to monitor, update and mainstream these strategies. The implementation strategies highlighted in this chapter are in line with the performance levels of the disaster resilience indicator of the CSCAF 2.0.

4.1. Assessment of Loss and Damage

The Paris Agreement has called for an enhanced 'understanding, action and support for averting, minimizing and addressing loss and damage' associated with climate-related disasters (MHA & UNDP, 2019). In India, the data on loss and damage is aggregated by the district and state disaster management authorities. The city authorities must document the data for loss and damage within the city limits. Furthermore, the damage and loss database should incorporate the following fundamental characteristics (UNNATI, 2007):

1. Should be compliant with similar global and local directives and initiatives
2. Should have the ability to aggregate data and report to the Sendai Framework and UNFCCC
3. Should contribute to the preparation of the national and local disaster reports, risk, vulnerability and capacity assessment
4. Should contribute to monitoring the national and local level SDG targets and initiative;

Table 4.1. A table indicating the types of loss and damage data to be collected, a participatory framework and toolkit, UNNATI

Loss and Damage data type	Indicators	Data collection sources
Human loss	Injured, dead, missing, directly affected, indirectly affected, evacuated	Hospitals, police/fire department, incident response units, SDRF, civil defence
Housing damage	Houses damaged, houses destroyed, damage type, construction type, built condition type	Housing department, urban development department, incident response units, SDRF, civil defence
Physical infrastructure damage	Roads, public buildings, vehicles, water supply, drainage, industries, public transport	PWD, development authority, water board, transport department, municipal corporation, Civil defence, SDRF
Community infrastructure damage	Education centres, hospitals and health centres, community spaces	PWD, health department, municipal corporation, Civil defence, SDRF
Environmental damage	Rivers and water bodies, urban vegetation, coastal ecosystems, green cover	Environment department, horticulture department, coastal zone management
livelihood loss	Agriculture, local trade and goods, small and medium industries	Finance department, trading authority, MSME dept, TVC
Health and psycho-social impact	Post-disaster diseases trauma, and associated mental health symptoms	Health dept, Incident response

4.2. Hazard, Risks, Vulnerability Assessment (HRVA)

HVRA is a process to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability/capacity that could pose a potential threat or harm to people, property, livelihoods and the environment. The objective of HVRA is to anticipate the potential problems and possible solutions to help save lives, protect property, assets, reduce damage and facilitate a speedy recovery.

Benefits of HVRA

- HVRA benefits the necessary authorities to prepare for emergencies.
- HVRA helps the policymakers, administrators and the community to make risk-based choices to address vulnerabilities, mitigate hazards, and prepare for response to and recovery from hazard events (Kerala SDMA, 2019)

Multi-Hazard Approach for HVRA

A multi-hazard approach considers more than one hazard in a given place (ideally progressing to consider all known hazards) and the interrelations between these hazards, including their simultaneous or cumulative occurrence and their potential interactions. The approach assesses the composite risk from all hazards so that integrated planning can be undertaken. Looking at hazards in isolation may result in a situation where mitigation measures proposed as a solution for one risk may create vulnerability for another hazard (Gill & Malamud, 2016).

Figure 4.1. Multi-hazard approach, (Gill & Malamud, 2016)

	1	2	3
A	Earthquake triggers landslides	Drought triggers agricultural practice change	Earthquake triggers nuclear reactor meltdown
B	Subsurface mining drives dewatering	Subsurface mining triggers mine collapse	Fluid injection triggers earthquakes
C	Transport accident triggers chemical spill	Dam collapse triggers flooding	Structural collapse drives infilled (made) ground

Why is a multi-hazard approach important?

- Improves preparedness, mitigate severe impacts of disasters and strengthen disaster response mechanisms
- Improves recovery management at all levels
- Builds capacity to assess and prioritize risks, prepare for, detect, respond to and

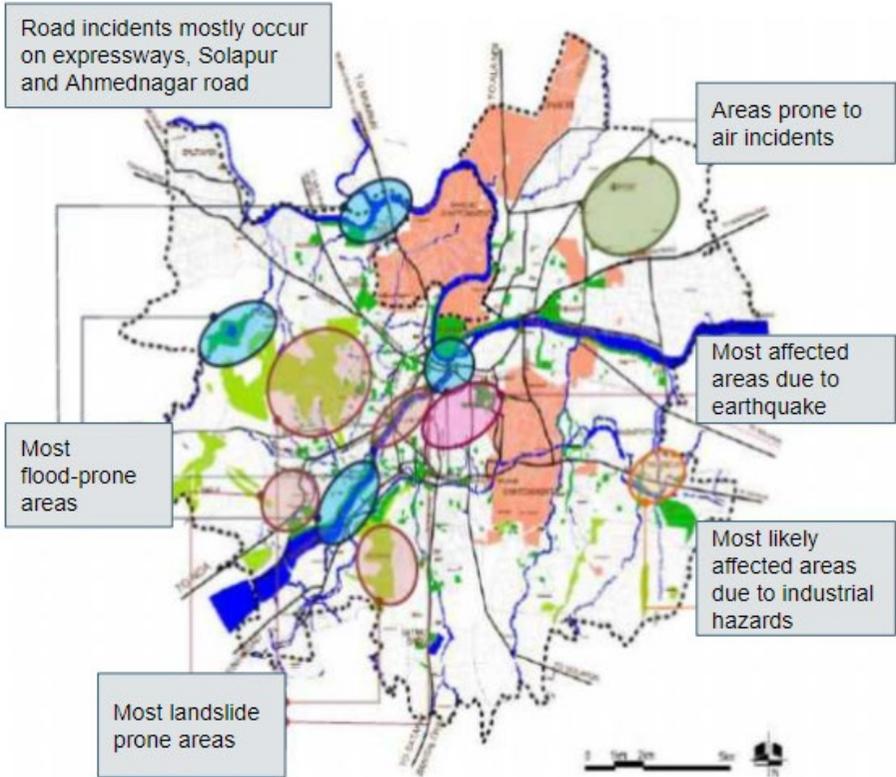
recover from multiple hazards with public health consequences in an effective and timely manner

How to conduct HVRA?

To efficiently conduct an HVRA, cities undertake the following steps:

1. Preparation of hazard and exposure database with a multi-hazard approach
2. Spatially mapping vulnerable population
3. Understanding building and infrastructure vulnerability, including age-based condition assessment
4. Ascertaining intensity and frequency of different hazards
5. Prioritising risk reduction measures based on the understanding of the risk

Figure 4.2. Multi-hazard HVRA map done by Pune for the Integrated Regional Disaster Management Plan



Basic Data requirements for carrying out HVRA

- Hazard, vulnerability and capacity dataset
- Base map with geology, topology, lithology layers
- Land use map
- Natural and man-made drainage layers
- Transport network
- Emergency services
- Building inventory

For a detailed example of how to conduct an HVRA on the ward level, please refer to the document on this link: <https://docs.google.com/spreadsheets/d/1HonOnUfliwayGLHRudTt bh2VzuLEfHUO/edit#gid=1406927493>.

The document contains indicators for a ward-level assessment of hazards, vulnerabilities and risks and a database template on ward-wise data representation of the scale of impact.

4.3. City Disaster Management Plan

A city disaster management plan (CDMP) is the creation of actions through which the urban communities mitigate the risks of hazards. It is designed to enhance institutional and community resilience towards disasters and climate change on a city level. The plan is made in alignment with district disaster management plans but focuses specifically on urban challenges.

How does a CDMP help in Disaster Management?

- Through CDMP, cities can have a better understanding of disasters occurring within the city limits
- It enables city authorities and departments in providing capacity building and logistics support to the district, state and national disaster management authorities.
- It helps cities localise disaster preparedness, mitigation, response and recovery by ward-level management and mobilising local resources
- It ensures minimum disruption of the city activities, lives and property.

Components of a City Disaster Management Plan

The following are the broad components of a CDMP (NDMA, 2014):

1. City Profile

The profile of a city may include its historical context, demography, geography and climate, soil, flora and fauna, crops and irrigation, information about industries and land use et al.

2. Hazard, Vulnerability and Risk Assessment

HVRA requires a multi-hazard profile of the city, historical information on disasters, seasonality of disasters, a population vulnerable to various hazards and various risks posed by the hazards in the city. CDMP can have a ward-level multi-hazard HVRA.

3. Institutional Arrangements

Institutional arrangements include a disaster management cell/emergency operations centre for managing disasters by effective coordination, decision-making and flow of information. It also includes the technical staff, transport and personnel for normal and emergency operations.

4. Preparedness Measures

Based on the HVRA, the CDMP includes measures to minimise the risks of disasters. This may include annual maintenance measures, mock drills, identifying evacuation routes, materials, communication and outreach, among others.

5. Mitigation Measures

These include activities that prevent and reduce the likelihood of a disaster or reduce the damaging effects of unavoidable emergencies. Mitigation measures such as resilient city planning, development control norms, IEC activities for disaster awareness etc. focus on decreasing the need for emergency response.

6. Response Measures

These are the activities that reduce the impact of a disaster and enable timely and proper deployment of human resources and sequencing of actions to effectively save lives and livelihoods in an emergency. These measures include hazard-specific responses, early warnings, emergency operations etc.

7. Relief and Recovery Measures

These are the activities and actions that need to be initiated and taken up following the end of the response phase. The required actions along with roles and responsibilities of all concerned stakeholders are laid down in the CDMP for the recovery and reconstruction phases. These measures include search and rescue operations, restoring transport and communications, medical assistance, setting up of relief shelters, documentation of loss and damage etc.

8. Capacity Building Measures

These include identifying the capacity gaps and training the officials, responders and other personnel for effective preparedness, mitigation, response and recovery.

9. Budgetary Provisions

The successful implementation of the actions under the CDMP has to be ensured by providing a suitable budget. Budgetary provisions should be made as a part of CDMP for different activities and phases of city disaster management.

10. Plan Management

This includes setting up a system to develop, implement, monitor, review and update the CDMP on time.

For further information, please refer to the following City Disaster Management Plans:

Figure 4.3. City Disaster Management Plans of Gangtok and Visakhapatnam

<p>City Disaster Management Plan, Gangtok</p> <p>http://www.ssdma.nic.in/Uploads/PdfFiles/CityDisasterManagement.pdf</p>	<p>City Disaster Management Plan, Visakhapatnam</p> <p>https://apsdma.ap.gov.in/common_mns/DM_plans/CDMP_pdf/CDMP_Vizag%20Vol-II.pdf</p>

4.4. Establishment of an Emergency Operations Centre (EOC)

An EOC is a facility where organisations and stakeholders come together during an emergency to coordinate response and recovery actions and resources. These centres may be alternatively called command centres, control rooms, situation rooms, crisis management centres et al (E-gyankosh, 2017).

Features of an EOC

Flexibility: Plan operations and adapt operational space to meet the needs of hazard events.

Sustainability: Support operations for 24 hours/seven days a week during all emergencies without interruption; to the extent practicable.

Security: Guarded against potential risks and its operations should be protected from unauthorised disclosure of sensitive information.



Photo Credits: Emergency Operations Centre, Andhra Pradesh State Disaster Management Authority

Interoperability: Share common principles of operations and exchange routine and time-sensitive information with other national/state/district EOCs and incident response teams.

How to Set up an Emergency Operations Centre in Cities

Emergency Operations Centres can be set up on national, state, district, city and/or organisational levels. The capacity and strength of the EOCs at each level may vary according to the context and area of operation but the primary aim of an EOC remains the same. Having EOCs on a city level enhances the urban capacity to mitigate the effects of any disaster and offers the city authorities opportunities to coordinate, plan and respond better in case of an emergency (E-gyankosh, 2017).

For cities, setting up an EOC can be classified into the following 4 steps.

Step 1: Understanding the functions of the EOC

This step includes developing an understanding of the roles and responsibilities undertaken by the EOC in the pre-disaster, during and post-disaster phases of any emergency in the city. Below is a broad classification of the functions for the EOC for effective disaster response.

Table 4.2. Functions of the EOC

Pre-disaster Functions	
 <p><small>Created by iStock/Getty Images Plus</small></p>	<p>Maintain a systematic database of disaster events, risk zones, safe zones, first responders etc.</p>
 <p><small>Created by iStock/Getty Images Plus</small></p>	<p>Conduct mock drills, IEC activities and outreach initiatives with citizens</p>
During-disaster Functions	
 <p><small>Created by iStock/Getty Images Plus</small></p>	<p>Prioritise resource distribution and requisition additional resources from district/state/national authorities</p>
	<p>Monitor and assess the affected areas in real-time</p>
	<p>Conduct evacuation, search and rescue operations</p>
 <p><small>Created by iStock/Getty Images Plus</small></p>	<p>Coordination and communication with other EOCs, line departments and first responders</p>
Post-disaster Functions	
 <p><small>Created by iStock/Getty Images Plus</small></p>	<p>Consolidate, analyze, and disseminate damage and loss data</p>
 <p><small>Created by iStock/Getty Images Plus</small></p>	<p>Coordinate with departments for relief and rehabilitation efforts</p>

Step 2: Organising the EOC into sections to manage operations

This step includes categorising various operations of the EOC into management, operations, planning and intelligence, logistics, finance and administration sections (University of California MERCED, 2022).

Management: This section has overall responsibility for the management and direction of all EOC activities including development, implementation and review of strategic decisions.

Operations: This section represents on-scene emergency responders and provides coordination between the EOC and field operations.

Planning and Intelligence: This section is responsible for receiving, evaluating and analyzing all disaster information and providing updated status reports to EOC management and field operations. The planning and intelligence section is also responsible for damage assessment and developing specialized technical assessments of events.

Logistics: Logistics is responsible for procuring supplies, personnel and material support necessary to conduct emergency responses (e.g., personnel call-out, equipment acquisition, lodging, transportation, food, etc.).

Finance and Administration Section: The section handles cost accountability, purchase authorizations, documentation and risk assessment.

Step 3: City-specific identification of stakeholders

Once the operational framework of the EOC has been established, the next step is to identify the stakeholders who need to participate in the emergency response activities. These stakeholders may vary as per the context, hazard risks and administrative structures in different cities. The below graphic broadly indicates the stakeholder agencies that may partner and operate the EOC.

Step 4: Allocating resources and assigning roles

As a final step, the city authorities can describe or identify the EOC staff and equipment requirements necessary for an EOC. Cities should map roles and responsibilities to different sections of the EOC and the stakeholders before, during and after a disaster.

Some of the indicative roles at an emergency operations centre are (Himachal Pradesh State Disaster Management Authority, 2011):

Figure 4.4. Stakeholders for an Emergency Operations Centre



Operation and Service

The responsibilities for the Operation division could lie with the revenue department. In an emergency, some of the functions of the operations desk will be to

- Manage the rescue and evacuation efforts
- Requisition of accommodation, transport and other necessary equipment for relief groups
- Construct of temporary shelters, school buildings, medical facilities
- Ensure adequate food, water and shelter to the needy
- Manage transportation and logistics
- Coordinate with government departments, NGOs, first responders and district/state EOCs
- Organize and clear debris and temporary repair of communication facilities, power supply and water supply

Communication

This division can be handled by the Public Relations department of the ULB. The roles and responsibilities under Communication will be to

- Monitor the weather reports and share the information;
- Keep the contingency plans along with all necessary maps in hand
- Maintain a database of important information, resources and key people
- Send and receive messages and keep records of the communication
- Maintain information on damage, materials sent and ongoing activities for immediate sharing with the District EOC

Logistics

The logistics division can be jointly handled by the transport department and the public works department (PWD). The roles and responsibilities under this division will be to

- Assess the need in terms of manpower and resources and ensure regular supply;
- Ensure proper storage and transport facilities for relief materials
- Maintain an adequate supply of necessary transport and equipment
- Coordinate with private transport associations for emergency management
- Organize transportation for rescue parties, evacuated people, medical teams and injured or sick people.

Health

The health division can be managed by the Health Department. The roles and responsibilities will be to

- Organize treatment of injured and sick, disposal of carcasses
- Ensure preventive medicine and anti-epidemic measures are taken

- Maintain a record of all activities
- Assess and ensure setting up medical relief camps
- Maintain an adequate supply of medicines, equipment and personnel
- Monitor maintenance of health measures in all relief camps and provide safe drinking water

Resource

The Resource division can be managed by the Revenue Department. The roles and responsibilities will be to

- Maintain cash and disbursements receipts and records on dispatched relief materials, compensation (TA/DA) of relief duty staff, daily wages and compensation paid
- Issue all cash and material receipts
- Enable reimbursement of all approved expenses
- Issue cash vouchers for fuel and other necessary items

4.5. Emergency Management Exercises

Emergency management exercises are conducted to improve the urban disaster management capacity of the city's emergency infrastructure, responders, education institutions, hospitals, humanitarian agencies and other actors working in disaster-related fields. They are a vital assessment, evaluation and testing tool for designing disaster management plans (NDMA, 2015).

Prerequisites for Emergency Management Exercises:

1. Multi-hazard risk assessment and development profile of the city

This should document the city's recent disaster and emergency history as well as the seasonality of hazards. The profile should also contain information on the city's current social and economic position, which include information on a vulnerable population, population density, schools, commercial areas, industries, low-lying areas and the development challenges.

2. Institutional and technical systems for disaster management

The city should already have some sort of disaster management framework in place and should have identified the organizations and agencies responsible for disaster management and emergency response.

3. Disaster Management Plan

As the primary purpose of an emergency management exercise is to ascertain the effectiveness of disaster management strategies, there should already be a city disaster management plan with standard operating procedures for ESF teams and government authorities along with sector-specific disaster strategies.

4. Emergency Operations Centre

There should be an operational Emergency Operations Centre and functional

interagency communication and coordination systems in the city (NDMA, 2015).

For detailed steps on conducting emergency management exercises, please visit the link to the NDMA training manual 'How to Conduct Emergency Operation Exercises'. <https://ndma.gov.in/sites/default/files/PDF/Reports/training%20manual-EMEx.pdf>



Photo Credits: Mock Drills/Training, NDMA

4.6. Early Warning System

An early warning system is a part of the disaster response measures. EWS is needed to empower individuals and communities threatened by hazards to act in sufficient time and in an appropriate manner to reduce the possibility of personal injury, loss of life and damage to property and the environment. A successful EWS protects life and livelihood, land and infrastructures and is instrumental in supporting long-term sustainability in cities, regions and countries (UNISDR, 2006). An early warning system comprises 4 broad elements illustrated in the figure:

1. Risk Knowledge

The combination of hazards and vulnerabilities gives rise to risks at a particular location. Risks must be assessed through a systematic collection of data on multiple hazards and vulnerabilities. The risk assessment must take into account the processes

of urbanisation, environmental degradation and climate change. A timely assessment of risks can help the local government in better disaster mitigation, response and recovery.

2. Monitoring and Warning Service

Continuous monitoring of hazards parameters is essential to generate accurate and timely warnings. An early warning system should inculcate accurate predicting and forecasting capabilities for multiple hazards in a scientific manner.

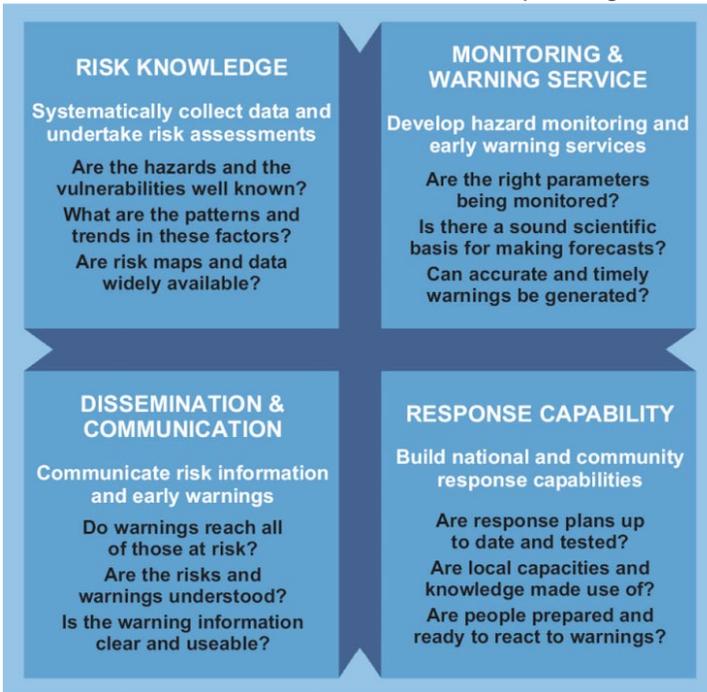
3. Dissemination and Communication

Warnings generated by an EWS must reach those at risk on time. The warning message must be clear and simple and contain useful information for effective response to safeguard lives. Multiple communication channels must be used to disseminate a warning so that the information reaches maximum people in time.

4. Response Capability

Warning dissemination should lead to a timely and effective response. The response capabilities can be enhanced through the development of city-level disaster management plans and information, education and communication activities for the communities at risk. For more information on developing or evaluating early warning systems, please refer to a simple checklist of main elements and actions prepared by the UN/ISDR here. https://www.unisdr.org/files/608_10340.pdf

Figure 4.5. Four Elements of People-centred Early Warning Systems, UN/ISDR Platform for the Promotion of Early Warning



Early Warning System of the Indian Meteorological Department

The India Meteorological Department (IMD) is the principal government agency in India in all matters relating to meteorology and allied subjects. IMD issues early warnings for a range of weather-related hazards. The following colour codes are used in weather warnings for bringing out the severity of the weather phenomena expected. This mainly serves as a signal for the disaster management authorities about the impact of the weather expected to keep them ready for necessary action related to disaster risk reduction (IMD, 2021).

Figure 4.6. Early warning colour code of IMD

WARNING (TAKE ACTION)
ALERT (BE PREPARED)
WATCH (BE UPDATED)
NO WARNING (NO ACTION)

IMD has developed a Standard Operation Procedure to provide uniform monitoring of weather, especially disastrous weather events. The SoP can be accessed here: https://www.unisdr.org/files/608_10340.pdf

Integration of Early Warning System and ICCC

The Integrated Command and Control Centres are developed in smart cities to aggregate information across multiple applications and sensors deployed across the city, and then provide actionable insights for the city officials. The ICCCs, equipped with Internet of Things (IoT) based real-time early warning systems, can enable quick response from the city administration and citizens during incidents of emergencies and disasters.

The ICCC can implement use cases related to disaster and emergencies through their core 4 functionalities, which are (MoHUA, 2020):

1. Data acquisition

To ingest data from different edge devices (sensors, devices, actuators), various sub-systems, open APIs and systems.

2. Data correlation and analysis

To analyze the multidimensional data and create patterns, trends, correlation and forecasting for decision making.

3. Command and control

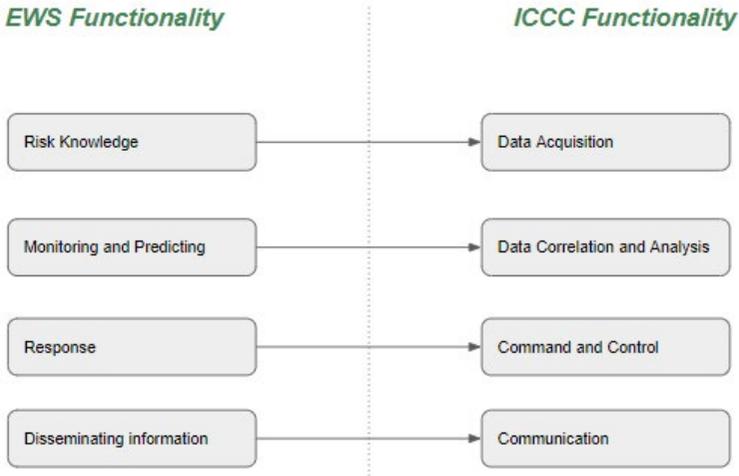
To configure or automate processes to handle events in different scenarios.

4. Communication

To connect with edge devices, mobile assets and resources to enable the communication or facilitate the management of different systems.

Drawing parallels between the functionalities of ICCC and the Early Warning System, it can be concluded that Early Warning Systems can be seamlessly integrated into the ICCCs to leverage their highest potential for disaster response.

Figure 4.7. Correlation between the functionalities of the ICCC and EWS



The below images illustrate the key functions performed at ICCCs for emergency response use cases. These functions can be utilised to set up an early warning system. For more details on the ICCC emergency and disaster management, please refer to the indicative list of use cases under the Annexure-II of the ICCC Maturity Assessment Framework. here. https://smartnet.niua.org/sites/default/files/resources/iccc_maturity_assessment_framework_imaf_.pdf

Figure 4.8. ICCC functions under Data Correlation to be leveraged for the Risk Knowledge component of an Early Warning System by UN/ISDR

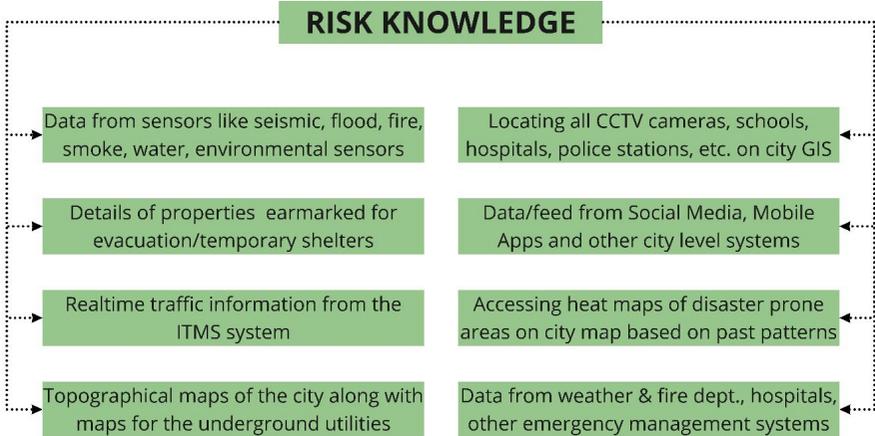


Figure 4.9. ICCC functions under Data Correlation and Analysis to be leveraged for the Monitoring and Warning component of an Early Warning System by UN/ISDR

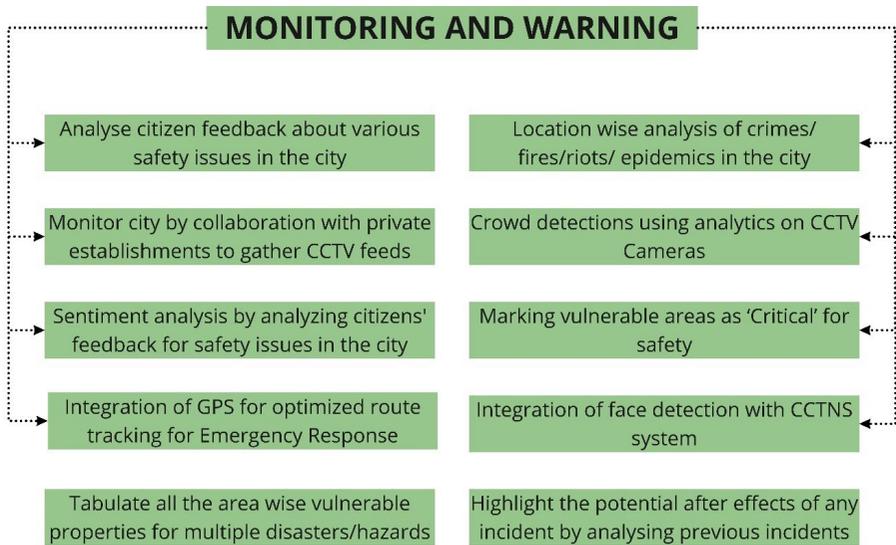


Figure 4.10. ICCC functions under Command and Control to be leveraged for the Response component of an Early Warning System by UN/ISDR

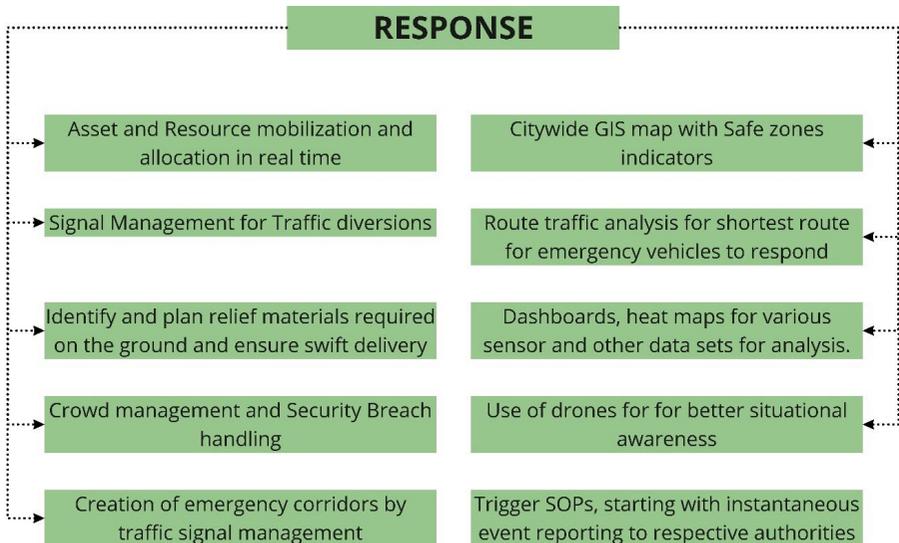
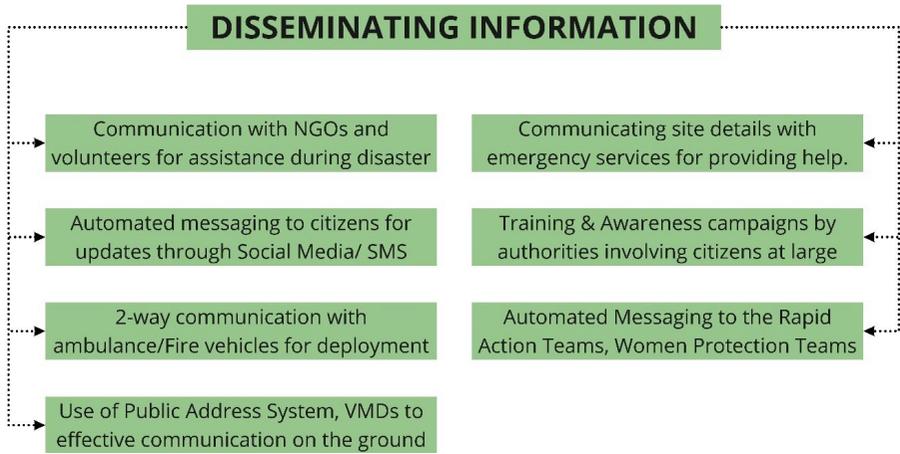


Figure 4.11. ICCC functions under Communication to be leveraged for the Disseminating Information component of an Early Warning System by UN/ISDR



4.7. Monitoring, Updating, Mainstreaming

Monitoring and Updating involve setting up systems to consistently review the progress of disaster management plans against key performance indicators and updating the plan based on the data and learnings gathered from disaster events. Monitoring is a continuous process that entails the regular collection and analysis of data to assist timely decision making, check whether activities are being executed according to plan, ensure accountability and provide the basis for evaluation and learning.

Mainstreaming disaster management into the development planning process essentially means analysing the programs, activities and projects that are being planned, not only from the perspective of reducing the existing risks of disaster disasters but also from the perspective of minimizing its potential contribution to the creation of new risks of disasters (UNESCAP, 2022).

The city-level disaster management plan must be reviewed on their performance on key indicators timely. It should be updated regularly and mainstreamed within the development policies, plans and programs.

To monitor, update and mainstream the plan, the following actions are recommended (NDMP, 2016) (UNISDR, 2012):

1. Formulate a strategy for monitoring and evaluation to implement the plan using training events, exercises and real-time incidents.
2. Identify performance indicators to track progress and achievement of the plan's vision and objectives
3. Define responsibilities for carrying out the monitoring and evaluation and establish a timeline for delivering progress reports of the tasks identified and implemented under the plan
4. Include feedback mechanisms and consultation with the community and other stakeholders as a part of the monitoring and evaluation strategy
5. Mainstream the city disaster management plan by including the actions identified under it into city/state level development plans, bylaws, building codes, development control codes and regulations.
6. Timely update the plan with technical inputs from the ULB and other stakeholders and evidence gathered through regular monitoring of the plan.
7. Develop data-driven decision support systems to monitor the progress of the disaster management plan and obtain insights to support actions.

For more information, please refer to:

Monitoring actions under the National Disaster Management Plan: <https://www.mha.gov.in/sites/default/files/National%20Disaster%20Management%20Plan%20May%202016.pdf>

A handbook on How to Make Cities More Resilient. https://www.preventionweb.net/files/26462_handbookfinalonlineversion.pdf

UNISDR Monitoring and Evaluation Framework. https://www.preventionweb.net/files/49324_unisdrmeframeworkver1.0.pdf

5

Case Studies

5.1. City Disaster Management Plan: Vijayawada

Access the plan document here.

https://apsdma.ap.gov.in/common_mns/DM_plans/CDMP_pdf/CDMP-Vijayawada.pdf

Introduction

Vijayawada is one of the best performing cities in the Disaster Resilience Indicator, successful in placing preparedness, response and recovery systems for tackling disasters. The city developed the disaster management plan in 2015 to reduce the risks of disasters amplified by the negative impacts of unprecedented urbanisation like heat islands and inundation of low lying areas.

The objective of this plan is to reduce overall disaster risks in the city of Vijayawada through appropriate planning to prevent the loss of human lives and property. The Plan lays down strategies to enhance the capacity for better response during a disaster as well as appropriate actions for disaster prevention and mitigation. The Plan has specific sections on city profile, hazard risks and vulnerability analysis, preparedness, response and mitigation. It provides hazard-specific actions and lays down standard operating procedures for all key departments. A comprehensive resource inventory along with a list of important telephone numbers and other contact details is provided in the annexure for better response and preparedness planning.

Methodology

A series of steps were taken to formulate the disaster management plan, which is highlighted below:

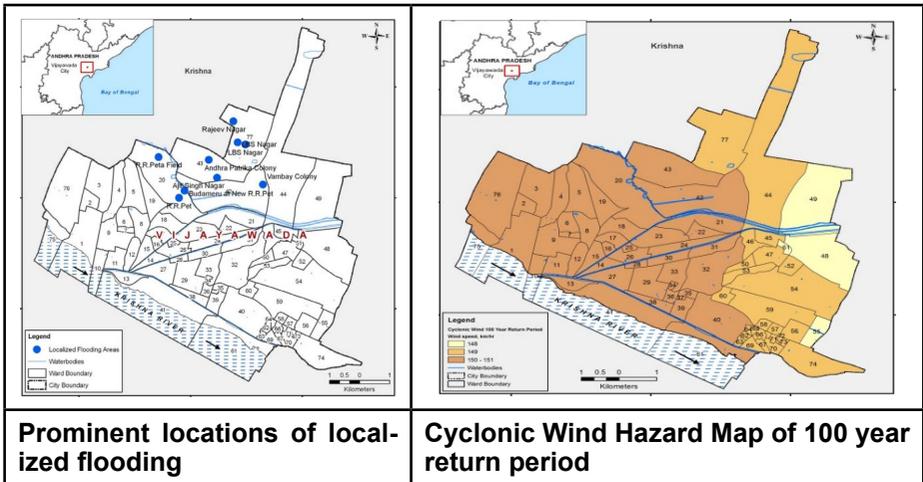
1. An inception workshop with line departments was conducted by UNDP on Climate Risk Management.
2. An expert agency was invited to review the existing city plan and recommendations through consultations with the ULB and line departments.
3. A standard framework for the plan was prepared by IRADe, New Delhi, and other expert agencies
4. The project steering committee, Hyderabad recommended local academic institutions develop the city disaster management plan based on the framework.
5. Consultations were held with the Department of Environmental Sciences, Nagarjuna university while developing the plan
6. A series of meetings with the ULB and other line departments on experiences for updating the city disaster management plan
7. Sharing of draft city disaster management plan for Vijayawada with VMC and other line departments for feedback
8. With recommendation and feedback on the draft plan, prepared city disaster management plan for Vijayawada

Features

1. The city identifies a warning mechanism along with a set of mitigation activities and the agency responsible to execute the actions on the ground.
2. Identified recommended early warning system and suitable equipment.
3. Non-structural mitigation measures/Integrated human resource development service Programmes (awareness, counselling, health care, economic safety measures, social safety measures, institutional safety measures).
4. Annual ward action plan along with identified activities under physical, Health protection, economic development, social development, another general.

5. The plan contains capacity building and training measures, along with an annual training calendar.
6. Natural disaster mitigation strategies for civilians.
7. The plan includes profiling, capability analysis (municipal infrastructure, resources, manpower), hazard, risk and vulnerability analysis (floods, landslides, earthquakes, cyclones, tsunami) and contingency planning for various hazards.
8. The plan enlists health epidemics along with high-risk areas within the city.

Figure 5.1. Hazard maps for Flooding and Cyclone in Vijayawada CDMP



Financial Arrangements

To meet up the expenditure of immediate relief and response, the plan envisages the state disaster response fund to be mobilized. In the event of a shortfall of funds, at the request of the state government, additional financial assistance will be provided from the national disaster response fund by the Government of India.

The plan specifies that the municipal corporation will allocate an annual budget for disaster preparedness and effective response. This fund is to be used to create awareness as well as take necessary preparedness measures for floods, cyclones, landslides, fires etc. The fund will also be used for conducting various training and capacity building programmes as well as for procuring emergency equipment for disaster response. In addition to this, each of the wings of the corporation will take up necessary disaster risk reduction measures through their regular development plans and allocate the necessary budget for the same.

Monitoring and Updation

The plan has envisaged the following activities for monitoring and updating.

1. The city disaster management plan will be updated half-yearly during (May & Oct). In addition to it, the contingency plan of each line department will also be updated half-yearly and two annual meetings will take place every year for reviewing these plans.
2. To test the efficacy of the plan, mock drills will be conducted twice annually by the municipal corporation of Vijayawada in coordination with the office of the joint collector.
3. national disaster response force (NDRF) and the police department will also be involved in creating city level awareness and conducting mock drills at ward level within the city.
4. Vijayawada municipal corporation will also take help from the Police and Fire department to conduct fire drills in important public buildings and schools.
5. CDMC will review the city disaster management plan periodically after the inputs from the trial implementation [mock drills], the inputs and learning can be the basis for further strengthening the city disaster plan.
6. In the implementation of the plan, an exclusive senior officer shall be assigned to facilitate implementation, to make trials periodically and to update on the recommendation by the city disaster management committee.

5.2. City Disaster Management Plan: Visakhapatnam

Access the plan document here: https://apsdma.ap.gov.in/common_mns/DM_plans/CDMP_pdf/CDMP_Vizag%20Vol-II.pdf

Introduction

The City of Visakhapatnam, also known as Vizag, is one of the important cities on the east coast of India. It is also one of the top performers in the Disaster Resilience indicator of the CSCAF 2.0. It is the largest city in the state of Andhra Pradesh and is known for its potential as the industrial and financial capital of the state. Visakhapatnam experiences a variety of natural disasters throughout the year, which occur in 74% of the total area in which 63% of the population resides and is vulnerable to hazards. To enhance its ongoing efforts to reduce disaster risks, the Greater Visakhapatnam Municipal Corporation developed the city disaster management plan.

The objective of preparing the CDMP was to help in building a safer and disaster-resilient Visakhapatnam. The task of preparation of the plan was given to Andhra University College of Engineering and efforts were made to synchronize the plan with the national policy on which State and District DMPs are prepared. Further, inputs were taken from both HRVA and EWS for the preparation of the plan. The CDMP is prepared using the Hyogo framework of action.

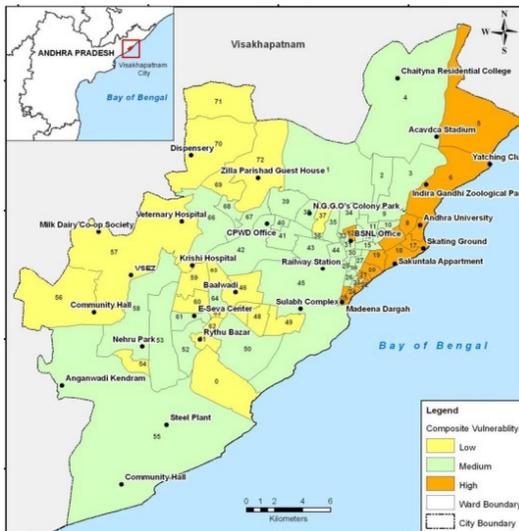
Methodology

1. Stakeholder consultations and meetings with the community stakeholders and city authorities
2. Field visits were conducted at the vulnerable locations and communities at risk were identified
3. Departmental interactions were conducted for effective coordination and assignment of roles
4. Data and information were gathered through primary and secondary sources
5. Existing plans and systems were reviewed
6. Collation and finalization for the plan happened after a series of consultations and technical meetings

Features

1. Includes a ward wise multi-hazard HVRA and a vulnerability index, which is developed by the juxtaposition of hazard areas with the exposed population. The vulnerability index has high, medium and low-risk levels. Highly vulnerable zones cover most of the populated zones of the city particularly along the coast towards the north. However, the medium zones cover most of the geographical area of the city.
2. Proposes to set up a city-level disaster management cell/department to undertake disaster risk reduction measures for public safety and security.
3. Focuses on the dissemination of knowledge and training of the vulnerable communities in the city through workshops and IEC activities.
4. Incorporates a multi-hazard approach to disaster management by identifying preparedness, response, recovery, mitigation and capacity-building measures for several hazards occurring in the city.

Figure 5.2. Composite Vulnerability Map of the CDMP, Visakhapatnam



Annual Preparedness Measures

The plan envisages preparedness measures to be taken well in advance to make the city resilient for various disasters. Mock Drills (MD) for respective disasters are carried out during the respective months where disaster occurrences are likely, as shown in the figure below. The CDO organizes regular mock drills with 200 persons in a session, which are to be utilized for training the GVMC officials and vulnerable communities.

Figure 5.3. CDMP highlights the probability of annual occurrence of disasters

PROBABILITY OF ANNUAL OCCURRENCE OF DISASTERS												
Natural Disasters / Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cyclone					MD							
Flood / Reservoir						MD						
Tsunami/Storm Surge	MD											
Earthquake*	MD											
Landslide						MD						
Heat Wave		MD										
Epidemic	MD											
Forest Fire		MD										
Legend		High		Low			*Zone-III of low intensity and less frequent. Can occur anytime.					

6

Interactive exercise

The interactive exercise is developed with the intent to familiarize the participants with the early warnings issued by the Indian Meteorological Department (IMD) for various weather-related hazards. The goal is to enable an understanding of the warnings in terms of the real-world impact of the hazards for which the warnings are issued.

The exercise is designed for the following weather-related hazards:

1. Air Quality
2. Heatwave
3. Cyclone
4. Rainfall (Mumbai Coastal Scenario)
5. Flood

Exercise Format

1. A board with different hazard warning levels and a set of chits with associated impacts/indicators is presented to the participants
2. The warning levels have to be correlated with the associated impacts/indicators. The participants have to drag and drop the chits in the relevant boxes below the warning levels.

Table 6.1. A table showcasing the snapshot of the disaster resilience exercise

Cyclone	Mark answers here	Associated Indicators/Impacts
Pre-cyclone watch		<ol style="list-style-type: none"> 1. Development of cyclonic disturbance. 2. Landfall time and location forecast 3. Coastal areas likely to be affected identified 4. Inland areas to experience adverse weather identified 5. Associated heavy rainfall, strong wind and storm surge forecast. 6. Cyclone's likely direction of movement after the landfall identified
Cyclone alert		
Cyclone warning		
Post landfall outlook		
Heatwave		
Normal Day (No Action)		<ol style="list-style-type: none"> 1. Heat illnesses and heat strokes very likely among all age groups. 2. High health concern for vulnerable people. 3. Heat generally tolerable. 4. Heat illness symptoms might appear in people exposed to the sun or doing heavy work. 5. Heat generally tolerable but moderate discomfort to vulnerable people.
Heat Alert (Be Prepared)		
Severe Heat Alert (Be Prepared)		
Extreme Heat Alert (Take Action)		
Rainfall		

Cyclone	Mark answers here	Associated Indicators/Impacts
Moderate Rainfall		<ol style="list-style-type: none"> 1. Danger to trees and old structures 2. Traffic congestion 3. Slippery roads 4. Short-term disruption to municipal services 5. Localized flooding/waterlogging of low lying areas 6. Possibility of inundation of coastal areas 7. Major roads/local trains affected 8. Possibility of local landslides in elevated hilly areas 9. Widespread water logging/ flooding in most parts of low lying areas
Heavy rainfall with moderate to intense spell		
Very heavy rainfall		
Heavy rainfall with isolated extremely heavy rainfall at isolated places		
Flood		
Nil to Low Flood		<ol style="list-style-type: none"> 1. Disruption in key emergency services 2. The water level remains below the danger level 3. Several areas in the city inundated 4. Wide-scale damage of urban infrastructure, trees, livestock 5. The water level is within 0.5 meters of the HFL 6. Water level crosses the danger level 7. Water level crosses the HFL 8. Several areas in the city inundated 9. Traffic standstill in affected areas
Moderate Flood		
High Flood		
Unprecedented Flood		
Air Quality		
Good (0-50 µg/cum)		<ol style="list-style-type: none"> 1. Minor breathing discomfort to sensitive people 2. The respiratory impact even on healthy people 3. Serious health impacts on people with lung/heart disease 4. Respiratory illness to the people on prolonged exposure 5. Respiratory illness pronounced in people with lung/heart diseases 6. Breathing discomfort to people on prolonged exposure 7. Breathing discomfort to people with lung disease 8. Discomfort to people with heart disease, children and older adults 9. Minimal health issues
Satisfactory (51-100)		
Moderate (101-200)		
Poor (201-300)		
Very Poor (301-400)		
Extreme (401-500)		

3. A second board with a list of priority actions based on the early warning is presented to the participants, wherein they are asked to put a 'thumbs-up' sign on the actions they are taking in their city.

To access the detailed content of the exercise, including the IMD warnings on the above mentioned weather-related hazards, their associated impact and suggested actions, please refer to the document here: <https://docs.google.com/spreadsheets/d/18YHzDwGTlwhbJxDiCJVYD5p7tlf-Ae6vZITwRdjj71g/edit#gid=0>

A snapshot of the exercise is given in the figure.

Priority Actions by Cities based on the IMD Warning

	1 Increase bus and metro services by augmenting contract buses and increasing frequency of service	2 Congestion management at traffic junctions, congestion pricing, low-emission zones (LEZ), etc.
	3 Alert in newspapers/TV/radio to advise people with respiratory and cardiac patients to avoid polluted areas and create a weather assessment.	4 Stringently enforce/stop garbage burning in landfills and other places and impose heavy fines
	5 Do periodic mechanized sweeping on roads with heavy traffic and water sprinkling also on unpaved roads every two days	6 Stringently enforce rules for dust control in construction activities and their non-compliance cases
	7 Increase frequency of mechanized cleaning of road and sprinkling of water on roads. Identify road stretches with high dust generation.	8 Shut down heavy polluting industries and take action against non-compliance
	9 Stop construction activities	10 Stop entry of heavy polluting vehicles like trucks into the city and create truck terminals at designated spots
	11 Stop use of coal/firewood in houses and open spaces	12 Shut down schools
	13 Information dissemination Social media, mobile Apps should be used to inform people about the pollution levels, nearest details of control room, enable them to report polluting activities/sources to the concerned authorities	14 Promote EV and NEM in the city
	15 Develop green buffers along the traffic corridors, dewatering of open areas and creation of parks and gardens. Plant native species that absorb fine dust	16 Carry out emission testing for the public buses and fleet maintenance with EV buses

7

List of Additional Materials

Handbooks, Manuals and Procedures

1. Developing Disaster-Risk Resilience in Cities by National Institute of Disaster Management
https://nidm.gov.in/PDF/pubs/capres_DDRRC.pdf
2. Training Manual on 'How to Conduct Emergency Operation Exercises' by NDMA
<https://ndma.gov.in/sites/default/files/PDF/Reports/training%20manual-EMEx.pdf>
3. Monitoring and Evaluation Framework by UNISDR
https://www.preventionweb.net/files/49324_unisdrmeframeworkver1.0.pdf
4. Standard Operation Procedure - Weather Forecasting and Warning Services by IMD
https://mausam.imd.gov.in/imd_latest/contents/pdf/forecasting_sop.pdf
5. Urban Flooding: Standard Operating Procedure by MoUD (Now MoHUA)
https://smartnet.niua.org/sites/default/files/resources/SOP%20Urban%20flooding_5%20May%202017.pdf
6. Mainstreaming Disaster Risk Reduction & Climate Change Adaptation in the National Flagship Programmes
<https://ndmindia.mha.gov.in/images/pdf/Final%20report%202019.pdf>
7. Multi-Hazard Risk and Vulnerability Assessment (HRVA) for City of Cuttack, Odisha
<https://ndmindia.mha.gov.in/images/pdf/UNDPCuttackHRVAreport.pdf>

8. Action Plan for Mainstreaming Disaster Risk Reduction and Climate Change Adaptation
<https://ndmindia.mha.gov.in/images/pdf/ActionplanformainstreaminigDRRandCCAinForestdepartmentofAP.pdf>
9. Disaster Risk Reduction: A Handbook for Urban Managers
<https://ndmindia.mha.gov.in/images/pdf/DRRHandbookUrbanManagers.pdf>
10. Review Of Early Warning System in Bhubaneshwar, Gangtok, Madurai, Navi Mumbai, Shimla, Thiruvananthapuram And Visakhapatnam
https://ndmindia.mha.gov.in/images/pdf/09_SummaryReport7cities.pdf
11. Mainstreaming Disaster Risk Reduction (DRR) and Climate Change Adaptation (CAA) in Development Programs, Odisha
[https://ndmindia.mha.gov.in/images/pdf/MainstreamingDisasterRiskReduction\(DRR\)andClimateChangeAdaptation\(CCA\)inDevelopmentPrograms.pdf](https://ndmindia.mha.gov.in/images/pdf/MainstreamingDisasterRiskReduction(DRR)andClimateChangeAdaptation(CCA)inDevelopmentPrograms.pdf)
12. Navi Mumbai Municipal Corporation- Fire Hazards Response and Mitigation Plan
<https://ndmindia.mha.gov.in/images/pdf/NaviMumbaiMunicipalCorporationFireHazardsResponseandMitigationPlan.pdf>
13. Assessment of Disaster Risk Management effectiveness responding to very severe cyclonic storm Phailin in Odisha
<https://ndmindia.mha.gov.in/images/pdf/PhailinReport-UNDP-Odisha.pdf>

Disaster Management Plans

National Disaster Management Plan (NDMP)


 National Disaster Management Authority
 Ministry of Home Affairs
 Government of India
 May 2016

National Disaster Management Plan by NDMA

UNDER GOI-UNDP-USAID PROJECT ON ENHANCING INSTITUTIONAL & COMMUNITY RESILIENCE TO DISASTERS AND CLIMATE CHANGE



City Disaster Management Plan

Evacuation and Response

Sikkim State Disaster Management Authority & Gangtok Municipal Corporation

This plan was formulated in consultation with District Disaster Management Authority, EAST and Gangtok Municipal Corporation. The plan is in accordance with the HoNDMP. This version is updated till August, 2023.

City Disaster Management Plan, Gangtok



CITY DISASTER MANAGEMENT PLAN

GREATER VISAKHAPATNAM MUNICIPAL CORPORATION

Andhra University College of Engineering (Autonomous)
 Visakhapatnam 530003



City Disaster Management Plan, Visakhapatnam



VIJAYAWADA CITY DISASTER MANAGEMENT PLAN - 2015



GOI - UNDP DISASTER MANAGEMENT PROJECT
 VIJAYAWADA MUNICIPAL CORPORATION
 KRISHNA DISTRICT ANDHRA PRADESH

City Disaster Management Plan, Vijayawada

2019 UPDATE

AHMEDABAD HEAT ACTION PLAN

GUIDE TO EXTREME HEAT PLANNING IN AHMEDABAD, INDIA



EASY READ VERSION

Ahmedabad Heat Action Plan

City Disaster Management Plan

CEC



**CITY DISASTER MANAGEMENT
PERSPECTIVE PLAN 2021**

*City Disaster Management Perspective
Plan, Chennai*

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सत्यमेव जयते

**Ministry of Housing and Urban Affairs
Government of India**

DISASTER RESILIENCE